

Bulletin 677

PB85-184331



Thermodynamic Data for Mineral Technology

By L. B. Pankratz, J. M. Stuve,
and N. A. Gokcen



UNITED STATES DEPARTMENT OF THE INTERIOR
William P. Clark, Secretary

BUREAU OF MINES
Robert C. Horton, Director

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

Library of Congress Cataloging in Publication Data

Pankratz, L. B.
Thermodynamic data for mineral technology.

(Bulletin/United States Department of the Interior, Bureau of Mines; 677)

Includes bibliographies.

Supt. of Docs. no.: I 28.27:

1. Mineralogy—Thermal properties. 2. Phase rule and equilibrium. 3. Mineral industries. I. Stuve, J. M. II. Gokcen, N. A. III. Title. IV. Series: Bulletin (United States. Bureau of Mines); 677.

QE364.P285 1984 549 .131 84-600195

CONTENTS

	<u>Page</u>
Abstract.....	1
Introduction.....	1
Chapter 1.--Thermodynamic background and applications.....	4
Laws of thermodynamics.....	4
The first law of thermodynamics.....	4
Enthalpy change of phase transformation.....	7
Thermochemistry.....	10
Adiabatic flame temperature.....	14
The second law of thermodynamics.....	16
The third law of thermodynamics.....	18
Interpolation of tabulated data.....	22
Extrapolation of tabulated data above listed temperatures.....	24
The second law method for calculation of ΔH° and ΔS°	25
Gibbs energy function and the third law method for ΔH_{298}°	28
Complex equilibria.....	30
Additional examples and practical applications.....	33
References.....	46
Chapter 2.--Thermodynamic property tables.....	47
Elements.....	47
Antimonides.....	92
Arsenides.....	95
Borides.....	98
Bromides.....	103
Carbides.....	127
Carbonates.....	140
Chlorides.....	144
Fluorides.....	179
Hydrides.....	218
Iodides.....	228
Nitrides.....	248
Oxides.....	261
Phosphides.....	296
Selenides.....	299
Silicates.....	307
Silicides.....	313
Sulfates.....	319
Sulfides.....	327
Tellurides.....	346
References.....	353

UNIT OF MEASURE ABBREVIATIONS USED IN THIS BULLETIN

atm	atmosphere (1 atm = 101325 pascals)
cal	thermochemical calorie (1 cal = 4.1840 joules)
cal/mol	calorie per mol
cal/mol·K	calorie per mol per kelvin
K	kelvin (the unit of thermodynamic temperature)
kcal/mol	kilocalorie per mol
mm	millimeter
mol	mol (gram formula weight or molar mass)
mol pct	mol percent
Pa	pascal
pct	percent

OTHER ABBREVIATIONS AND SYMBOLS USED IN THIS BULLETIN

°	Standard state, pure phase at 1 atm
T	Thermodynamic temperature in kelvins
C _p	Heat capacity at constant pressure
S	Entropy
H - H ₂₉₈	Enthalpy increment between T and 298.15 K
ΔH	Enthalpy change (ΔH _f = enthalpy of formation)
ΔG	Gibbs energy change (ΔG _f = Gibbs energy of formation)
P	Pressure in atmosphere, 1 atm = 101325 Pa
R	Gas constant, 1.98719 cal/K·mol
F	Faraday constant, 23060.9 cal/volt·equivalent

Thermodynamic Data for Mineral Technology

By L. B. Pankratz,¹ J. M. Stuve,¹ and N. A. Gokcen²

ABSTRACT

Thermodynamic data on the elements, oxides, sulfides, halides, and selected hydrides, carbides, nitrides, carbonates, sulfates, silicates, and miscellaneous compounds were reviewed, evaluated, and compiled at the Bureau of Mines. Values for C_p° , S° , $H^\circ - H_{298}^\circ$, ΔH_f° , and ΔG_f° are given in tabular form. A brief thermodynamic background and a number of examples and applications are presented.

INTRODUCTION

This compilation is part of the Bureau of Mines continuing effort to provide information for use as guidelines in mineral technology advancement, pollution control, and energy economy.

The values in this compilation are the result of a review and evaluation of relevant thermodynamic data through 1979 for the elements and oxides, and through 1982 for the remaining compounds. The sources of data are given at the beginning of each section of tables. Estimates were used where the necessary data were lacking. Estimated and extrapolated values are indicated in the tables with asterisks (*) and footnotes immediately below the table. When C_p° is shown to have been estimated, then S° and $H^\circ - H_{298}^\circ$ have also been estimated. An asterisk and a footnote are also used to indicate decomposition, metastable phases, and irreversible transformations.

¹Research chemist.

²Research supervisor.

Albany Research Center, Bureau of Mines, Albany, OR.

The selected experimental data were fit with a polynomial as a function of temperature by using a computer program. The resulting polynomial was then used in a subroutine of the program to calculate standard heat capacities, relative enthalpies, and entropies at selected temperatures. In addition, the tables for the elements in their unstable states and the compounds include the values for the standard enthalpy of formation and Gibbs energy of formation. (See, e.g., the tables for Mg(g) below 1363 K and for MgO(c) at all temperatures.) To conserve space, most of the tables are given at 200 K intervals for the range of stability of each phase. The transformation temperatures have been rounded off in the tables, with the exact temperature listed in the footnotes. A thermodynamic value D midway between the values A and B, which are 200 K apart, can be obtained from

$$D = 0.375A + 0.75B - 0.125C,$$

where A, B, and C are the successive values at temperatures such as 800, 1000 and 1200 respectively, and D is the value at 900 K. If the values are required for temperatures between 800 and 900 K, then an additional linear interpolation is adequate.

Tabulated values are for the substances in their standard states indicated by the superscript °. Standard states, for the pure condensed substances, are the most stable form at 1 atm pressure at the specified temperature. For vitreous and metastable substances, the superscript refers to the pure substance. For gases, the standard state is the pure substance at unit fugacity whether the gas is or is not stable at unit fugacity. Where possible, all phases of an element or compound are presented in a single table. Transformation temperatures and thermodynamic properties at these temperatures are included in the tables. Immediately below each such table, the nature of the transformations is given along with the associated enthalpies.

The symbol Δ refers to the formation reaction from the elements as reactants in their standard stable states. Thus, Δ in the table for Mg(g) at 600 K refers to $\text{Mg(c)} = \text{Mg(g)}$, and at 1000 K, $\text{Mg(l)} = \text{Mg(g)}$. Likewise, Δ in the table for MgO(c) at 600 K refers to $\text{Mg(c)} + 0.5 \text{ O}_2(\text{g}) = \text{MgO(c)}$, and at 1000 K, $\text{Mg(l)} + 0.5 \text{ O}_2(\text{g}) = \text{MgO(c)}$. In contrast, for all the compounds containing S, Se, and Te, the standard

enthalpies and Gibbs energies of formation were calculated by using the diatomic gaseous species in their standard states as one of the reactants, whether these gaseous species are stable or not at unit fugacity. E.g., $\Delta H_f^\circ_{298}$ in the table for $\text{Cu}_2\text{S}(\text{c})$ refers to $0.5 \text{ S}_2(\text{g}) + 2 \text{ Cu}(\text{c}) = \text{Cu}_2\text{S}(\text{c})$; however, if the formation from rhombic sulfur is desired, then $\Delta H_f^\circ_{298}$ for $\text{S}(\text{c}) = 0.5 \text{ S}_2(\text{g})$ must be added to the first $\Delta H_f^\circ_{298}$.

The common practice of tabulating five- and sometimes six-digit values has been followed. E.g., enthalpy values are given to the nearest calorie. The number of digits given is not intended to reflect the accuracy of the experimental values used. It is an effort to produce internal consistency in the tabulated values. The succeeding section, "Thermodynamic Background and Applications," illustrates the use and selected applications of the tables.

CHAPTER 1.--THERMODYNAMIC BACKGROUND AND APPLICATIONS

This section is a brief review of thermodynamic background and summary based on standard recent texts and treatises on thermodynamics. (See, e.g., a few selected references (1, 3, 6, 9).³) The objective here is to present a comprehensive basis for using the tables presented in this compilation. Numerical examples are given where necessary.⁴

Laws of Thermodynamics

Thermodynamics deals with the conservation and interconversion of various forms of energy, and the relationships between energy and changes in properties of matter. Thermodynamic state of a system is defined in this publication in terms of the variables of state, which are pressure, temperature, and numbers of mols of components. Other variables of state, such as gravitational, electrical, and magnetic fields, are not considered here. A closed system is separated from its surroundings by a rigid or movable boundary that prevents the exchange of components with the surroundings. In a closed system, the variables of state may be taken as pressure, P , and temperature, T , and in an open system, P , T , and the numbers of mols of components, ϵ . The volume of the system, V , may be used instead of P or T , and further, other variables may appear in certain equations, replacing P , T , and ϵ . Thermodynamics formulates all types of relations involving energy and variables of state.

The First Law of Thermodynamics

The law of conservation of energy is a law of physics that is inherently related to the first law of thermodynamics. The best statement of the first law is by Carathéodory (6):

³Underlined numbers in parentheses refer to items in the list of references at the end of this chapter.

⁴Parts of the text and the numerical examples in this section have been taken or adapted from copyrighted sources by specific permission for publication in this bulletin. Reproduction of these parts without permission from N. A. Gokcen may constitute infringement of copyrights.

There is a function E , called the energy of system, which is a function of variables of state, and the change in the value of E , ΔE , is zero when the system proceeds from a given initial state to a final state and then returns to the initial state.

If ΔE were not zero, then energy must be either created or destroyed, contrary to the law of conservation of energy. The first law therefore requires that all the processes that take a closed system from the same initial state to the same final state cause the same change in energy, ΔE . Since E is the starting function for the derivation of all the remaining thermodynamic properties designated as Λ , it is also necessary that for any process, $\Delta\Lambda$ must also be the same, irrespective of what process is followed in making the same change in Λ . For a closed system consisting of a single phase, E may be taken as a function of any set of two variables out of P , V , and T . We take E as a function of T and V , i.e., $E = E(T, V)$, and if the system is permitted to exchange only thermal energy dQ and only the reversible work of expansion and compression $dW = -PdV$, then the first law requires that

$$dE = dQ - PdV. \quad (1)$$

This equation shows that indeed E is a function of V since dV appears on the right side as required by the properties of differential equations. It is possible to define a new function called the enthalpy, H , by adding the product PV to E so that $H \equiv E + PV$. The total differential of H is

$$dH \equiv d(E + PV) = dE + PdV + VdP = dQ + VdP, \quad (2)$$

where $dE = dQ - PdV$ is substituted for dE to obtain the last equality. Note that one of the variables of state for dH is now P because dP appears as the differential on the right side. A process is defined by a specified path on the pressure-temperature coordinates that takes a given closed system from (P_1, T_1) to (P_2, T_2) , and for such a process the change in enthalpy is written as

$$H(P_2, T_2) - H(P_1, T_1) \equiv \Delta H, \quad (3)$$

where Δ always refers to the final state minus the initial state. At constant pressure, $VdP = 0$ in equation 2, and

$$C_p \equiv \left(\frac{\partial H}{\partial T} \right)_p, \quad (4)$$

where C_p is called the heat capacity at constant pressure. [The heat capacity at constant volume, $C_v = (\partial E / \partial T)_v$, is not used in this compilation because most of the chemical and metallurgical processes occur at constant pressure; hence, the "heat capacity" will always refer to C_p .] The first law requires that for any process that takes the system from the initial state (P_1, T_1) to the final state (P_2, T_2) , ΔH must be the same because PV itself also represents a form of energy. When a pure substance melts or transforms from one crystalline state into another at a fixed temperature, then C_p becomes infinity despite the fact that ΔH for such a transformation is finite.

The standard state is the state of pure elements and pure compounds in their stable states at 1 atm of pressure (1 atm = 101325 Pa). For the standard states, H and C_p , are designated as H° and C_p° , which are both independent of pressure. The tabulated values of relative standard enthalpy $H^\circ - H_{298}^\circ$ can be fitted with a polynomial in T and then differentiated according to equation 4 to obtain C_p° as a function of T , or conversely, C_p° can be expressed as a function of T , and $dH^\circ = C_p^\circ dT$ can be integrated within the temperature range of existence of a stable phase to obtain $H^\circ - H_{298}^\circ$ as a function of T as follows:

$$H_T^\circ - H_{298}^\circ \equiv \int_{298}^T C_p^\circ dT. \quad (5)^5$$

The subscript T in H_T° is for emphasis here in the text, and does not appear in the tables; thus, H° in the tables always refers to the listed temperatures. The results for C_p° and $H^\circ - H_{298}^\circ$ are tabulated usually in 200 K intervals in this compilation. (The dimensional units used for C_p° are calories per mol per kelvin, and for $H^\circ - H_{298}^\circ$, calories per mol in the text but kilocalories per mol in the tables.)

⁵In subscripts, in lower integration limits, and in lower summation limits, 298 represents 298.15, exactly. This procedure is followed even when the upper limit is designated with a fractional temperature.

Example 1: The data on C_p° for Mg(c), reproduced as table 1 here, can be fitted with the following equation by using the values of C_p° at 400 and 800 K.

$$C_p^\circ = 5.12 + 0.0028T. \quad (6)$$

Application of equation 5 yields

$$H_T^\circ - H_{298}^\circ = [5.12T + 0.0014T^2]_{298}^T = -1651 + 5.12T + 0.0014T^2, \quad (7)$$

where -1651 is the lower integration limit. For $T = 800$, $H_{800}^\circ - H_{298}^\circ = 3341$, in very close agreement with the listed value based on polynomials in T . A simple three-term equation, used by Kelley (8) and later by Pankratz (11) in Bureau publications, is

$$C_p^\circ = a + 2bT - (c/T^2), \quad (8)$$

where a , b , and c are empirical constants. Integration of this equation yields

$$H_T^\circ - H_{298}^\circ = aT + bT^2 + \frac{c}{T} + \underline{d}, \quad (9)$$

where $\underline{d}$ is the integration constant for the right side, obtained by the substitution of 298.15 in the first three terms in equation 9; i.e., $-\underline{d} = ax298.15 + bx298.15^2 + c/298.15$.

Enthalpy Change of Phase Transformation

A first-order phase transformation occurs at a fixed temperature and pressure under equilibrium conditions. Let $H_T^\circ(I)$ and $H_T^\circ(II)$ be the enthalpies of phase I and phase II, respectively, and let phase II be stable infinitesimally above the transformation temperature T' . The transformation reaction is [phase I $\rightarrow$ phase II] for which $\Delta H_T^\circ = H_T^\circ(II) - H_T^\circ(I)$. The standard enthalpy is tabulated as $H_T^\circ - H_{298}^\circ$ where H_{298}° refers to the pure elements or compounds stable or assumed to be stable at 298.15 K, and H_T° refers to any stable state at T , as in table 1. Let the stable phase for a substance be phase I from 298.15 to T' , phase II from T' to T'' , and phase III above T'' , and let $(298.15 < T' < T'' < T)$. The standard enthalpy change upon heating to T , in reference to $H_{298}^\circ(I)$, is

TABLE 1. - Thermodynamic properties of Mg(c,l,g). C_p° and S° are in calories per mol per kelvin on the tables and in the text; however, $H^\circ - H_{298}^\circ$ is in kilocalories per mol on the tables but in calories per mol in the text.

Mg(c,l,g) Magnesium			
T	C_p°	S°	$H^\circ - H_{298}^\circ$
298	5.950	7.810	0
400	6.240	9.600	.621
600	6.800	12.240	1.926
800	7.360	14.270	3.342
922	7.710	15.340	4.261
922	7.680	17.660	6.400
1000	7.880	18.290	7.010
1200	8.400	19.770	8.640
1363	8.820	20.860	10.040
1363	4.968	43.051	40.290
1400	4.968	43.185	40.474
1600	4.968	43.848	41.468
1800	4.968	44.433	42.461
2000	4.969	44.957	43.455

922 K, melting point; $\Delta H^\circ = 2.139$

1363 K, boiling point; $\Delta H^\circ = 30.250$

TABLE 2. - Thermodynamic properties of Mg(g). ΔH_f° and ΔG_f° are in kilocalories per mol on the tables but in calories per mol in the text.

Mg(g) Magnesium (ideal monatomic gas)					
T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	4.968	35.501	0	35.000	26.744
400	4.968	36.961	.506	34.885	23.941
600	4.968	38.975	1.500	34.574	18.533
800	4.968	40.404	2.493	34.151	13.244
1000	4.968	41.513	3.487	31.477	8.254
1200	4.968	42.419	4.481	30.841	3.662
1400	4.968	43.185	5.474	0	0
1600	4.968	43.848	6.468	0	0
1800	4.968	44.433	7.461	0	0
2000	4.969	44.957	8.455	0	0

$$\begin{aligned}
H_T^\circ(\text{III}) - H_{298}^\circ(\text{I}) &\equiv [H_{T'}^\circ(\text{I}) - H_{298}^\circ(\text{I})] + \Delta H_{T'}^\circ(\text{I} \rightarrow \text{II}) + [H_{T''}^\circ(\text{II}) - H_{T'}^\circ(\text{II})] \\
&+ \Delta H_{T''}^\circ(\text{II} \rightarrow \text{III}) + [H_T^\circ(\text{III}) - H_{T''}^\circ(\text{III})].
\end{aligned}
\quad (10)$$

The alternative form of this equation is obtained by substituting equation 5 for the terms in the first, third, and fifth set of brackets:

$$\begin{aligned}
H_T^\circ(\text{III}) - H_{298}^\circ(\text{I}) &= \int_{298}^{T'} C_p^\circ(\text{I}) dT + \Delta H_{T'}^\circ(\text{I} \rightarrow \text{II}) + \int_{T'}^{T''} C_p^\circ(\text{II}) dT \\
&+ \Delta H_{T''}^\circ(\text{II} \rightarrow \text{III}) + \int_{T''}^T C_p^\circ(\text{III}) dT.
\end{aligned}
\quad (11)$$

For substances such as $\text{Mg}(\text{g})$, $\text{S}_2(\text{g})$, and $\text{H}_2\text{O}(\text{g})$, H_{298}° refers to the gaseous state instead of the more stable condensed states below their boiling points. The tables indicate that the reference state is the "ideal gas," with the superscript ($^\circ$) specifying 1 atm standard state, as shown in table 2. Tables are also included in which H_{298}° refers to the stable phases of these substances, e.g., crystalline magnesium, $\text{Mg}(\text{c})$, crystalline sulfur, $\text{S}(\text{c})$, and liquid water, $\text{H}_2\text{O}(\text{l})$.

Example 2: The C_p° data for $\text{Mg}(\text{c})$ in table 1 was fitted with equation 6 by using the values of C_p° at 400 and 800 K and repeated here for convenience:

$$C_p^\circ(\text{c}) = C_p^\circ(\text{I}) = 5.12 + 0.0028T. \quad (12)$$

For the melting process at 922 K, $\Delta H_{922}^\circ(\text{c} \rightarrow \text{l}) = \Delta H_{T'}^\circ(\text{I} \rightarrow \text{II}) = 2139 \text{ cal/mol}$, and $C_p^\circ(\text{l})$ for the liquid can be closely represented by

$$C_p^\circ(\text{l}) = C_p^\circ(\text{II}) = 5.28 + 0.0026T. \quad (13)$$

For the boiling process at 1363 K, $\Delta H_{1363}^\circ(\text{l} \rightarrow \text{g}) = \Delta H_{T''}^\circ(\text{II} \rightarrow \text{III}) = 30250$, and $C_p^\circ(\text{g})$ for the gas is

$$C_p^\circ(\text{g}) = C_p^\circ(\text{III}) = 4.968. \quad (14)$$

Substitution of these equations in equation 11 yields

$$\begin{aligned}
H_T^\circ(g) - H_{298}^\circ(c) &= \left[5.12T + 0.0014T^2 \right]_{T=298}^{T'=922} + 2139 \\
&+ \left[5.28T + 0.0013T^2 \right]_{T'=922}^{T''=1363} + 30250 + \left[4.968T \right]_{T''=1363}^T \\
&= 33516 + 4.968T.
\end{aligned} \tag{15}$$

At 2000 K, $H_{2000}^\circ(g) - H_{298}^\circ(c) = 43452$ from the preceding equation, in nearly perfect agreement with 43455 in table 1. For the liquid phase region, where ($922 < T < 1363$), equation 11 needs to be terminated after the second integral, i.e.,

$$H_T^\circ(l) - H_{298}^\circ(c) = 426 + 5.28T + 0.0013T^2. \tag{16}$$

At 1000 K, $H_{1000}^\circ(l) - H_{298}^\circ(c) = 7006$, which is in very close agreement with 7010 listed in table 1. Note that $[H_T^\circ(l) - H_{298}^\circ(c)]$, used here, does not appear in table 1 with (l) and (c), but the Mg(c,l,g) in the table title signifies that H_{298}° refers to $H_{298}^\circ(c)$, and H° refers to the stable phase at the listed temperatures. Table 2 is entirely for Mg(g) (gaseous magnesium) from 298.15 to 2000 K. For gaseous Mg, $C_p^\circ = 4.968$; therefore,

$$H_T^\circ(g) - H_{298}^\circ(g) = -1481 + 4.968T. \tag{17}$$

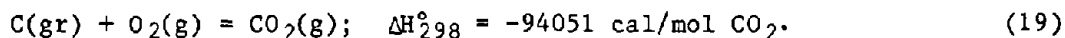
Subtraction of equation (17) from equation (15) yields

$$H_{298}^\circ(g) - H_{298}^\circ(c) = 34997 \approx 35000, \tag{18}$$

where 35000 is the enthalpy of sublimation of Mg(c), or in terms of the notation of table 2 for Mg(g), the standard enthalpy of formation of Mg(g) from the stable phase Mg(c) at 298.15 K. This example is dealt with again in the next section.

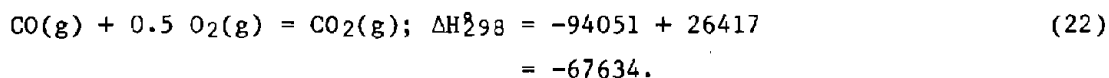
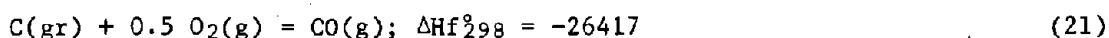
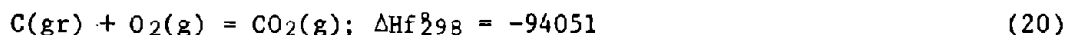
Thermochemistry

Thermochemistry deals with the energy and the enthalpy changes accompanying chemical reactions and phase transformations. In fact, phase transformations can be considered as reactions in thermodynamics. A selected reaction and the accompanying ΔH_{298}° at constant pressure are as follows:

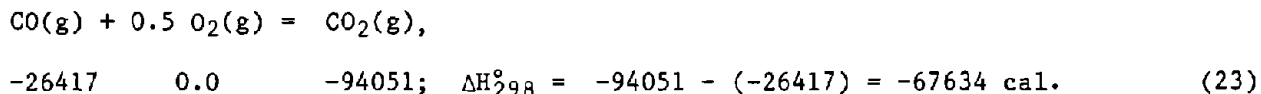


Throughout the remainder of this publication, Δ refers to a phase transformation or a chemical reaction, not to the heating and cooling processes; e.g., henceforth, to avoid confusion, Δ is not used to denote $\Delta H^\circ = H_T^\circ - H_{298}^\circ$. Reaction 19 in thermochemistry is assumed to convert the reactants entirely into the product(s), which is only $\text{CO}_2(\text{g})$ in this example. All of the reactants and the products are in their standard states, signifying that $\text{C}(\text{gr})$ is the pure element in its stable state at 1 atm pressure and the gases are ideal, each at 1 atm pressure. Reaction 19 is the formation of CO_2 from its elements in their standard states; hence, ΔH_{298}° of equation 19 is also the standard enthalpy of formation of CO_2 , which is denoted by ΔH_f° .

For the pure elements in their stable standard states, ΔH_f° is obviously zero. The enthalpy of reaction at any temperature is calculated by combining the enthalpies of formation; thus, at 298.15 K,



The last reaction is obtained by subtracting the second reaction from the first; therefore, ΔH_f° is often written underneath each reactant and product for convenience in calculating ΔH_f° :



The same procedure can be followed for calculating ΔH° at 1000 K by using the tables for CO and CO_2 to obtain

$$\Delta H_{1000}^{\circ} = -94312 + 26766 = -67546. \quad (24)$$

The effect of temperature on ΔH_T° can be calculated from the following identity:

$$\Delta(H_T^{\circ} - H_{298}^{\circ}) \equiv \Delta H_T^{\circ} - \Delta H_{298}^{\circ}, \quad (25)$$

where the left side is obtained from the tables, in the columns for $H_T^{\circ} - H_{298}^{\circ}$. Thus, for $\text{CO(g)} + 0.5 \text{ O}_2\text{(g)} = \text{CO}_2\text{(g)}$, equation 25 is

$$\begin{aligned} & (H_T^{\circ} - H_{298}^{\circ})(\text{for CO}_2) - (H_T^{\circ} - H_{298}^{\circ})(\text{for CO}) \\ & - 0.5(H_T^{\circ} - H_{298}^{\circ})(\text{for O}_2) \equiv \Delta H_T^{\circ} - \Delta H_{298}^{\circ}. \end{aligned} \quad (26)$$

This equation is rearranged to obtain

$$\begin{aligned} \Delta H_T^{\circ} &= \Delta H_{298}^{\circ} + (H_T^{\circ} - H_{298}^{\circ})(\text{for CO}_2) - (H_T^{\circ} - H_{298}^{\circ})(\text{for CO}) \\ & - 0.5(H_T^{\circ} - H_{298}^{\circ})(\text{for O}_2). \end{aligned} \quad (27)$$

At $T = 1000 \text{ K}$, $H_{1000}^{\circ} - H_{298}^{\circ} = 7984$ for CO_2 ; $H_{1000}^{\circ} - H_{298}^{\circ} = 5183$ for CO ; $0.5(H_{1000}^{\circ} - H_{298}^{\circ}) = 2713$ for 0.5 O_2 ; $\Delta H_{298}^{\circ} = -67634$; hence,

$$\Delta H_{1000}^{\circ} = -67634 + 7984 - 5183 - 2713 = -67546, \quad (28)$$

which is evidently identical with the result in equation 24.

Equation 27 can be generalized as follows:

$$\begin{aligned} \Delta H_T^{\circ} &= \Delta H_{298}^{\circ} + \sum_{\substack{\text{all} \\ \text{products}(i)}} \alpha_i (H_T^{\circ} - H_{298}^{\circ})(\text{for } i) \\ & - \sum_{\substack{\text{all} \\ \text{reactants}(j)}} \beta_j (H_T^{\circ} - H_{298}^{\circ})(\text{for } j). \end{aligned} \quad (29)$$

The factors α_i and β_j are the stoichiometric coefficients. This equation may be

rewritten by using equation 5 when there is no phase transformation for the reactants and the products from 298.15 to T; thus,

$$\Delta H_T^\circ = \Delta H_{298}^\circ + \int_{298}^T \left[\sum_i \alpha_i C_p^\circ(i) - \sum_j \beta_j C_p^\circ(j) \right] dT \equiv \int_{298}^T \Delta C_p^\circ dT, \quad (30)$$

where the identity defines ΔC_p° , which is the sum of $\alpha_i C_p^\circ(i)$ for the products minus the sum of $\beta_j C_p^\circ(j)$ for the reactants. Note that the last equality is the integral of another form of equation 4, which may be written as

$$\frac{d\Delta H^\circ}{dT} = \Delta C_p^\circ; \quad \Delta H_T^\circ - \Delta H_{298}^\circ = \int_{298}^T \Delta C_p^\circ dT. \quad (31)$$

Since H° is independent of pressure, ∂ is replaced by d in equation 4. Equations 29 and 31, in their appropriately modified forms, constitute the basis for calculation of temperature dependence for numerous thermodynamic properties, e.g.,

$$\Delta S_T^\circ = S_{298}^\circ + \int_{298}^T \left(\frac{d\Delta S^\circ}{dT} \right) dT = \Delta S_{298}^\circ + \int_{298}^T \frac{\Delta C_p^\circ}{T} dT, \quad (32)$$

where $d\Delta S^\circ = (\Delta C_p^\circ/T)dT$ is defined in the next section, "The Second Law of Thermodynamics."

Application of equation 31, or the last equality in equation 30, to reaction 23 requires empirically expressed equations for C_p° as functions of temperature. The values of C_p° for CO_2 vary fairly strongly with temperature; therefore, a quadratic equation for C_p° is obtained by using the tabulated data for C_p° at 298.15, 600, and 1000 K, but for CO and O_2 , linear equations using the tabulated C_p° at 400 and 1000 K are adequate. The results are

$$C_p^\circ(\text{CO}_2) = 5.486 + 0.01303T - 5.531 \times 10^{-6} T^2 \quad (33)$$

$$-C_p^\circ(\text{CO}) = -6.401 - 0.00153T \quad (34)$$

$$-0.5C_p^\circ(\text{O}_2) = -3.219 - 0.00095T \quad (35)$$

$$\Delta C_p^\circ = -4.134 + 0.01055T - 5.531 \times 10^{-6} T^2. \quad (36)$$

It should be emphasized that the equations for C_p° are valid roughly from 298 to 1000 K. Substitution of ΔC_p° of equation 36 in equation 30, integration of the result, and substitution of $\Delta H_{298}^\circ = -67634$ yield

$$\Delta H_T^\circ = -66822 - 4.134T + 0.005275T^2 - 1.844 \times 10^{-6}T^3. \quad (37)$$

From this equation, $\Delta H_{1000}^\circ = -67525$ which is very close to -67546 previously obtained from the tables for CO and CO₂. Actually, ΔC_p° is small for most reactions involving only gaseous inorganic reactants and products, and ΔH_T° usually varies weakly with temperature.

Adiabatic Flame Temperature

When the combustion of a substance at 298.15° K gives the products also at 298.15° K, the resulting effect is ΔH_{298}° of reaction. Since the value of ΔH_{298}° for combustion is negative, or ΔH_{298}° is dissipated to the surroundings, it is possible to devise an adiabatic process by returning ΔH_{298}° into the combustion products to raise their temperature:

$$-\Delta H_{298}^\circ = \sum_{\text{products}} \alpha_i (H_T^\circ - H_{298}^\circ) = \int_{298}^T \sum_{\text{products}} \alpha_i C_{pi}^\circ dT. \quad (38)$$

The resulting temperature, T , is called the adiabatic flame temperature, which can be determined either from the tabular values of $H_T^\circ - H_{298}^\circ$ or by integrating the sum of the heat capacities of products only as shown in equation 38 when there are no phase transitions.

Example 3: Calculate the adiabatic flame temperature for CO burned in a theoretically sufficient amount of air. For simplicity, assume that air is 0.2 mol fraction O₂ and 0.8 mol fraction N₂; use $\Delta H_{298}^\circ = -67634$ for the enthalpy of combustion of CO. (Actual composition of air is closer to 0.21 mol fraction of O₂; this example is adapted from reference 10.)

Solution: One mol of CO requires 2.5 mols of air in which 2 mols are N₂. The combustion products are 1 mol of CO₂ and 2 mols of N₂. Equation 38 for this case is

$$-\Delta H_{298}^{\circ} = +67634 = (H_T^{\circ} - H_{298}^{\circ})(\text{for CO}_2) + 2(H_T^{\circ} - H_{298}^{\circ})(\text{for N}_2). \quad (39)$$

The right side can be calculated from the tables for CO₂ and N₂ at temperatures estimated to be close to the adiabatic temperature:

$$\begin{aligned} 2200 \text{ K: } & 24755 + 2 \times 15144 = 55043, \\ 2400 \text{ K: } & 27674 + 2 \times 16883 = 61440, \\ 2600 \text{ K: } & 30613 + 2 \times 18634 = 67881, \\ 2800 \text{ K: } & 33567 + 2 \times 20393 = 74353. \end{aligned}$$

It is evident that the required temperature is between 2400 and 2600 K. Assuming that the right side of equation 39 varies linearly with temperature in this range, the linear interpolation yields $T = 2592 \text{ K}$.

An alternative method is to express $H_T^{\circ} - H_{298}^{\circ}$ as a quadratic function of T for CO₂ and N₂ in the range of 2000 to 3000 K and solve for T . Thus, if we use the results for 2200, 2600, and 2800 K in a quadratic equation, we obtain the following equation for the right-hand side (RHS) of equation 39:

$$\text{RHS} = -13040 + 29.975T + 4.417 \times 10^{-4}T^2. \quad (40)$$

Equation 39 now becomes, after rearrangement,

$$4.417 \times 10^{-4}T^2 + 29.975T - 80674 = 0, \quad (41)$$

from which, $T = 2592$, in agreement with the preceding computation.

Example 4: Recompute the preceding example but with the air preheated to 1000 K prior to combustion.

Solution: The procedure is simplified by cooling the air to 298.15 K, extracting the corresponding $\Delta H_{\text{cool}}^{\circ}$ and adding it to -67634, and using $-(\Delta H_{\text{cool}}^{\circ} - 67634)$

for the left side of equation 39. For the air consisting of 2 mols of N_2 and 0.5 mol of O_2 , cooling from 1000 to 298.15 K yields

$$\Delta H_{cool}^{\circ} = -2 \times 5130 - 0.5 \times 5426 = -12973 \text{ cal}, \quad (42)$$

and equation 39 becomes

$$-(-67634 - 12973) = -13040 + 29.975T + 4.417 \times 10^{-4}T^2, \quad (43)$$

from which $T = 2992$ K. Thus, preheating the air from 298.15 to 1000 K, increases the adiabatic flame temperature by 400 K. This is important from the practical point of view because a process may not be possible unless an appropriate temperature is attained.

The Second Law of Thermodynamics

The second law of thermodynamics is stated as follows:

It is impossible to construct a system that can convert heat from a uniform temperature into mechanical energy without leaving any effect elsewhere.

It should be emphasized that dQ in equation 1 is not a property of any system. However, the second law and the Carnot theorem lead to the existence of a property called the entropy, which is given by

$$dS = \frac{dQ(\text{reversible})}{T} = \frac{dE + PdV}{T}. \quad (44)$$

The proof of the existence of entropy is beyond the scope of this section (see references 1, 3, 6, and 9). Rearrangement of this equation yields the combined expression of the first and second laws of thermodynamics:

$$dE = TdS - PdV. \quad (45)$$

The independent variables in this equation are S and V ; i.e., E is a function of S and V because dS and dV appear on the right side. For $H \equiv E + PV$, equation 45 becomes

$$dH = TdS + VdP; (dH)_P = T(dS)_P, \quad (46)$$

where the second equation is for the constant pressure condition, and if the system is in the standard state for an element or a compound at 1 atm, then $dH^\circ = TdS^\circ$, and both H° and S° are only dependent on temperature for a given closed phase. Summation of $dS^\circ = dH^\circ/T$ over small ranges of temperature yields the change in entropy:

$$\sum_{298}^T dS^\circ = S_T^\circ - S_{298}^\circ = \sum_{298}^T \frac{dH^\circ}{T}. \quad (47)$$

For a first order phase transformation, e.g., phase I $\rightarrow$ phase II at a constant temperature, T' , the sum of dH° is $\Delta H_{T'}^\circ$, and $S_{T'}^\circ(\text{phase II}) - S_{T'}^\circ(\text{phase I}) = \Delta H_{T'}^\circ/(I \rightarrow II)/T'$. In a range of temperature where there is no phase transformation, the summation in equation 47 can be replaced with integrals. For this purpose, we rearrange equation 4 at $P = 1$ atm to write $dH^\circ = C_P^\circ dT$ and equation 47 as

$$S_T^\circ - S_{298}^\circ = \int_{298}^T \frac{C_P^\circ}{T} dT. \quad (48)$$

Computation of $S_T^\circ - S_{298}^\circ$ follows the same pattern as the computation of $H_T^\circ - H_{298}^\circ$ shown by equation 11. Thus, for only one phase transition, phase I $\rightarrow$ phase II at T' [$T > T' > 298.15$], the change in entropy from 298.15 to T is given by

$$\begin{aligned} S_T^\circ(\text{phase II}) - S_{298}^\circ(\text{phase I}) &= \int_{298}^{T'} \frac{C_P^\circ(\text{phase I})}{T} dT + \frac{\Delta H^\circ(I \rightarrow II)}{T'} \\ &+ \int_{T'}^T \frac{C_P^\circ(\text{phase II})}{T} dT. \end{aligned} \quad (49)$$

The standard entropy, S° , like C_P° , is expressed in calories per mol per kelvin throughout this publication.

Example 5: Express $S_T^\circ(l) - S_{298}^\circ(c)$ as a function of temperature for Mg, by using the data in example 2.

Solution: For Mg(c), equation 12 gives $C_p^\circ(c)$, and for c $\rightarrow$ l transformation, $\Delta H^\circ(c\rightarrow l) = \Delta H_T^\circ = 2139$ cal/mol with $T' = 922$; for Mg(l), equation 13 gives $C_p^\circ(l)$. Substitution of these results in equation 49 gives

$$\begin{aligned} S_T^\circ(l) - S_{298}^\circ(c) &= \int_{298}^{922} \left[\frac{5.12}{T} + 0.0028 \right] dT + \frac{2139}{922} + \int_{922}^T \left[\frac{5.28}{T} + 0.0026 \right] dT \\ &= 5.12 \ln \frac{922}{298.15} + 0.0028(922 - 298.15) + \frac{2139}{922} + 5.28 \ln \frac{T}{922} \\ &\quad + 0.0026(T - 922) = 5.28 \ln T + 0.0026 T - 28.594. \end{aligned} \quad (50)$$

At 1000 K, this equation yields $S_{1000}^\circ - S_{298}^\circ = 10.479$, and the table for Mg(c,l,g) (table 1) gives $S_{1000}^\circ - S_{298}^\circ = 18.290 - 7.810 = 10.480$, in very close agreement with equation 50. The results in the table are based on the C_p° equations that contain more than two terms.

The Third Law of Thermodynamics

The third law of thermodynamics is best stated as follows:

The entropy of each pure element or pure compound in its stable molecular configurations is zero at zero kelvin.

This law permits calculation of entropy at any temperature because S_0° (at zero kelvin) = 0. The values of S_{298}° listed in this compilation have been obtained by using a relationship of the type shown by equation 49 from 0 to 298.15 K. The third law also requires that C_p°/T approach zero faster than T approach zero (6).

The equations based on the second and third laws of thermodynamics are obtained by simple changes of independent variables. It was already noted that $E = E(S,V)$, or E is a function of independent variables S and V as shown in equation 45. If we write a new function, $A \equiv E - TS$, differentiate it, and then use equation 45 on the right side, we obtain $dA = -SdT - PdV$, and A is called the Helmholtz energy. A more useful equation is obtained by using the definition $G \equiv H - TS$, differentiation of this equation, and substitution of equation 46; the result is

$$dG \equiv dH - TdS - SdT = VdP - SdT. \quad (51)$$

It is important to observe that the independent variables in this equation are P and T , namely, $G = G(P, T)$, and these variables are more convenient than the independent variables for E , H , and A . The change of variables accomplished in this manner is a very simple form of Legendre transforms in mathematics. Integration of equation 51 at a given temperature for 1 mol of gas obeying $PV = RT$ is

$$G(P, T) - G(P_1, T) = + \int_{P_1}^P RT \frac{dP}{P} = -RT \ln P_1 + RT \ln P. \quad (52)$$

If P_1 is set to unity, then $G(1, T)$ is designated as $G^\circ = G^\circ(T)$ and equation 52 becomes

$$G(P, T) = G^\circ + RT \ln P, \quad (53)$$

where $G = G(P, T)$ for a pure substance has been called the chemical potential by J. W. Gibbs, and renamed the Gibbs energy, first in Europe. The term "chemical potential" arises from the experimental observation that a pure gas "B" tends to go from a confining chamber Y, with a membrane permeable to B, into an adjoining chamber Z, containing a mixture of gases, if $G(\text{pure B in chamber Y})$ is greater than $G(\text{B in chamber Z})$; further, when equilibrium is attained, then G of B in both chambers becomes equal. Another example is the vaporization process, i.e., $\text{Mg}(l) \rightarrow \text{Mg}(g)$, for which $G(l) = G^\circ(l)$ if the liquid is pure, and for $G(g)$ of the gas we write $G(g) = G^\circ(g) + RT \ln P$; at equilibrium $G^\circ(l) = G(g)$; hence,

$$G(l) \equiv G^\circ(l) = G^\circ(g) + RT \ln P. \quad (54)$$

Rearrangement of this equation gives

$$G^\circ(g) - G^\circ(l) \equiv \Delta G^\circ = -RT \ln P. \quad (55)$$

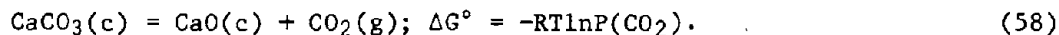
The left side of this equation is for the equilibrium vaporization of $\text{Mg}(l)$;

$$\text{Mg}(l) = \text{Mg}(g). \quad (56)$$

From the definition of G° as $G^\circ = H^\circ - TS^\circ$ and from the fact that reaction 56 is considered to take place at a constant temperature, ΔG° is related to ΔH° and ΔS° by

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ. \quad (57)$$

This equation is very important in thermodynamics. An identical argument for the decomposition of limestone yields



For a reaction in which some of the stoichiometric coefficients are different from unity, the corresponding ΔG° must contain the stoichiometric coefficients, e.g.,



for which ΔG° is given by

$$2G^\circ(\text{NH}_3) - G^\circ(\text{N}_2) - 3G^\circ(\text{H}_2) \equiv \Delta G^\circ = -RT \ln \frac{[\text{P}(\text{NH}_3)]^2}{\text{P}(\text{N}_2)[\text{P}(\text{H}_2)]^3} \dots \quad (60)$$

The terms after the logarithmic notations in 55, 58, and 60 are called the equilibrium constant K_p in terms of the partial pressures (or fugacities when they are available). Thus, $K_p = P$ in equation 55, $K_p = P(\text{CO}_2)$ in equation 58, and $K_p = [\text{P}(\text{NH}_3)]^2 / \text{P}(\text{N}_2)[\text{P}(\text{H}_2)]^3$ in equation 60 at sufficiently low total pressures, e.g., 1 or 2 atm, where $\text{P}(\text{NH}_3), \dots$ are the partial pressures. (See, e.g., reference 6 for a treatment using the fugacities at high pressures.)

The numerical values of ΔG° as well as ΔH° in the examples are in calories per mol or calories per reaction. This convention is essential when ΔS° is in calories per mol per kelvin because $T\Delta S^\circ$ is then in calories per mol and ΔH° must therefore also be in calories per mol for the dimensional consistency in equation 57.

Example 6: Calculate the vapor pressure of $\text{Mg}(\text{g})$ over $\text{Mg}(\text{l})$ at 1000 K and 1400 K.

Solution: The reaction and the equilibrium relationships are given by equations 56 and 55, respectively. Table 2 for $\text{Mg}(\text{g})$ gives $\Delta G^\circ = 8254$ at 1000 K; therefore,

$$\Delta G^\circ = 8254 = -1000 R \ln P, \quad (61)$$

from which $P = 0.0157 \text{ atm} = 1591 \text{ Pa}$. If it is necessary to compute the pressure above the boiling point, e.g. at 1400 K, the values for $\text{Mg}(l)$ in table 1 must be extrapolated beyond the range where the liquid is stable at pressures higher than 1 atm. In general, ΔG° is close to being a linear function of T at temperatures usually above 1000 K, within experimental errors in a small range of temperature, e.g., $\pm 100 \text{ K}$, and often $\pm 200 \text{ K}$. To obtain an equation for ΔG° , we take $\Delta G^\circ = 3662 \text{ cal}$ at 1200 K and $\Delta G^\circ = 0$ at 1363 K, the boiling point of $\text{Mg}(l)$ where $P = 1 \text{ atm}$, and write

$$3662 = \Delta H^\circ - 1200 \Delta S^\circ; \quad (62)$$

$$0 = \Delta H^\circ - 1363 \Delta S^\circ. \quad (63)$$

We solve for ΔH° and ΔS° to obtain

$$\Delta G^\circ = 30622 - 22.466 T = -RT \ln P, \quad (64)$$

where ΔH° and ΔS° are assumed to be temperature independent within the small range of 1200 to 1400 K. Actually ΔH° and ΔS° do vary slightly with temperature, but the assumption that they are constant affects the values of ΔG° to a small extent, owing to the partial cancellation of errors between ΔH° and $-T\Delta S^\circ$. At 1400 K, this equation yields $P \approx 1.348 \text{ atm}$.

Example 7: Calculate ΔG° and the equilibrium constant for the following reaction at 1000 and 2000 K:



Solution: The values of ΔG° can be written under the reactants and the products to obtain ΔG° for the reaction, in the same way as in equations 23 and 24; thus the values of ΔG_f° for the required temperatures are as follows:

T, K	ΔG_f°			ΔG° (reaction 65)	K_p
	CO	0.5 O ₂	CO ₂		
1000	-47857	*0.0	-94619	-46762	1.66x10 ¹⁰
2000	-68343	0.0	-94728	-26385	764

* ΔG_f° is zero for the elements in their standard states.

It must be recalled that the standard state is the pure stable element or compound at 1 atm pressure. For gases, the standard state is the pure gas whose properties are extrapolated from very low pressures to 1 atm so that the standard state is an ideally behaving gas at 1 atm pressure. The symbol ΔG_f° refers to the standard Gibbs energy of formation of a compound in its standard state from the elements in their standard states; hence, it is obvious that ΔG_f° is zero for the elements in their standard states.

An alternative, longer method for calculating ΔG° at 1000 K is illustrated by the following example. First, $\Delta H_{1000}^\circ = -67546$ is calculated as in equation 24. Second, the value of ΔS_{1000}° for the reaction is obtained by the same procedure, i.e.,

$$\begin{aligned}\Delta S_{1000}^\circ &= S_{1000}^\circ(\text{CO}_2) - 0.5 S_{1000}^\circ(\text{O}_2) - S_{1000}^\circ(\text{CO}) \\ &= 64.342 - 0.5 \times 58.190 - 56.031 = -20.784 \text{ cal/K.}\end{aligned}\quad (66)$$

Then the substitution of the values for ΔH_{1000}° and ΔS_{1000}° in equation 57 gives

$$\Delta G_{1000}^\circ = -67546 + 1000 \times 20.784 = -46762. \quad (67)$$

This method simply illustrates the interconsistency of various data in the tables, and it is not meant to be a recommended calculational procedure.

Interpolation of Tabulated Data

Published compilations of thermodynamic data are usually presented in 100 K intervals. In this publication, the chosen intervals are 200 K, except when the

tables are short enough to justify 100 K. The reason for this procedure is to maintain this publication in a manageable size without sacrificing accuracy. The values halfway within each 200 K interval can be obtained by a simple and accurate procedure called the Lagrangian interpolation. If A, B, and C are the successive values of a tabulated thermodynamic property, then the interpolated value D at the average of the temperatures for A and B is

$$D = 0.375A + 0.75B - 0.125C. \quad (68)$$

This equation is exact when the curve passing through A, B, and C is parabolic. However, when the interval between A and C is small, the curve is very closely approximated by a parabolic section.

Example 8: Calculate the value of $H_{1100}^\circ - H_{298}^\circ$ for $\text{CO}_2(\text{g})$ from $H_{1000}^\circ - H_{298}^\circ = 7984 = A$, $H_{1200}^\circ - H_{298}^\circ = 10632 = B$, and $H_{1400}^\circ - H_{298}^\circ = 13362 = C$. Repeat the same type of calculation for S_{1100}° .

Solution: Substitution of the foregoing values in equation 68 yields

$$\begin{aligned} H_{1100}^\circ - H_{298}^\circ = D &= 0.375 \times 7984 + 0.75 \times 10632 \\ &\quad - 0.125 \times 13362 = 9298. \end{aligned} \quad (69)$$

The value listed by Pankratz, based on a polynomial equation, is 9296, which is very nearly identical with the result in equation 69. The simple linear interpolation between 1000 and 1200 K gives 9308, which is off by only 0.13 pct and is adequate for most practical purposes.

The same type of interpolation for the entropy at 1100 K yields $S_{1100}^\circ = 65.587$, versus Pankratz' tabulated value, $S_{1100}^\circ = 65.592$.

The interpolations are much simpler when C_p° is independent of temperature, as for $\text{Al}(\text{l})$ and $\text{Mg}(\text{g})$. For example, $C_p^\circ = 7.590$ for $\text{Al}(\text{l})$; therefore, a linear interpolation for $H_T^\circ - H_{298}^\circ$ is exact even for larger temperature intervals. For example, $H_{1400}^\circ - H_{298}^\circ$ is the average of the corresponding values at 1200 and 1600 K; i.e., $H_{1400}^\circ - H_{298}^\circ = 0.5(8913 + 11949) = 10431$. For S_T° , it is simpler to use a

slightly different form of equation 48, with the lower integration limit as the lower temperature from which the extrapolation is to be made. Assuming that $S_{1000}^\circ = 17.589$ is known for Al(l), it is possible to compute S_T° for Al(l) at any temperature using the preceding value of $C_p^\circ = 7.590$:

$$S_T^\circ = S_{1000}^\circ + \int_{1000}^T 7.590 \frac{dT}{T} = S_{1000}^\circ + 7.590 \ln \frac{T}{1000}. \quad (70)$$

For $T = 1400$, this equation gives

$$S_{1400}^\circ = 17.589 + 7.590 \ln \frac{1400}{1000} = 20.143, \quad (71)$$

which is the same as the tabulated value. In this case, equation 68 may again be used for the intermediate range between two successive listed temperatures, but equation 70 is simpler and preferable.

After the calculation of an intervening value by a suitable preceding method, linear interpolations of thermodynamic properties can be made for the temperatures that are fractions of 100 K. This is the recommended procedure in other compilations that use 100 K intervals.

Extrapolation of Tabulated Data Above Listed Temperatures

The data in this compilation are generally listed up to the highest practical temperatures justified by the accuracy of data. Extrapolation above the highest temperature can be carried out by using a power series, linear, or quadratic, or cubic in T . It can be shown that by using an equation for C_p° of CO_2 linear in T , the values of C_p° can be extrapolated to 4000 K within 0.7 pct, and $H_{4000}^\circ - H_{298}^\circ$, within 0.07 pct. Considerably better results can be obtained by using higher order equations, but this is rarely necessary. Note that ΔH_f° varies at a slower fractional rate than $H_T^\circ - H_{298}^\circ$. A linear variation of ΔH_f° can be used to obtain its values at temperatures up to 4000 K. For example, the listed data at 2800 and 3000 K for CO_2 can be used to obtain ΔH_{4000}° as follows:

$$\begin{aligned} \Delta H_{4000}^\circ &= \Delta H_{3000}^\circ + \left(\frac{4000-3000}{200} \right) (\Delta H_{3000}^\circ - \Delta H_{2800}^\circ) = -95624 \\ &+ 5(-95624 + 95429) = -96599, \end{aligned} \quad (72)$$

which agrees within 0.35 pct of the tabulated value in the JANAF Thermochemical Tables (2). For ΔG° , the variation is even smaller and either linear extrapolation or the data for 3000 K can be used as follows: $\Delta G_f^\circ_{3000} = -94523$, $\Delta H_f^\circ_{3000} = -95624$; substitution in $\Delta G_f^\circ_{3000} = \Delta H_f^\circ_{3000} - 3000\Delta S_f^\circ_{3000}$ yields $\Delta S_f^\circ_{3000} = -0.367$. Assuming that $\Delta H_f^\circ_{3000}$ and $\Delta S_f^\circ_{3000}$ do not vary greatly with temperature, $\Delta G_f^\circ_T$ can be expressed as a linear function of temperature as follows:

$$\Delta G_f^\circ = \Delta H_f^\circ_{3000} - T\Delta S_f^\circ_{3000} = -95624 + 0.367T. \quad (73)$$

At 4000 K, $\Delta G_f^\circ = -94156$, which differs only 0.09 pct from the value listed in JANAF. Actually ΔH_f° and ΔS_f° do vary to a small extent with temperature, but their variation is such that the errors very often cancel out considerably in equation 73, and ΔG_f° calculated in this way becomes fairly accurate, as mentioned earlier. Most pyrometallurgical processes take place below 2000 K, and most sets of data are likely to be in error well in excess of 1 pct above 3000 K; therefore, extrapolation above 3000 K with more polynomials in T is seldom needed.

The Second Law Method for Calculation of ΔH° and ΔS°

The second law method for calculation of ΔH_T° and ΔS_T° and their extrapolation to 298.15 K is based on the linearity of $\ln K_p$ versus $(1/T)$ within a short range of temperature because of the following relationship:

$$-\frac{\Delta G^\circ}{RT} = \ln K_p = -\frac{\Delta H^\circ}{RT} + \frac{\Delta S^\circ}{R}. \quad (74)$$

(Instead of $\ln K_p$ versus $(1/T)$, a plot of $\Delta G_T^\circ = -RT \ln K_p$ versus T also yields a straight line.) The resulting linear relationship determines the values of $\Delta H_{T'}^\circ$ and $\Delta S_{T'}^\circ$, where T' is an appropriate average for all the data points. The values of ΔH_{298}° and ΔS_{298}° can be calculated from the following identities:

$$\Delta(H_{T'}^\circ - H_{298}^\circ) \equiv \Delta H_{T'}^\circ - \Delta H_{298}^\circ; \quad \Delta(S_{T'}^\circ - S_{298}^\circ) \equiv \Delta S_{T'}^\circ - \Delta S_{298}^\circ, \quad (75)$$

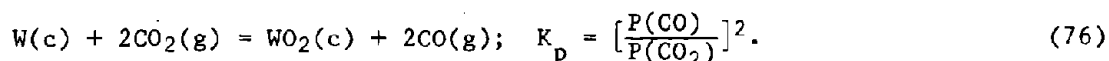
where Δ refers to the reaction for which K_p has been measured, and Δ implicitly accounts for the stoichiometric coefficients as shown in the succeeding example. The use of Δ in this way is not explicit, but the practice of using Δ in writing equation 75, and a similar equation for the Gibbs energy function, is universal.

Example 9: Assume that the molar ratios of CO:CO₂ over WO₂ are determined at selected temperatures at a total CO + CO₂ pressure of 1 atm as follows:

$$\text{CO/CO}_2: \quad 2.878 \quad 2.663 \quad 2.370$$

$$T, \text{ K}: \quad 911 \quad 990 \quad 1121$$

In actual experiments, considerably more than three sets of measurements are made; however, for simplicity, only three sets of measurements are used here to illustrate the general procedure. The reaction investigated and its equilibrium constant are as follows:



A least squares plot of $\ln K_p$ versus $1/T$ (not shown here) gives

$$\ln K_p = \frac{1887}{T} + 0.0468. \quad (77)$$

The corresponding equation for ΔG° is

$$\Delta G^\circ = -3750 - 0.093T, \quad (78)$$

which is valid within the experimental range of temperature. The average of all values for $(1/T)$ is 0.00100, which corresponds to 1000 K; therefore,

$$\Delta H_{1000}^\circ = -3750; \quad \Delta S_{1000}^\circ = 0.093. \quad (79)$$

Note that the average of T is 1007 K, and in this simplified example it is not greatly different from the average of $1/T$; however, this is generally not the case when there are numerous values of K_p over a wider range of temperature. The value of $\Delta(H_{1000}^\circ - H_{298}^\circ)$ in equation 75 for reaction 76 is

$$\Delta(H_{1000}^\circ - H_{298}^\circ) = (H_{1000}^\circ - H_{298}^\circ)(\text{WO}_2) + 2(H_{1000}^\circ - H_{298}^\circ)(\text{CO}) - (H_{1000}^\circ - H_{298}^\circ)(\text{W})$$

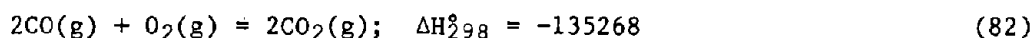
$$-2(H_{1000}^\circ - H_{298}^\circ)(\text{CO}_2) = 11895 + 2 \times 5183 - 4370 - 2 \times 7984$$

$$= 1923, \quad (80)$$

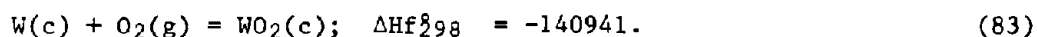
or, simply,

$$\Delta(H_f^{\circ}1000 - H^{\circ}298) \equiv \Delta H_f^{\circ}1000 - \Delta H^{\circ}298 \equiv -3750 - \Delta H^{\circ}298 = 1923, \quad (81)$$

where $\Delta H_f^{\circ}1000 = -3750$ is from equation 79. Equation 81 yields $\Delta H^{\circ}298 = -5673$, which is called the second law value of $\Delta H^{\circ}298$ for reaction 76. Combination of this $\Delta H^{\circ}298$ and $\Delta H^{\circ}298$ for the following reaction



yields the standard enthalpy of formation of $\text{WO}_2\text{(c)}$; i.e.,



The same procedure can be used for $\Delta(S^{\circ}1000 - S^{\circ}298)$ to obtain $\Delta S^{\circ}298$ for reaction 76 by the second law method. Each term $S^{\circ}1000 - S^{\circ}298$ in $\Delta(S^{\circ}1000 - S^{\circ}298)$ can be calculated when C_p° and the enthalpies of transitions in the range of 298.15 to 1000 K are known for each species, but some or all of the $S^{\circ}298$ values may not be known. We assume that the required C_p° values for all the species in reaction 76 are known, so that ΔC_p° is closely represented by

$$\Delta C_p^{\circ} = 4.20 - 0.00222 T. \quad (84)$$

There is no phase transition for the reactants and the products in reaction 76; therefore, for this simple example,

$$\begin{aligned} \Delta(S^{\circ}1000 - S^{\circ}298) &\equiv \Delta S^{\circ}1000 - \Delta S^{\circ}298 = \int_{298}^{1000} \frac{\Delta C_p^{\circ}}{T} dT \\ &= 4.20 \ln \frac{1000}{298.15} - 0.00222(1000 - 298.15) = 3.525. \end{aligned} \quad (85)$$

The substitution of $\Delta S^{\circ}1000 = 0.093$ from equation 79 in the preceding equation yields

$$0.093 - \Delta S_{298}^{\circ} = 3.525; \quad (86)$$

hence, $\Delta S_{298}^{\circ} = -3.432$, and this value is called the second law value of ΔS_{298}° for reaction 76. If, for example, the value of S_{298}° for WO_2 is not known from the measurements of C_p° from 0 to 298 K, but the values of S_{298}° for the remaining species are known, i.e., $S_{298}^{\circ} (CO) = 47.217$, $S_{298}^{\circ} (W) = 7.800$, $S_{298}^{\circ} (CO_2) = 51.070$, then it is possible to calculate $S_{298}^{\circ} (WO_2)$ by the second law method. The required relationship is

$$\begin{aligned} \Delta S_{298}^{\circ} &= -3.432 = S_{298}^{\circ} (WO_2) + 2S_{298}^{\circ} (CO) - S_{298}^{\circ} (W) - 2S_{298}^{\circ} (CO_2) \\ &= S_{298}^{\circ} (WO_2) + 2 \times 47.217 - 7.800 - 2 \times 51.070. \end{aligned} \quad (87)$$

This equation yields $S_{298}^{\circ} (WO_2) = 12.074$, which is the second law value of the $S_{298}^{\circ} (WO_2)$. The third law value of $S_{298}^{\circ} (WO_2)$ is actually known from the measurements of C_p° from near 0 K to about 300 K, followed by the integration of $(C_p^{\circ}/T)dT$ from 0 to 298.15 K; the result is $S_{298}^{\circ} (WO_2) = 12.08$, in excellent agreement with the second law value. Reconciliation of an occasionally large difference between the second and third law values of S_{298}° for an element or a compound is very important in selecting the correct value for S_{298}° .

Gibbs Energy Function and the Third Law Method for ΔH_{298}°

The Gibbs energy function (G_{ef}) is defined by

$$G_{ef} = \frac{G_T^{\circ} - H_{298}^{\circ}}{T}. \quad (88)$$

It should be emphasized here that the term "Gibbs energy function" is not used in referring to G , G° , ΔG , and ΔG° . Substitution of $G_T^{\circ} = H_T^{\circ} - TS_T^{\circ}$ in the numerator of equation 88 gives $[-TS_T^{\circ} + (H_T^{\circ} - H_{298}^{\circ})]$; hence, equation 88 becomes

$$G_{ef} = -S_T^{\circ} + \frac{H_T^{\circ} - H_{298}^{\circ}}{T}. \quad (89)$$

Therefore, G_{ef} is obtained from the tables of this publication by

$$\text{Gef} = -(\text{third column}) + [(\text{fourth column}) \times 1000/T]. \quad (90)$$

The values of Gef are therefore in calorie per mol per kelvin, as for C_p° and S° . When T is set to 298.15, the second term in equation 89 becomes zero and $\text{Gef} = -S_{298}^\circ$. The Gibbs energy function is often tabulated in other compilations, but it is omitted in this publication to save space because it can be obtained by using equation 90. This function is useful for two reasons: (1) Its value for a reaction varies slowly with temperature, and (2) it is very useful and convenient in calculation of ΔH_{298}° when the data for ΔG_T° or K_p at high temperatures are available.

Calculation of ΔH_{298}° from high-temperature data for ΔG_T° or for K_p , by using Gef, is called the third law method, which is based on the following identity derived from equation 88:

$$\Delta \text{Gef} \equiv \frac{\Delta G_T^\circ}{T} - \frac{\Delta H_{298}^\circ}{T}. \quad (91)$$

The symbol Δ refers to the reaction to which ΔG_T° refers and accounts for the stoichiometric coefficients. For each experimental value of ΔG_T° , one value of ΔH_{298}° is calculated, and then all the values of ΔH_{298}° are arithmetically averaged to obtain the final value of ΔH_{298}° .

Example 10: The values of Gef and ΔGef in calorie per indicated mols per kelvin for reaction 76 at 800, 1000, and 1200 K are as follows:

T, K	Gef				ΔGef for reaction 76
	W(c)	2CO ₂ (g)	WO ₂ (c)	2CO(g)	
800	-9.965	-109.408	-17.602	-99.524	2.247
1000	-10.890	-112.716	-20.080	-101.696	1.830
1200	-11.722	-115.788	-22.356	-103.674	1.480

For example, at 800 K for W(c), $S_{800}^\circ = 13.820$ and $H_{800}^\circ - H_{298}^\circ = 3084$, and substitution of these values in equation 89 yields $\text{Gef} = -13.820 + (3084/800) = -9.965$. This value is listed in the table. Likewise, at 800 K for CO₂(g), $S_{800}^\circ = 61.520$ and $H_{800}^\circ - H_{298}^\circ = 5453$, and substitution of these values in equation 89 yields Gef

= $-61.520 + (5453/800) = -54.704$; however, for 2 mols of CO_2 , G_{ef} is -109.408 , as listed in the table. The values of ΔG_{ef} for reaction 76 are listed in the last column.

Example 11: Calculate the values of ΔH_{298}° for reaction 76 by the third law method from the values of K_p at 911, 990, and 1121 K in example 9.

Solution: The values of ΔG_{ef} vary slowly with temperature as shown in the last column of the table in the preceding example; hence, linear interpolations to 911, 990, and 1121 K are quite satisfactory. For example, ΔG_{ef} at 911 K is $2.247 + [(911 - 800)/200](1.830 - 2.247) = 2.016$. The results for ΔG_{ef} in calories per kelvin and ΔH_{298}° in calories, both for reaction 76 as written, are summarized in the following table:

T, K	CO:CO ₂	K _p	ΔG_{ef} , cal/K	ΔH_{298}° , cal
911	2.878	8.283	2.016	-5664
990	2.663	7.092	1.851	-5686
1121	2.371	5.622	1.618	-5660

Average = -5670

For example, the calculation for 911 K, with $\Delta G_T^\circ/T = -R \ln K = -4.2013$ and with equation 91 results in

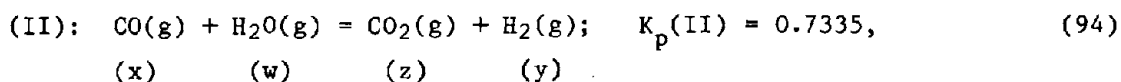
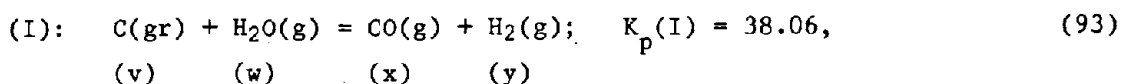
$$\Delta G_{\text{ef}} = 2.016 = -4.2013 - \frac{\Delta H_{298}^\circ}{911}; \quad \Delta H_{298}^\circ = -5664 \text{ cal.} \quad (92)$$

The average value, $\Delta H_{298}^\circ = -5670$ cal, is nearly identical with $\Delta H_{298}^\circ = -5673$ cal, obtained by the second law method. Note that while a single value of K_p yields one third law value for ΔH_{298}° , at least two values of K_p are necessary for the second law method for the linear correlation required by equation 77 and for the calculation of ΔH_{298}° . The third law method must be preferred over the second law method when reliable values of ΔG_{ef} are available.

Complex Equilibria

Calculations of the equilibrium concentrations of the species in one reaction, formed from the given amounts of initial species, can be carried out easily for one

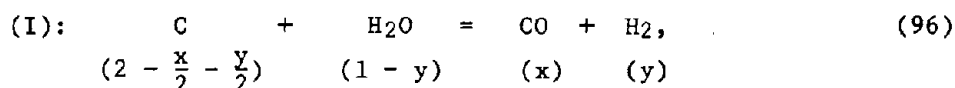
reaction. When there are two or more simultaneous reactions, the calculations become complex and often necessitate a computer (4, 7). The procedure requires the mass balance or atomic balance and the equilibrium constants to solve for all the species formed from the starting species after the attainment of equilibrium. As a simple example, assume that 2 mols of graphite and 1 mol of H_2O at 1200 K and 1 atm are injected into a closed chamber to form CO , H_2 , and CO_2 at 1200 K and 1 atm. The required independent reactions and their equilibrium constants are as follows:

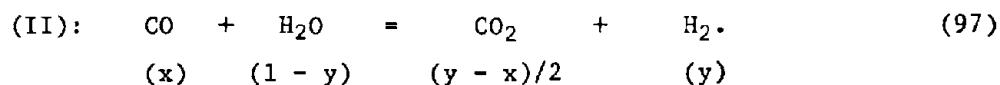


where the symbol in parentheses under each reactant or product is the mols at equilibrium. The standard Gibbs energy change $\Delta G^\circ(I)$ for the first reaction is obtained by writing $\Delta G_f^\circ(I) = \Delta G_f^\circ(CO) - \Delta G_f^\circ(H_2O) = -52049(CO) + 43371(H_2O) = -8678$ cal. Similarly, for the second reaction, $\Delta G^\circ(II) = -94681(CO_2) + 43371(H_2O) + 52049(CO) = 739$ cal. From $\Delta G^\circ(I) = -1200R \ln K_p(I) = -8678$ cal, $K_p(I)$ is 38.06, and likewise, from $\Delta G^\circ(II)$, $K_p(II)$ is 0.7335. There are five species, and the number of mols of each species after the attainment of equilibrium is written in parentheses under each formula. The material balance for carbon, hydrogen, and oxygen yields

$$2 = v + x + z, \text{ (carbon); } 2 = 2w + 2y, \text{ (hydrogen); } 1 = w + x + 2z, \text{ (oxygen), } \quad (95)$$

where the left side in each of the three equations is the initial number of atoms of each element prior to the occurrence of either reaction, and the right side, the number of atoms of each element in all the species after both reactions attain equilibrium. These three equations for mass balance and the two equilibrium constants are sufficient to solve for the five unknowns. From $v = 2 - x - z$, $w = 1 - y$, and $2z = 1 - x - w = y - x$, the variables v , w , and z are eliminated, and the reactions are rewritten as





The total number of mols of gaseous species is

$$1 - y + x + y + (y - x)/2 = 1 + (x + y)/2. \quad (98)$$

The partial pressure of each species is the same as its mol fraction because the total pressure is 1 atm; hence, the equilibrium constants are expressed by

$$K_p(I) = \frac{xy}{(1-y)[1 + (x+y)/2]} = 38.06, \quad (99)$$

$$K_p(II) = \frac{y(y-x)/2}{x(1-y)} = 0.7335. \quad (100)$$

Simplification and rearrangement of these equations give

$$y^2 + 1.05255xy + y - x - 2 = 0; \quad y^2 + 0.467xy - 1.467x = 0. \quad (101)$$

The second equation yields

$$x = y^2/(1.467 - 0.467y). \quad (102)$$

Substitution of this equation in the first equation in 101 gives

$$y^3 + 4.1004y - 5.0107 = 0. \quad (103)$$

This equation can be solved easily by successive approximation because inspection shows that y is very close to unity, and in fact for $y = 1$, the left side is 0.0897 instead of zero, and for $y = 0.98$, -0.0511. Likewise, for $y = 0.990$ and 0.985, the left side is +0.0190 and -0.0161, respectively, and the linear interpolation between these values yields $y = 0.9873$ to four decimal places. The value of x from the value of y substituted in equation 102 is 0.9690, and the results for all the species in mols are as follows:

$$\text{C: } v = 1.0218; \quad \text{H}_2\text{O: } w = 0.0127; \quad \text{CO: } x = 0.9690;$$

$$\text{H}_2: y = 0.9873; \quad \text{CO}_2: z = 0.0092.$$

In complex reactions, it is necessary to have special computer programs (4, 7) for calculating the number of mols of all species; such tasks become increasingly complex at high temperatures largely because of the occurrence of many simultaneous reactions involving many species.

Additional Examples and Practical Applications

The examples presented in the preceding sections should be adequate for effectively using the tables of this compilation. Additional examples and practical applications in this section, mostly taken or adapted from references 1 and 7, are intended to give the reader further confidence in using and applying the tabular data in various areas.

Example 12: Express the standard enthalpy of liquid zinc and gaseous zinc, both relative to the standard enthalpy of solid zinc, from the following data:

$$\begin{aligned} C_p^\circ(\text{c}) &= 5.35 + 0.0024T, \\ \Delta H^\circ(\text{melt.}) &= 1750 \text{ cal/mol at } 692.73 \text{ K (melting point)}, \\ C_p^\circ(\text{l}) &= 7.50, \\ \Delta H^\circ(\text{vap.}) &= 27565 \text{ cal/mol at } 1180 \text{ K (boiling point)}, \\ C_p^\circ(\text{g}) &= 4.97. \end{aligned}$$

$C_p^\circ(\text{c})$ is obtained by using the tabulated values at 298.15 and 600 K, and rounding off the terms as indicated; $C_p^\circ(\text{g})$ is rounded off to two decimal places.

Solution: The substitution of the foregoing values in equation 11 for the liquid yields:

$$\begin{aligned} H_T^\circ(\text{l}) - H_{298}^\circ(\text{c}) &= \int_{298}^{692.73} C_p^\circ(\text{c}) dT + \Delta H^\circ(\text{melt.}) + \int_{692.73}^T C_p^\circ(\text{l}) dT \\ &= [5.35T + 0.0012T^2]_{298}^{692.73} + 1750 + 7.50(T - 692.73) \\ &= -865 + 7.50T. \end{aligned} \tag{104}$$

For the second part, we take advantage of equation 104 by writing it as

$$H_{1180}^{\circ}(l) - H_{298}^{\circ}(c) = -865 + 7.50 \times 1180 = 7985, \quad (105)$$

and adding to it the following two equations:

$$H_{1180}^{\circ}(g) - H_{1180}^{\circ}(l) = 27565 = \Delta H_{1180}^{\circ}(\text{vap.}), \quad (106)$$

$$H_T^{\circ}(g) - H_{1180}^{\circ}(g) = \int_{1180}^T 4.97 \, dT = 4.97T - 5865. \quad (107)$$

The result for the left side is $H_T^{\circ}(g) - H_{298}^{\circ}(c)$, and the result for the right side is given in the following equation:

$$H_T^{\circ}(g) - H_{298}^{\circ}(c) = 29685 + 4.97T. \quad (108)$$

At 1300 K, this equation gives 36146, and the linear interpolation from the table for $\text{Zn}(c, l, g)$ gives 36147, in nearly perfect agreement.

Example 13: What is the amount of zinc, initially at 298.15 K, to be added into 1 mol of liquid zinc at 692.73 K to obtain equal amounts of liquid and solid? Use the data for $\text{Zn}(c)$ and $\text{Zn}(l)$ in the preceding example.

Solution: As a basis for calculation, we take 1 mol of $\text{Zn}(l)$ at 692.73 K, and add n mols of $\text{Zn}(c)$ initially at 298.15 K to form $1 + n$ mols, and to obtain $(1 + n)/2$ mols of liquid and $(1 + n)/2$ mols of solid as required by the example. The initial amount of liquid, minus the final amount of liquid, i.e., $1 - [(1 + n)/2] = (1 - n)/2$, is the amount of liquid solidified to raise the temperature of added solid zinc. From the preceding example,

$$\Delta H_{692.73}^{\circ}(\text{melt.}) = 1750, \quad (109)$$

$$H_T^{\circ}(c) - H_{298}^{\circ}(c) = 5.35T + 0.0012T^2 \Big|_{298}^{692.73} = 2580. \quad (110)$$

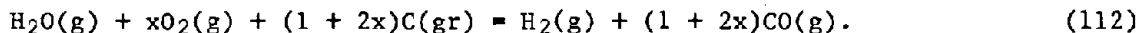
The resulting enthalpy balance requires that $(1 - n)/2$ mols of solidified zinc provide the enthalpy for raising the temperature of n mols of Zn(c) initially at 298.15 K:

$$\left(\frac{1 - n}{2}\right) 1750 = (n) 2580. \quad (111)$$

This equation gives $n = 0.2533$ mol, which is the answer.

Example 14: A mixture of steam and oxygen at 1000 K reacts completely with a column of graphite in a furnace also at 1000 K to yield a mixture of H_2 and CO at the same temperature. Calculate the composition of the steam-oxygen mixture assuming that the furnace temperature is not affected by the reaction; i.e., the overall reaction does not generate enthalpy.

Solution: We start with 1 mol of $\text{H}_2\text{O(g)}$ and x mols of $\text{O}_2\text{(g)}$, both at 1000 K, and react these gases with C(gr) in the furnace as follows:



The process does not generate enthalpy because $\text{H}_2\text{O} + \text{C}$ react endothermically to absorb the enthalpy generated by the exothermic reaction of $\text{O}_2 + \text{C}$. The reaction is assumed to go to completion; therefore, the substitution of the standard enthalpies of formation for CO(g) and for $\text{H}_2\text{O(g)}$, both at 1000 K, from the tables into the following enthalpy balance yields

$$\begin{aligned} \Delta H_{1000}^\circ &= 0 = (1 + 2x)\Delta H_{1000}^\circ(\text{CO}) - \Delta H_{1000}^\circ(\text{H}_2\text{O}) \\ &= -(1 + 2x)26766 + 59243 = 32477 - 53532x = 0. \end{aligned} \quad (113)$$

The value of x from this equation and the molar composition of the gas mixture are as follows:

$$\begin{aligned} x &= 0.6067; \text{H}_2\text{(g)}: \frac{1}{1 + (1 + 2x)} = 0.3112 \text{ mol fraction;} \\ \text{CO(g)}: &\text{balance, or } 1 - 0.3112 = 0.6888 \text{ mol fraction.} \end{aligned}$$

Example 15: Two mols of Zn(s) at 25° C are added adiabatically into 1 mol of Zn(l) at 700 K and 1 atm pressure. Calculate the entropy change from the following data: $C_p^\circ(\text{solid}) = 5.35 + 0.0024T$, $\Delta H_{692.73}^\circ(\text{melt.}) = 1750$ and $C_p^\circ(1) = 7.50$.

Solution: The process is adiabatic at constant pressure, and example 13 shows that the final temperature must be below the freezing point; therefore,

$$\Delta H_p = 0 = 2 \int_{298}^T C_p^\circ(c) dT + \int_{700}^{692.73} C_p^\circ(1) dT - \Delta H^\circ(\text{melt.}) + \int_{692.73}^T C_p^\circ(c) dT, \quad (114)$$

where the first term is for heating 2 mols of Zn(c), and the remaining terms are for cooling 1 mol of Zn(l). Integration and substitution of the limits yield

$$0 = (2 \times 5.35T + 0.0024T^2 - 3404) - 55 - (1750) + 5.35T + 0.0012T^2 - 4282. \quad (115)$$

This equation is rearranged to obtain

$$0.0036T^2 + 16.05T - 9491 = 0. \quad (116)$$

This quadratic equation gives $T = 528.7$ K as its positive root.

The process is irreversible, but since T is known, ΔS° can be calculated by equation 49 first by heating 2 mols of Zn(c) to 528.7 K, and then cooling 1 mol of Zn(l) to 528.7 K:

$$\begin{aligned} \Delta S^\circ &= 2 \int_{298}^{528.7} \frac{C_p^\circ(c)}{T} dT + \int_{700}^{692.73} \frac{C_p^\circ(1)}{T} dT - \frac{\Delta H^\circ(\text{melt.})}{692.73} + \int_{692.73}^{528.7} \frac{C_p^\circ(c)}{T} dT \\ &= 10.7 \ln(528.7/298.15) + 0.0048(528.7 - 298.15) \\ &\quad + 7.5 \ln(692.73/700) - 1750/692.73 + 5.35 \ln(528.7/692.73) \\ &\quad + 0.0024(528.7 - 692.73) = 2.792. \end{aligned} \quad (117)$$

Example 16: An ideal gas mixture is formed at 1 atm and 300 K by mixing two pure ideal gases, 0.25 mol Ar and 0.75 mol Ne, each at 1 atm and 300 K. Part 1:

Calculate the resulting change in entropy; part 2: Calculate the overall entropy change if the mixing is followed by heating the gas mixture to 600 K at 1 atm. Assume that $C_p^\circ = 2.5 R$ for each gas.

Solution: The properties of each ideal gas are independent of the presence of other gases in a gas mixture, and dependent on temperature and its own pressure, which is called its partial pressure in the mixture. Therefore, it is necessary to compute P_j for each gas j in each part.

Part 1: Each gas expands upon mixing and occupies the entire volume of mixture at the same temperature; therefore, $P_{Ar} = 1/4$ and $T = 300$ K after mixing, because $P_{Ar} + P_{Ne} = 1$ in the mixture. The energy of an ideal gas is a function of temperature only, i.e., $E = E(T)$, and the differential of E at constant temperature is zero, i.e., $d(E)_T = 0$; thus, the integration of equation 44 from 1 atm to $1/4$ atm gives

$$\int_{P=1}^{1/4} dS = S(\text{Ar in mixt.}) - 0.25S^\circ(\text{Ar}) = \int_{P=1}^{1/4} \frac{PdV}{T}, \quad (118)$$

where $S^\circ(\text{Ar})$ is the molar entropy of pure Ar at 1 atm. Differentiation of $PV = 0.25RT$ at constant temperature yields $PdV = -VdP$, and further, $V = (0.25RT/P)$; therefore, $PdV = -(0.25RT/P)dP$. Substitution in equation 118 gives

$$S(\text{Ar in mixt.}) - 0.25S^\circ(\text{Ar}) = -\int_{P=1}^{1/4} \frac{0.25RdP}{P} = -0.25R \ln \frac{1/4}{1} = 0.3466R. \quad (119)$$

The same type of calculation for 0.75 mol of Ne at $P = 3/4$ in the gas mixture yields

$$S(\text{Ne in mixt.}) - 0.75S^\circ(\text{Ne}) = -0.75R \ln(3/4) = 0.2158R. \quad (120)$$

Addition of these equations, with the notation that $S(1\text{-mol mixt.}) - 0.25S^\circ(\text{Ar}) - 0.75S^\circ(\text{Ne}) \equiv \Delta S(\text{mixing per mol of mixture}) \equiv \Delta S(\text{mixing})$, yields

$$\Delta S(\text{mixing}) = -0.25R \ln(1/4) - 0.75R \ln(3/4) = 0.5624R. \quad (121)$$

The generalized form of this equation for c components, each with its mol fraction of x_i , is

$$\Delta S(\text{mixing}) = -R \sum_{i=1}^c x_i \ln x_i. \quad (122)$$

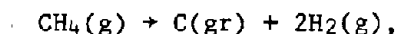
(It may be noted that if the pressure of the gas mixture were 4 atm instead of 1 atm, the change in the entropy of Ar would have been zero.) This equation is also used for calculating the ideal entropy of mixing of 1 mol of alloy from x_i mol of pure component metals in pure state at 1 atm pressure.

Part 2: The gas mixture is an ideal monatomic gas itself, for which $C_p^\circ = 2.5R$; therefore,

$$\begin{aligned} S(\text{mixt. at } 600 \text{ K}) - S(\text{mixt. at } 300 \text{ K}) &= \int_{300}^{600} \frac{C_p^\circ}{T} dT \\ &= 2.5R \ln \frac{600}{300} = 1.7329R. \end{aligned} \quad (123)$$

The total change in entropy for both steps is therefore $0.5624R + 1.7329R = 2.2953R$.

Example 17: One mol of CH_4 is sealed in a chamber at 0.330 atm and 300 K, and heated to 800 K at constant volume. Assume that $\text{CH}_4(\text{g})$ dissociates according to



without other concurrent reactions. The final pressure in the chamber is 1.197 atm. Calculate K_p as follows: Part 1, by using the pressure change; part 2, from the appropriate tables.

Solution: Part 1: It is evident that if there were no dissociation, the pressure at 800 K would have been directly proportional to the temperature in K, i.e., $P = 0.330 \times 800/300 = 0.880$ atm. However, owing to the change in the number of mols of gaseous species after dissociation, the pressure is higher than 0.880 atm. Thus, from the complete dissociation of x mols of methane out of 1 mol, there are $1 - x$, x , and $2x$ mols of CH_4 , C , and H_2 , respectively, at equilibrium, i.e.,



hence, the total number of gaseous mols is $(1-x) + 2x = 1+x$. From the observed pressure and from the ideal gas law, $1.197V = (1+x)800R$, and from the initial conditions, the volume is given by $0.330V = 300R$; division of these equations side by side gives

$$\frac{1.197V}{0.330V} = \frac{(1+x)800R}{300R}; \quad (125)$$

hence,

$$1.197 = (1+x)0.880, \quad \text{and} \quad x = 0.3602. \quad (126)$$

The equilibrium constant is therefore

$$K_p = \frac{\left(\frac{2x}{1+x} 1.197\right)^2}{\left(\frac{1-x}{1+x} 1.197\right)} = 1.197 \frac{(0.530)^2}{0.4704} = 0.715. \quad (127)$$

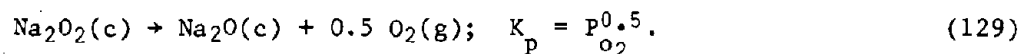
Part 2: The dissociation reaction is the reverse of the formation reaction from the pure components. The table for $\text{CH}_4(\text{g})$ gives $\Delta G_{800}^\circ = -533$, therefore, for the dissociation reaction, $\Delta G_{800}^\circ(\text{dissoc.}) = +533$, and

$$533 = -800R \ln K_p; \quad K_p = 0.715, \quad (128)$$

which is in agreement with the experimental observation.

Example 18: Calculate the partial pressure of O_2 , P_{O_2} , over (1) $\text{Na}_2\text{O}(\text{c}) + \text{Na}_2\text{O}_2(\text{c})$ mixtures at 800 K and (2) $\text{C}(\text{gr}) + \text{CO}(\text{g})$ at 2000 K when $P_{\text{CO}} = 1$ atm; (3) calculate also P_{O_2} in a gas mixture containing an equimolar mixture of CO and CO_2 at a total pressure of 1 atm and 2000 K.

Part 1: The reaction that yields oxygen is



It is assumed that the solid species are mutually insoluble; therefore, the equilibrium constant is simply $P_{O_2}^{0.5}$. From the tables, ΔG° for this reaction is

$$\Delta G^\circ = -73300 + 80684 = -800R \ln P_{O_2}^{0.5}. \quad (130)$$

Hence, $P_{O_2} = 9.24 \times 10^{-5}$ atm, or 0.07 mm Hg. Therefore, it is possible to dissociate $Na_2O_2(c)$ in a vacuum furnace at 800 K at a pressure less than 0.07 mm Hg, which is readily attained with a mechanical vacuum pump.

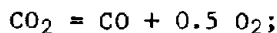
Part 2: The oxygen pressure in this case is calculated from

$$C(gr) + 0.5 O_2(g) = CO(g); \quad K_p = \frac{P_{CO}}{P_{O_2}^{0.5}}. \quad (131)$$

Since $P_{CO} = 1$, then $K_p = P_{O_2}^{-0.5}$. The required data, equation, and P_{O_2} are as follows:

$$\Delta G_{2000}^\circ = -68343 = -2000R \ln P_{O_2}^{-0.5}; \quad P_{O_2} = 1.16 \times 10^{-15}. \quad (132)$$

Part 3: The reaction, equilibrium constant, and result are as follows:

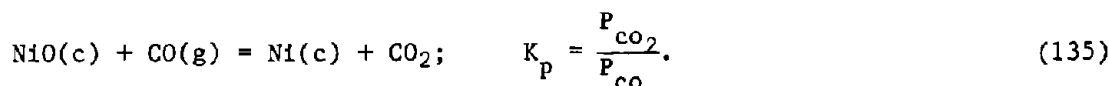


$$\begin{aligned} \Delta G^\circ &= \Delta G^\circ f(CO) - \Delta G^\circ f(CO_2) = -68343 + 94728 = -2000R \ln \frac{P_{CO} P_{O_2}^{0.5}}{P_{CO_2}} \\ &= -2000R \ln P_{O_2}^{0.5}, \end{aligned} \quad (133)$$

$$P_{O_2} = 1.71 \times 10^{-6}. \quad (134)$$

In equation 133, $P_{CO}:P_{CO_2}$ is unity because molar concentrations of CO and CO_2 were given as equal. Observe that from pure CO to equimolar mixtures of CO and CO_2 , the oxygen pressure varies from 1.16×10^{-15} to 1.71×10^{-6} , or roughly a factor of 1 billion. This interesting control of oxygen pressure by changing CO: CO_2 ratios (as well as $H_2O:H_2$ ratios in similar separate equilibria) is used in studying oxidation-reduction equilibria, and activity and solubility of oxygen in metals (5). The succeeding example illustrates an oxidation-reduction equilibrium.

Example 19: Calculate the equilibrium molar ratio of $CO_2:CO$ at 1600 K for the following reaction:



The reaction does not change the number of gas molecules; therefore, K_p is also equal to the molar ratio of $\text{CO}_2:\text{CO}$.

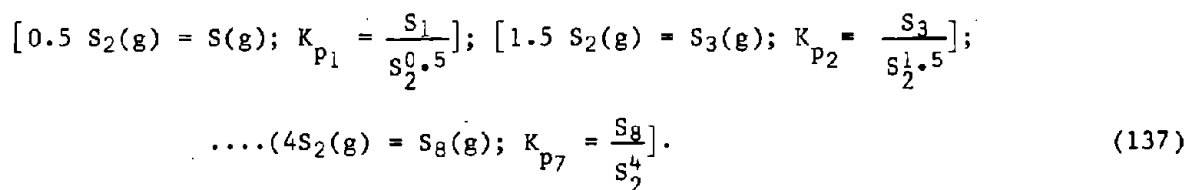
Solution: For reaction 135, $\Delta G^\circ = \Delta G_f^\circ(\text{CO}_2) - \Delta G_f^\circ(\text{NiO}) - \Delta G_f^\circ(\text{CO})$, and substitution of the respective values for ΔG_f° at 1600 K from the tables gives

$$\begin{aligned} \Delta G^\circ &= -94725(\text{CO}_2) + 23579(\text{NiO}) + 60279(\text{CO}) \\ &= -10867 = -1600R \ln K_p; \quad K_p = \text{CO}_2/\text{CO} = 30.5. \end{aligned} \quad (136)$$

It is evident that $P_{\text{CO}_2}:P_{\text{CO}}$ is the same as the molar ratio $\text{CO}_2:\text{CO}$ because a pressure change of a few atmospheres for $\text{CO}_2 + \text{CO}$ gas mixture has no effect on this reaction. Thus, a gas mixture of 96.83 mol pct CO_2 and 3.17 mol pct CO is in equilibrium with Ni and NiO at 1600 K. Similar calculations can be carried out (11) with $\text{H}_2\text{O} + \text{H}_2$ instead of $\text{CO}_2 + \text{CO}$, i.e., by starting with $\text{NiO(c)} + \text{H}_2(\text{g}) = \text{Ni(c)} + \text{H}_2\text{O(g)}$.

Example 20: Calculate the composition of a gaseous mixture of S_i ($i = 1$ to 8) at 1 atm total pressure of all S_i species as follows: Part 1, at 1000 K, and part 2 at 2000 K.

Solution: There are eight sulfur species, and we take 1 mol of all the species as the basis so that the mol fraction and the partial pressure of each species are identical. It is simple to take the chemical symbol S_i ($i = 1, 2, \dots, 8$) the same as the mol fraction of S_i to simplify the notation. Equilibria between S_2 and the remaining seven species have been selected to express seven equilibria as shown in the tables, e.g.,



Part 1: There are seven equilibrium constants for the eight species, and the eighth equation is the sum of the mol fractions, which must be equal to 1. The equilibrium constants calculated from $\Delta G^\circ_{000} = -1000R \ln K_{pi}$ are as follows:

$$\begin{aligned} \frac{S_1}{S_2^{0.5}} &= 6.93 \times 10^{-9}; \quad \frac{S_3}{S_2^{1.5}} = 0.09839; \quad \frac{S_4}{S_2^2} = 9.062 \times 10^{-3}; \quad \frac{S_5}{S_2^{2.5}} = 0.02708; \\ \frac{S_6}{S_2^3} &= 0.01329; \quad \frac{S_7}{S_2^{3.5}} = 5.070 \times 10^{-3}; \quad \frac{S_8}{S_2^4} = 1.034 \times 10^{-3}. \end{aligned} \quad (138)$$

The eighth equation is the sum of the mol fractions, i.e.,

$$\begin{aligned} \sum_{i=1}^8 S_i &= 1 = 6.93 \times 10^{-9} S_2^{0.5} + S_2 + 0.09839 S_2^{1.5} + 9.062 \times 10^{-3} S_2^2 + 0.02708 S_2^{2.5} \\ &\quad + 0.01329 S_2^3 + 5.070 \times 10^{-3} S_2^{3.5} + 1.034 \times 10^{-3} S_2^4. \end{aligned} \quad (139)$$

This equation can be solved by successive approximations. Since S_2 has to be less than 1, we start with $S_2 = 0.9$ and proceed toward $S_2 = 0$; thus,

$$[S_2 = 0.9; \text{equation 139} = 1.02603]; [S_2 = 0.8; \text{equation 139} = 0.90125].$$

These results show that for an interval of 0.1 in S_2 , equation 139 decreases $1.02603 - 0.90125 = 0.12478$, so that for a decrease of $1.02603 - 1.0000 = 0.02603$, S_2 should decrease from 0.9 by $(0.02603/0.12478) \times 0.1 \approx 0.02$, i.e., $S_2 \approx 0.88$. Substitution of $S_2 = 0.87$ and $S_2 = 0.88$ in equation 139 gives

$$[S_2 = 0.87; \text{equation 139} = 0.98828]; [S_2 = 0.88; \text{equation 139} = 1.00083].$$

These results would yield a slight refinement over $S_2 = 0.88$ to make $S_2 = 0.87934$ by linear interpolation similar to that carried out in the preceding approximation. Thus, equation 139 is satisfied well within the five significant figures selected for S_2 . The remaining mol fractions are calculated from the equilibrium constants in equation 138 by using $S_2 = 0.87934$. All the results are as follows:

S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8
6.50×10^{-9}	0.87934	0.08113	0.00701	0.01964	0.00904	0.00323	0.00062

The equilibrium constants indicate that as the total pressure decreases by orders of magnitude the predominant species becomes S_2 . This can be verified by the reader by repeating the foregoing calculations at 0.01 atm.

Part 2: The equilibrium constants at 2000 K are

$$\begin{aligned} \frac{S_1}{S_2^{0.5}} &= 3.174 \times 10^{-3}; \quad \frac{S_3}{S_2^{1.5}} = 5.303 \times 10^{-3}; \quad \frac{S_4}{S_2^2} = 8.80 \times 10^{-6}; \quad \frac{S_5}{S_2^{2.5}} = 4.26 \times 10^{-7}; \\ \frac{S_6}{S_2^3} &= 1.60 \times 10^{-9}; \quad \frac{S_7}{S_2^{3.5}} = 2.84 \times 10^{-11}; \quad \frac{S_8}{S_2^4} = 1.14 \times 10^{-13}. \end{aligned} \quad (140)$$

The species beyond S_4 are negligible; hence,

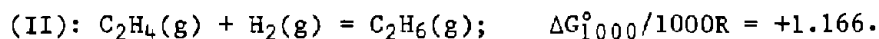
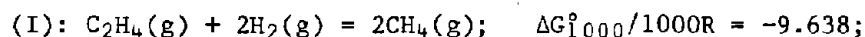
$$\sum_{i=1}^4 S_i = 1 = 3.174 \times 10^{-3} S_2^{0.5} + S_2 + 5.303 \times 10^{-3} S_2^{1.5} + 8.80 \times 10^{-6} S_2^2. \quad (141)$$

This equation is satisfied by $S_2 = 0.99159$ as obtained by successive approximations. The composition of the gas is

S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8
0.00316	0.99159	0.00524	8.7×10^{-6}	4.2×10^{-7}	1.6×10^{-9}	2.8×10^{-11}	1.1×10^{-13}

These results show that the simpler molecules, such as S and S_2 , tend to dominate in the gas mixture as the temperature is increased. For more complex problems involving many reactions and numerous species, a computer is necessary. Several computer programs are available for this purpose (4, 7).

Example 21: One mol of C_2H_4 and 3 mols of H_2 react at 1000 K and 1 atm of pressure as follows:



Assuming that there are no other concurrent reactions, calculate the number of mols of each species at equilibrium.

Solution: We write the number of mols at equilibrium under each species and use the atomic balance as follows:

$$(I): \underset{(v)}{C_2H_4} + \underset{(x)}{2H_2} = \underset{(y)}{2CH_4}; \quad K_p(I) = \exp\left(-\frac{\Delta G^\circ}{RT}\right) = \exp(9.638) = 15537; \quad (142)$$

$$(II): \underset{(v)}{C_2H_4} + \underset{(x)}{H_2} = \underset{(z)}{C_2H_6}; \quad K_p(II) = \exp\left(-\frac{\Delta G^\circ}{RT}\right) = \exp(-1.166) = 0.3116. \quad (143)$$

$$\text{Atoms of C: } 2 = 2v + y + 2z; \quad v = 1 - 0.5y - z, \quad (144)$$

$$\text{Atoms of H: } 10 = 4v + 2x + 4y + 6z. \quad (145)$$

Substitution of v from the first equation into the second gives $10 = 4 - 2y - 4z + 2x + 4y + 6z = 4 + 2y + 2z + 2x$, from which

$$z = 3 - x - y. \quad (146)$$

In turn, the substitution of the right side of this equation for z in the equation for v gives

$$v = x + 0.5y - 2. \quad (147)$$

These equations eliminate v and z in the succeeding equations. The total number of mols of gaseous species is

$$v + x + y + z = x + 0.5y + 1. \quad (148)$$

The mol fraction is the same as the partial pressure at 1 atm total pressure, e.g., for CH_4 , the mol fraction is $y/(x + 0.5y + 1)$. The substitution of the mol fractions in the equilibrium constants yields

$$(III): K_p(I) = \frac{y^2(x + 0.5y + 1)}{vx^2} = \frac{y^2(x + 0.5y + 1)}{(x + 0.5y - 2)x^2} = 15537; \quad (149)$$

$$(IV): K_p(II) = \frac{z(x + 0.5y + 1)}{vx} = \frac{(3 - x - y)(x + 0.5y + 1)}{(x + 0.5y - 2)x} = 0.3116. \quad (150)$$

ΔG° for reaction I has a fairly large negative value; therefore, it is reasonable to assume that reaction I is near completion, or $y \approx 2$. Substitute this value in III to obtain

$$(15337/4)(x - 1)x^2 - x - 2 = 0. \quad (151)$$

For $x = 1$, the left side is -3.0 ; for $x = 1.001$, the left side is $+0.841$. Therefore, an increase of 0.001 in x causes a total change of $-3 - (0.841) = -3.841$; a change of -3 in the left side of equation 151 to make it zero would correspond to $\Delta x = -3[0.001/(-3.841)] = 0.00078$. Therefore, $x = 1.00078$. Substitute this value of x in IV to obtain

$$0.5y^2 + 1.157092y - 4.311600 = 0; y = 1.99918, \quad (152)$$

where y is the positive root of this quadratic equation. Next substitute this value of y in III to obtain $x = 1.001178$ by successive approximations. Again set $x = 1.001178$ in IV, get $y = 1.998764$; eight more sets of approximations give $y = 1.998307$ and $x = 1.001613$. To test the results, substitute in $K_p(I)$ and $K_p(II)$ as follows:

$$K_p(I) = \frac{(1.998307)^2 (1.001613 + 0.999154 + 1)}{(1.001613 + 0.999154 - 2)(1.001613)^2} = 15583; \quad (153)$$

$$K_p(II) = \frac{(3 - 1.001613 - 1.998307)(1.001613 + 0.999154 + 1)}{(1.001613 + 0.999154 - 2)(1.001613)} = 0.3127. \quad (154)$$

The first set of parentheses in the denominators contain 0.000767 ; therefore, the approximation should be carried out to six repeatable decimal places. This example indicates the complexity of multispecies and multireaction equilibrium calculations.

1. Devereux, O. F. Topics in Metallurgical Thermodynamics. Wiley, 1983, 494 pp.
2. Dow Chemical Co., Thermal Research Laboratory. JANAF Thermochemical Tables. NSRDS-NBS 37, 2d ed., 1971, 1141 pp.; supplements available from Dow Chemical Co., Therm. Res. Lab., Midland, MI.
3. Gaskell, D. R. Metallurgical Thermodynamics. McGraw-Hill, 2d ed., 1981, 560 pp.
4. Gautam, R., and W. D. Seider. Computation of Phase and Chemical Equilibrium. AIChE J., v. 25, 1979, pp. 991-1015. (This article contains exhaustive references to previous computational methods.)
5. Gokcen, N. A. Equilibria in Reactions of Hydrogen, and Carbon Monoxide With Dissolved Oxygen in Liquid Iron; Equilibrium in Reduction of Ferrous Oxide With Hydrogen, and Solubility of Oxygen in Liquid Iron. Trans. AIME, v. 206, 1956, pp. 1558-1567.
6. Gokcen, N. A. Thermodynamics. Techscience Inc., Hawthorne, CA, 1975, 460 pp.
7. Gordon, S., and B. J. McBride. Computer Program for Calculation of Complex Chemical Equilibrium Compositions, Rocket Performance, Incident and Reflected Shocks, and Chapman-Jouquet Detonations. NASA SP-273, 1971, 250 pp.
8. Kelley, K. K. Contributions to the Data on Theoretical Metallurgy. XV. A Reprint of Bulletins 383, 384, 393, and 406. BuMines B 601, 1962, 525 pp.
9. Lupis, C. H. P. Chemical Thermodynamics of Materials. North-Holland Publ. Co., Amsterdam, 1983, 608 pp.
10. Martin, L. R., and N. A. Gokcen. Solutions Manual for Thermodynamics. Techscience Inc., Hawthorne, CA, 1978, 173 pp.
11. Pankratz, L. B. Thermodynamic Properties of Elements and Oxides. BuMines B 672, 1982, 509 pp.

CHAPTER 2.--TABLES OF THERMODYNAMIC PROPERTIES

Elements

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

Source of data: Pankratz (24).¹

¹Underlined numbers in parentheses refer to items in the list of references at the end of this chapter.

Ag(c,l)
Silver

T	Cp°	S°	H°-H° ₂₉₈
298	6.070	10.170	0
400	6.170	11.965	.623
600	6.436	14.515	1.881
800	6.751	16.409	3.200
1000	7.116	17.953	4.586
1200	7.530	19.286	6.049
1235	7.607	19.508	6.315
1235	8.000	21.694	9.015
1400	8.000	22.697	10.334
1600	8.000	23.765	11.934
1800*	8.000	24.707	13.534
2000	8.000	25.550	15.134

*Data extrapolated above 1600 K.
1235.08 K, melting point; $\Delta H^\circ = 2.700$

Ag(g)
Silver (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	41.321	0	68.090	58.802
400	4.968	42.781	.506	67.973	55.647
600	4.968	44.795	1.500	67.709	49.541
800	4.968	46.224	2.493	67.383	43.531
1000	4.968	47.333	3.487	66.991	37.611
1200	4.968	48.239	4.480	66.521	31.777
1400	4.968	49.004	5.474	63.230	26.400
1600	4.968	49.668	6.468	62.624	21.179
1800	4.968	50.253	7.461	62.017	16.034
2000	4.968	50.776	8.455	61.411	10.959

Al(c,l)
Aluminum

T	Cp°	S°	H°-H° ₂₉₈
298	5.820	6.776	0
400	6.120	8.530	.609
600	6.660	11.110	1.884
800	7.390	13.120	3.285
934	8.060	14.303	4.310
934	7.590	17.067	6.890
1000	7.590	17.589	7.395
1200	7.590	18.973	8.913
1400	7.590	20.143	10.431
1600	7.590	21.156	11.949
1800	7.590	22.050	13.467
2000*	7.590	22.850	14.985
2200	7.590	23.573	16.503
2400	7.590	24.234	18.021

*Data extrapolated above 1800 K.
933.61 K, melting point; $\Delta H^\circ = 2.580$

Al(g)
Aluminum (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	5.112	39.302	0	78.800	69.102
400	5.047	40.794	.517	78.708	65.802
600	5.002	42.830	1.521	78.437	59.405
800	4.987	44.266	2.520	78.035	53.118
1000	4.980	45.378	3.516	74.921	47.132
1200	4.976	46.286	4.512	74.399	41.623
1400	4.974	47.053	5.507	73.876	36.202
1600	4.972	47.717	6.501	73.352	30.854
1800	4.972	48.302	7.496	72.829	25.575
2000	4.971	48.826	8.490	72.305	20.353

Al₂(g)
Aluminum (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	9.189	55.789	0	116.400	103.807
400	9.849	58.590	.972	116.154	99.542
600	10.249	62.689	2.997	115.629	91.348
800	10.122	65.625	5.037	114.867	83.359
1000	9.933	67.862	7.042	108.652	75.968
1200	9.790	69.660	9.013	107.587	69.530
1400	9.700	71.162	10.962	106.500	63.274
1600	9.654	72.453	12.896	105.398	57.172
1800	9.640	73.589	14.825	104.291	51.211
2000	9.651	74.606	16.754	103.184	45.372

Am(c,l)
Americium

T	Cp°	S°	H°-H° ₂₉₈
298	6.178	13.023	0
400	6.491	14.882	.645
600	7.122	17.632	2.006
800	7.775	19.770	3.495
923	8.187	20.911	4.477
923	7.637	21.111	4.662
1000	7.898	21.733	5.260
1200	8.616	23.236	6.910
1350	9.192	24.284	8.246
1350	9.500	25.321	9.646
1400	9.500	25.666	10.121
1449	9.500	25.993	10.586
1449	10.000	28.367	14.026
1600	10.000	29.358	15.536
1800	10.000	30.536	17.536
2000	10.000	31.590	19.536

923 K, transition point; $\Delta H^\circ = 0.185$

1350 K, transition point; $\Delta H^\circ = 1.400$

1449 K, melting point; $\Delta H^\circ = 3.440$

Am(g)
Americium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.968	46.473	0	67.900	57.927
400	4.968	47.933	.506	67.761	54.541
600	4.968	49.947	1.500	67.394	48.005
800	4.968	51.376	2.493	66.898	41.613
1000	4.968	52.485	3.487	66.127	35.375
1200	4.968	53.391	4.480	65.470	29.284
1400	4.968	54.156	5.474	63.253	23.367
1600	4.970	54.820	6.468	58.832	18.093
1800	4.975	55.405	7.462	57.826	13.062
2000	4.989	55.930	8.458	56.822	8.142

Ar(g)
Argon

T	Cp°	S°	H°-H° ₂₉₈
298	4.968	36.983	0
400	4.968	38.443	.506
600	4.968	40.457	1.500
800	4.968	41.886	2.493
1000	4.968	42.995	3.487
1200	4.968	43.900	4.480
1400	4.968	44.666	5.474
1600	4.968	45.330	6.468
1800	4.968	45.915	7.461
2000	4.968	46.438	8.455
2200	4.968	46.912	9.448
2400	4.968	47.344	10.442
2600	4.968	47.742	11.436
2800	4.968	48.110	12.429
3000	4.968	48.453	13.423

As[α,1/4As₄(g)]
Arsenic

T	Cp°	S°	H°-H° ₂₉₈
298	5.892	8.534	0
400	6.068	10.295	.611
600	6.334	12.806	1.851
800	6.599	14.664	3.144
876	6.700	15.265	3.649
876	4.923	24.750	11.958
1000	4.934	25.402	12.569
1200	4.944	26.303	13.557

876 K, sublimation point to As₄(g);
ΔH° = 33.235/mol of As₄(g)

As(g)
Arsenic (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.968	41.611	0	72.120	62.258
400	4.968	43.071	.506	72.015	58.905
600	4.968	45.085	1.500	71.769	52.402
800	4.968	46.514	2.493	71.469	45.989
1000	4.968	47.623	3.487	63.038	40.817
1200	4.970	48.529	4.480	63.043	36.372

As₂(g)
Arsenic (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.366	57.546	0	52.820	40.751
400	8.594	60.040	.866	52.464	36.684
600	8.778	63.566	2.606	51.724	28.952
800	8.848	66.102	4.370	50.902	21.483
1000	8.882	68.080	6.142	33.824	16.548
1200	8.900	69.702	7.920	33.626	13.111

As₃(g)
Arsenic (ideal triatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	14.112	74.121	0	62.480	44.197
400	14.439	78.321	1.455	63.019	37.867
600	14.691	84.231	4.374	64.077	25.064
800	14.781	88.473	7.323	65.087	11.905
1000	14.826	91.776	10.284	53.910	0.237
1200	14.850	94.482	13.251	55.396	-10.638

As₄(g)
Arsenic (ideal tetrameric gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.456	78.232	0	36.640	23.493
400	19.056	83.752	1.916	36.112	19.083
600	19.500	91.580	5.780	35.016	10.802
800	19.660	97.212	9.696	33.760	2.915
1000	19.736	101.608	13.636	0	0
1200	19.776	105.212	17.588	0	0

Au(c,l)
Gold

T	Cp°	S°	H°-H° ₂₉₈
298	6.075	11.330	0
400	6.187	13.133	.625
600	6.397	15.679	1.882
800	6.597	17.549	3.183
1000	6.742	19.036	4.516
1200	7.254	20.299	5.903
1338	8.306	21.134	6.964
1338	7.972	23.345	9.921
1400	7.972	23.709	10.419
1600	7.972	24.773	12.013
1800	7.972	25.712	13.607
2000	7.972	26.552	15.202

1337.58 K, melting point; $\Delta H^\circ = 2.957$

Au(g)
Gold (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	43.116	0	87.500	78.023
400	4.968	44.576	.506	87.381	74.804
600	4.968	46.590	1.500	87.118	68.571
800	4.968	48.019	2.493	86.810	62.434
1000	4.970	49.128	3.487	86.471	56.379
1200	4.980	50.035	4.482	86.079	50.396
1400	5.011	50.805	5.480	82.561	44.627
1600	5.075	51.477	6.488	81.975	39.249
1800	5.178	52.081	7.513	81.406	33.942
2000	5.321	52.633	8.562	80.860	28.698

B(beta)
Boron

T	Cp°	S°	H°-H° ₂₉₈
298	2.650	1.410	0
400	3.660	2.330	.322
600	4.990	4.100	1.204
800	5.580	5.630	2.268
1000	5.960	6.920	3.425
1200	6.260	8.030	4.648
1400	6.560	9.020	5.930
1600	6.850	9.910	7.271
1800	7.130	10.740	8.669
2000	7.410	11.500	10.123

2350 K, melting point; $\Delta H^\circ = 12.0$

B(g)
Boron (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.971	36.649	0	132.800	122.293
400	4.970	38.110	.506	132.984	118.672
600	4.969	40.125	1.500	133.096	111.481
800	4.969	41.554	2.494	133.026	104.287
1000	4.968	42.663	3.487	132.862	97.119
1200	4.968	43.569	4.481	132.633	89.986
1400	4.968	44.335	5.475	132.345	82.904
1600	4.968	44.998	6.468	131.997	75.856
1800	4.968	45.583	7.462	131.593	68.876
2000	4.968	46.107	8.456	131.133	61.919

B₂(g)
Boron (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	7.301	48.228	0	198.500	184.962
400	7.667	50.425	.762	198.618	180.312
600	8.212	53.646	2.355	198.447	171.179
800	8.521	56.055	4.031	197.995	162.159
1000	8.703	57.978	5.755	197.405	153.267
1200	8.820	59.576	7.508	196.712	144.493
1400	8.902	60.942	9.281	195.921	135.858
1600	8.964	62.135	11.068	195.026	127.322
1800	9.014	63.194	12.866	194.028	118.943
2000	9.056	64.146	14.673	192.927	110.635

Ba(c,l)
Barium

T	Cp°	S°	H°-H° ₂₉₈
298	6.713	14.918	0
400	7.897	17.032	.738
582	13.010	20.823	2.607
600	8.585	21.084	2.761
768	10.145	23.422	4.358
800	10.084	23.835	4.682
1000	9.777	26.012	6.633
1002	9.778	26.032	6.653
1002	10.349	26.880	8.505
1200	9.765	29.695	10.496
1400*	9.700	31.191	12.437
1600	9.700	32.487	14.377
1800	9.700	33.629	16.317
2000	9.700	34.651	18.257

*Data extrapolated above 1300 K.
582 K, transition point; $\Delta H^\circ = 0$
768 K, transition point; $\Delta H^\circ = 0$
1002 K, melting point; $\Delta H^\circ = 1.852$

Ba(g)
Barium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.968	40.663	0	43.000	35.324
400	4.968	42.123	.506	42.768	32.732
600	4.968	44.137	1.500	41.739	27.907
800	4.968	45.566	2.493	40.811	23.426
1000	4.976	46.675	3.487	39.854	19.191
1200	5.022	47.586	4.486	36.990	15.521
1400	5.171	48.369	5.503	35.066	12.017
1600	5.496	49.079	6.566	35.189	8.642
1800	6.052	49.756	7.717	34.400	5.371
2000	6.848	50.433	9.003	33.746	2.182

Be(c,l)
Beryllium

T	Cp°	S°	H°-H° ₂₉₈
298	3.930	2.270	0
400	4.720	3.540	.443
600	5.610	5.650	1.489
800	6.080	7.330	2.662
1000	6.500	8.730	3.917
1200	6.950	9.950	5.262
1400	7.380	11.060	6.696
1527	7.610	11.710	7.651
1527*	7.700	12.110	8.262
1560	7.700	12.270	8.516
1560	7.040	14.140	11.435
1600	7.040	14.320	11.717
1800	7.040	15.140	13.125
2000	7.040	15.890	14.533
2200	7.040	16.560	15.941
2400	7.040	17.170	17.349

*Enthalpies of transition and fusion and data for Be(β) estimated.

1527 K, transition point; ΔH° = 0.611

1560 K, melting point; ΔH° = 2.919

Be(g)
Beryllium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.968	32.545	0	77.400	68.374
400	4.968	34.005	.506	77.463	65.277
600	4.968	36.019	1.500	77.411	59.190
800	4.968	37.449	2.493	77.231	53.136
1000	4.968	38.557	3.487	76.970	47.143
1200	4.968	39.463	4.481	76.619	41.203
1400	4.968	40.229	5.474	76.178	35.341
1600	4.968	40.892	6.468	72.151	29.636
1800	4.968	41.477	7.461	71.736	24.329
2000	4.969	42.001	8.455	71.322	19.100

Bi(c,l)
Bismuth

T	Cp°	S°	H°-H° ₂₉₈
298	6.100	13.560	0
400	6.350	15.380	.632
545	7.140	17.440	1.601
545	7.300	22.400	4.301
600	7.040	23.090	4.698
800	6.720	25.070	6.069
1000	6.550	26.550	7.395
1200	6.500	27.740	8.698
1400	6.500	28.740	9.998
1600	6.500	29.610	11.298
1800	6.500	30.370	12.598

*Data extrapolated above 800 K.

544.59 K, melting point; ΔH° = 2.700

Bi(g)
Bismuth (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.968	44.669	0	49.500	40.225
400	4.968	46.129	.506	49.374	37.074
600	4.968	48.144	1.500	46.302	31.270
800	4.968	49.573	2.493	45.924	26.322
1000	4.968	50.682	3.487	45.592	21.460
1200	4.968	51.587	4.480	45.282	16.666
1400	4.970	52.353	5.474	44.976	11.918
1600	4.976	53.017	6.469	44.671	7.220
1800	4.988	53.604	7.465	44.367	2.546

Bi₂(g)
Bismuth (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.830	65.480	0	52.600	41.187
400	8.880	68.002	.902	52.238	37.341
600	8.910	71.610	2.682	45.886	30.628
800	8.930	74.176	4.466	44.928	25.699
1000	8.930	76.168	6.252	44.062	20.994
1200	8.940	77.796	8.030	43.242	16.463
1400	8.940	79.174	9.826	42.430	12.058
1600	8.940	80.368	11.614	41.618	7.781
1800	8.940	81.422	13.402	40.806	3.578

Br₂(l,q)
Bromine

T	Cp°	S°	H°-H ₂₉₈ °
298	18.090	36.379	0
333	18.028	38.350	.621
333	8.683	59.592	7.686
400	8.775	61.197	8.275
600	8.908	64.784	10.045
800	8.970	67.356	11.833
1000	9.011	69.362	13.632
1200	9.042	71.008	15.437
1400	9.069	72.404	17.249
1600	9.094	73.617	19.065
1800	9.118	74.689	20.886
2000	9.141	75.651	22.712
2200	9.163	76.523	24.542
2400	9.185	77.322	26.377
2600	9.206	78.058	28.216
2800	9.228	78.741	30.060
3000	9.249	79.378	31.907

332.6 K, boiling point; $\Delta H^\circ = 7.065$

Br(g)
Bromine (ideal monatomic gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔH_f°	ΔG_f°
298	4.968	41.803	0	26.735	19.695
400	4.968	43.263	.506	23.104	18.038
600	4.979	45.279	1.500	23.213	15.480
800	5.026	46.717	2.500	23.319	12.887
1000	5.106	47.846	3.513	23.432	10.267
1200	5.199	48.785	4.543	23.560	7.622
1400	5.284	49.593	5.592	23.703	4.956
1600	5.351	50.304	6.656	23.859	2.266
1800	5.398	50.937	7.731	24.023	-0.443
2000	5.428	51.507	8.814	24.193	-3.170
2200	5.443	52.025	9.901	24.365	-5.915
2400	5.446	52.499	10.990	24.537	-8.675
2600	5.442	52.935	12.079	24.706	-11.450
2800	5.432	53.338	13.166	24.871	-14.238
3000	5.418	53.712	14.251	25.033	-17.037

Br₂(g)
Bromine (ideal diatomic gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔH_f°	ΔG_f°
298	8.616	58.640	0	7.388	0.751
400	8.775	61.197	.887	0	0
600	8.908	64.784	2.657	0	0
800	8.970	67.356	4.445	0	0
1000	9.011	69.362	6.244	0	0
1200	9.042	71.008	8.049	0	0
1400	9.069	72.404	9.860	0	0
1600	9.094	73.617	11.677	0	0
1800	9.118	74.689	13.498	0	0
2000	9.141	75.651	15.324	0	0
2200	9.163	76.523	17.154	0	0
2400	9.185	77.322	18.989	0	0
2600	9.206	78.058	20.828	0	0
2800	9.228	78.741	22.672	0	0
3000	9.249	79.378	24.519	0	0

C(c)
Carbon (graphite)

T	Cp°	S°	H°-H ₂₉₈ °
298	2.036	1.372	0
400	2.824	2.083	.248
600	4.026	3.474	.942
800	4.739	4.739	1.825
1000	5.165	5.845	2.819
1200	5.441	6.813	3.881
1400	5.635	7.667	4.990
1600	5.782	8.430	6.132
1800	5.899	9.118	7.301
2000	5.997	9.745	8.491
2200	6.083	10.320	9.699
2400	6.160	10.853	10.924
2600	6.231	11.349	12.163
2800	6.297	11.813	13.416
3000	6.360	12.250	14.682

C(c)
Carbon (diamond)

T	Cp°	S°	H°-H ₂₉₈ °	ΔH_f°	ΔG_f°
298	1.462	0.566	0	0.453	0.693
400	2.446	1.136	.200	.405	.784
600	3.852	2.418	.842	.353	.987
800	4.660	3.648	1.700	.328	1.201
1000	5.162	4.745	2.685	.319	1.419

$C_2(g)$
Carbon (ideal diatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.312	47.627	0	200.209	186.818
400	9.476	50.544	1.009	200.713	182.162
600	8.604	54.178	2.795	201.111	172.773
800	8.509	56.632	4.501	201.051	163.328
1000	8.595	58.538	6.210	200.772	153.924
1200	8.719	60.116	7.941	200.379	144.591
1400	8.852	61.470	9.698	199.918	135.328
1600	8.989	62.661	11.482	199.413	126.136
1800	9.125	63.728	13.294	198.892	117.006
2000	9.256	64.696	15.132	198.350	107.938
2200	9.381	65.584	16.996	197.793	98.921
2400	9.498	66.405	18.884	197.236	89.958
2600	9.607	67.170	20.795	196.669	81.042
2800	9.709	67.886	22.726	196.094	72.166
3000	9.805	68.559	24.678	195.514	63.337

$C_3(g)$
Carbon (ideal triatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	9.020	56.677	0	196.000	180.329
400	8.962	59.310	.912	196.168	174.944
600	9.490	63.029	2.750	195.924	164.360
800	10.153	65.852	4.716	195.241	153.933
1000	10.711	68.179	6.804	194.347	143.703
1200	11.149	70.173	8.992	193.349	133.668
1400	11.495	71.918	11.258	192.288	123.804
1600	11.775	73.472	13.586	191.190	114.099
1800	12.006	74.873	15.964	190.061	104.527
2000	12.202	76.148	18.386	188.913	95.087
2200	12.371	77.319	20.844	187.747	85.757
2400	12.520	78.402	23.333	186.561	76.538
2600	12.652	79.410	25.850	185.361	67.417
2800	12.770	80.352	28.393	184.145	58.389
3000	12.877	81.236	30.958	182.912	49.454

$C_4(g)$
Carbon (ideal tetratomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	11.992	54.543	0	232.000	217.374
400	13.780	58.333	1.318	232.326	212.326
600	16.045	64.388	4.320	232.552	202.257
800	17.463	69.213	7.681	232.381	192.175
1000	18.387	73.216	11.272	231.996	182.160
1200	19.003	76.627	15.015	231.491	172.241
1400	19.426	79.590	18.861	230.901	162.410
1600	19.724	82.204	22.778	230.250	152.676
1800	19.942	84.541	26.745	229.541	143.017
2000	20.104	86.650	30.751	228.787	133.447
2200	20.227	88.573	34.784	227.988	123.943
2400	20.324	90.337	38.840	227.144	114.524
2600	20.400	91.967	42.912	226.260	105.175
2800	20.461	93.481	46.999	225.335	95.894
3000	20.512	94.894	51.096	224.368	86.686

*All data except enthalpy of formation at 298 K estimated.

$C_5(g)$
Carbon (ideal pentatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	14.611	57.806	0	234.000	218.810
400	17.184	62.484	1.628	234.388	213.560
600	20.318	70.102	5.407	234.697	203.058
800	22.239	76.231	9.677	234.552	192.523
1000	23.484	81.337	14.258	234.163	182.051
1200	24.314	85.697	19.043	233.638	171.680
1400	24.883	89.490	23.966	233.016	161.399
1600	25.286	92.841	28.985	232.325	151.219
1800	25.579	95.837	34.073	231.568	141.123
2000	25.798	98.543	39.212	230.757	131.121
2200	25.965	101.010	44.389	229.894	121.192
2400	26.095	103.275	49.595	228.975	111.351
2600	26.198	105.368	54.825	228.010	101.590
2800	26.281	107.313	60.073	226.993	91.899
3000	26.349	109.129	65.336	225.926	82.289

*All data except enthalpy of formation at 298 K estimated.

Ca(c,l,g)
Calcium

T	Cp°	S°	H°-H ₂₉₈ °
298	6.050	9.940	0
400	6.275	11.750	.627
600	7.066	14.430	1.954
720	7.740	15.770	2.840
720	7.013	16.080	3.060
800	7.803	16.860	3.652
1000	9.776	18.810	5.410
1112	10.880	19.900	6.567
1112	7.000	21.740	8.607
1200	7.000	22.270	9.223
1400*	7.000	23.350	10.623
1600	7.000	24.280	12.023
1757	7.000	24.940	13.122
1757	4.979	45.786	49.748
1800	4.982	45.925	49.963
2000	5.008	46.451	50.962

*Data extrapolated above 1300 to 1757 K.

720 K, transition point; $\Delta H^\circ = 0.220$

1112 K, melting point; $\Delta H^\circ = 2.040$

1757 K, boiling point; $\Delta H^\circ = 36.626$

Ca(g)
Calcium (ideal monatomic gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔH_f°	ΔG_f°
298	4.968	36.992	0	42.500	34.434
400	4.968	38.452	.506	42.379	31.698
600	4.968	40.466	1.500	42.046	26.424
800	4.968	41.895	2.493	41.341	21.313
1000	4.968	43.004	3.487	40.577	16.383
1200	4.968	43.910	4.480	37.757	11.789
1400	4.969	44.675	5.474	37.351	7.496
1600	4.972	45.339	6.468	36.945	3.251
1800	4.982	45.925	7.463	0	0
2000	5.008	46.451	8.462	0	0

Ca₂(g)
Calcium (ideal diatomic gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔH_f°	ΔG_f°
298	9.152	61.289	0	82.660	70.314
400	8.699	63.918	.910	82.316	66.149
600	7.947	67.289	2.568	81.320	58.263
800	7.552	69.514	4.113	79.469	50.834
1000	7.344	71.175	5.601	77.441	43.886
1200	7.226	72.503	7.057	71.271	37.715
1400	7.154	73.611	8.494	69.908	32.233
1600	7.107	74.563	9.920	68.534	26.929
1800	7.075	75.398	11.338	-5.928	23.686
2000	7.052	76.142	12.750	-6.514	27.006

Cd(c,l,g)
Cadmium

T	Cp°	S°	H°-H ₂₉₈ °
298	6.200	12.380	0
400	6.490	14.240	.646
594	7.060	16.910	1.960
594	7.100	19.400	3.440
600	7.100	19.480	3.483
800	7.100	21.520	4.903
1000	7.100	23.110	6.323
1040	7.100	23.380	6.607
1040	4.968	46.273	30.416
1200	4.968	46.983	31.210
1400	4.968	47.749	32.204
1600	4.968	48.412	33.197
1800	4.968	48.998	34.191
2000	4.968	49.521	35.185

594.26 K, melting point; $\Delta H^\circ = 1.480$

1040 K, boiling point; $\Delta H^\circ = 23.809$

Cd(g)
Cadmium (ideal monatomic gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔH_f°	ΔG_f°
298	4.968	40.066	0	26.730	18.475
400	4.968	41.526	.506	26.590	15.676
600	4.968	43.540	1.500	24.747	10.311
800	4.968	44.970	2.493	24.320	5.560
1000	4.968	46.078	3.487	23.894	0.926
1200	4.968	46.983	4.480	0	0
1400	4.968	47.749	5.474	0	0
1600	4.968	48.412	6.468	0	0
1800	4.968	48.998	7.461	0	0
2000	4.968	49.521	8.455	0	0

Ce(c,l)
Cerium

T	Cp°	S°	H°-H ₂₉₈ °
298	6.440	17.200	0
400	6.760	19.140	.672
600	7.460	22.010	2.092
800	8.230	24.260	3.659
999	9.020	26.170	5.575
999	8.990	26.880	6.090
1000	8.990	26.890	6.099
1071	8.990	27.510	6.737
1071	9.010	28.730	8.042
1200	9.010	29.750	9.204
1400*	9.010	31.140	11.006
1600	9.010	32.340	12.808
1800	9.010	33.400	14.610
2000	9.010	34.350	16.412

*Data extrapolated above 1300 K.

999 K, transition point; $\Delta H^\circ = 0.715$

1071 K, melting point; $\Delta H^\circ = 1.305$

Ce(g)
Cerium (ideal monatomic gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	5.515	45.807	0	101.000	92.471
400	5.876	47.472	0.578	100.906	89.573
600	6.971	50.055	1.859	100.767	83.940
800	8.002	52.207	3.361	100.702	78.344
1000	8.731	54.078	5.040	99.941	72.753
1200	9.146	55.710	6.832	98.628	67.476
1400	9.322	57.136	8.682	98.676	62.282
1600	9.354	58.384	10.551	98.743	57.073
1800	9.315	59.484	12.419	98.809	51.858
2000	9.253	60.462	14.276	98.864	46.640

Cl₂(g)
Chlorine

T	Cp°	S°	H°-H ₂₉₈ °
298	8.111	53.290	0
400	8.437	55.725	.845
600	8.741	59.213	2.567
800	8.878	61.748	4.331
1000	8.956	63.738	6.115
1200	9.010	65.376	7.912
1400	9.051	66.768	9.718
1600	9.086	67.979	11.532
1800	9.117	69.051	13.352
2000	9.149	70.014	15.179
2200	9.184	70.887	17.012
2400	9.223	71.688	18.852
2600	9.268	72.428	20.701
2800	9.319	73.117	22.560
3000	9.374	73.761	24.429

Cl(g)
Chlorine (ideal monatomic gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	5.219	39.454	0	28.992	25.173
400	5.370	41.011	.540	29.110	23.850
600	5.445	43.210	1.625	29.333	21.171
800	5.389	44.771	2.710	29.537	18.419
1000	5.314	45.965	3.780	29.715	15.618
1200	5.248	46.928	4.836	29.872	12.784
1400	5.196	47.733	5.880	30.013	9.924
1600	5.156	48.424	6.915	30.141	7.046
1800	5.125	49.029	7.943	30.259	4.153
2000	5.101	49.568	8.965	30.368	1.245
2200	5.081	50.053	9.984	30.470	-1.671
2400	5.066	50.495	10.998	30.564	-4.598
2600	5.053	50.899	12.010	30.652	-7.529
2800	5.043	51.274	13.020	30.732	-10.471
3000	5.034	51.621	14.027	30.805	-13.417

Cm(c,l)
Curium

T	Cp°	S°	H°-H ₂₉₈ °
298*	6.617	17.200	0
400	6.828	19.174	.685
600	7.242	22.021	2.092
800	7.656	24.161	3.581
1000	8.070	25.914	5.154
1200	8.484	27.422	6.809
1400	8.898	28.761	8.548
1550	9.208	29.682	9.906
1550	8.000	30.182	10.681
1600	8.000	30.436	11.081
1618	8.000	30.525	11.225
1618	9.600	32.688	14.725
1800	9.600	33.712	16.472
2000	9.600	34.723	18.392

*All data except fusion
temperature estimated.

1550 K, transition point; ΔH° =
0.775

1618 K, melting point; ΔH° = 3.500

Cm(g)
Curium (ideal monatomic gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	6.717	47.158	0	92.600	83.668
400	6.936	49.168	.697	92.612	80.614
600	6.858	51.983	2.085	92.593	74.616
800	6.555	53.914	3.426	92.445	68.643
1000	6.334	55.351	4.713	92.159	62.722
1200	6.223	56.494	5.967	91.758	56.872
1400	6.191	57.450	7.207	91.259	51.094
1600	6.212	58.278	8.447	89.966	45.419
1800	6.269	59.012	9.694	85.822	40.282
2000	6.354	59.677	10.956	85.164	35.256

Co(c,l)
Cobalt

T	Cp°	S°	H°-H° ₂₉₈
298	5.930	7.180	0
400	6.340	8.970	.625
600	7.090	11.700	1.972
700	7.420	12.820	2.700
700	7.310	12.970	2.808
800	7.750	13.980	3.560
1000	8.840	15.810	5.214
1200	10.330	17.550	7.122
1394	13.140	19.280	9.379
1400	10.570	19.330	9.448
1600	9.150	20.610	11.368
1768	9.020	21.510	12.890
1768	11.516	23.604	16.590
1800	11.516	23.811	16.959
2000	11.516	25.024	19.262
2200	11.516	26.122	21.565
2400	11.516	27.124	23.869

700 K, transition point; $\Delta H^\circ = 0.108$

1394 K, Curie point; $\Delta H^\circ = 0$

1768 K, melting point; $\Delta H^\circ = 3.700$

Cr(c,l)
Chromium

T	Cp°	S°	H°-H° ₂₉₈
298	5.580	5.650	0
312	7.620	5.900	.077
400	6.020	7.350	.591
600	6.730	9.940	1.871
800	7.220	11.950	3.270
1000	7.660	13.600	4.752
1200	8.480	15.070	6.362
1400	9.270	16.430	8.142
1600	10.140	17.730	10.080
1800	10.920	18.970	12.188
2000	11.650	20.160	14.449
2130	12.100	20.910	15.993
2130	9.400	22.810	20.040
2200	9.400	23.110	20.698
2400	9.400	23.930	22.578

311.5 K, transition point; $\Delta H^\circ = 0$

2130 K, melting point; $\Delta H^\circ = 4.047$

Cr(g)
Chromium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	5.503	42.879	0	101.500	90.856
400	5.857	44.548	.579	101.454	87.223
600	6.188	47.000	1.791	101.319	80.139
800	6.259	48.793	3.038	100.978	73.128
1000	6.291	50.193	4.292	100.578	66.195
1200	6.329	51.343	5.554	99.932	59.380
1400	6.363	52.321	6.824	98.876	52.689
1600	6.383	53.172	8.099	98.231	46.132
1800	6.385	53.924	9.376	93.917	39.714
2000	6.374	54.597	10.652	92.890	33.744

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	41.635	0	95.000	84.271
400	4.968	43.094	.506	94.915	80.617
600	4.968	45.109	1.500	94.629	73.528
800	4.969	46.538	2.493	94.223	66.553
1000	4.980	47.648	3.488	93.736	59.688
1200	5.023	48.559	4.487	93.125	52.938
1400	5.124	49.340	5.501	92.359	46.285
1600	5.299	50.034	6.542	91.462	39.776
1800	5.544	50.672	7.625	90.437	33.373
2000	5.841	51.271	8.763	89.314	27.092
2200	6.165	51.843	9.963	84.265	21.052
2400	6.492	52.394	11.229	83.651	15.337

Cs(c,l,g)
Cesium

T	Cp°	S°	H°-H° ₂₉₈
298	7.695	20.370	0
302	7.747	20.458	.026
302	7.744	22.116	.526
400	7.533	24.268	1.276
600	7.409	27.293	2.767
800	7.393	29.421	4.247
952	7.404	30.695	5.371
952	4.968	47.710	21.569
1000	4.968	47.954	21.807
1200	4.969	48.860	22.800
1400	4.975	49.627	23.795
1600	4.992	50.292	24.791
1800	5.031	50.882	25.793
2000	5.102	51.415	26.805

301.55 K, melting point; $\Delta H^\circ = 0.500$

952 K, boiling point to ideal
monatomic gas; $\Delta H^\circ = 16.198$

Cs(g)
Cesium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	41.942	0	18.320	11.888
400	4.968	43.402	.506	17.550	9.896
600	4.968	45.417	1.500	17.053	6.179
800	4.968	46.846	2.493	16.566	2.626
1000	4.968	47.954	3.487	0	0
1200	4.969	48.860	4.480	0	0
1400	4.975	49.627	5.475	0	0
1600	4.992	50.292	6.471	0	0
1800	5.031	50.882	7.473	0	0
2000	5.102	51.415	8.485	0	0

Cs₂(g)
Cesium (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	9.114	68.053	0	25.400	17.257
400	9.178	70.739	.931	23.779	14.898
600	9.300	74.484	2.779	22.645	10.706
800	9.421	77.176	4.651	21.557	6.890
1000	9.542	79.291	6.548	-11.666	4.951
1200	9.666	81.042	8.468	-11.732	8.282
1400	9.799	82.542	10.415	-11.775	11.622
1600	9.946	83.859	12.389	-11.793	14.967
1800	10.114	85.040	14.395	-11.791	18.312
2000	10.306	86.116	16.436	-11.774	21.654

Cu(c,l)
Copper

T	Cp°	S°	H°-H° ₂₉₈
298	5.841	7.924	0
400	6.030	9.669	.605
600	6.330	12.174	1.843
800	6.570	14.028	3.133
1000	6.830	15.521	4.472
1200	7.270	16.803	5.879
1358	7.970	17.736	7.075
1358	7.800	20.034	10.195
1400	7.800	20.274	10.526
1600	7.800	21.316	12.086
1800	7.800	22.234	13.646
2000	7.800	23.056	15.206
2200	7.800	23.800	16.766
2400	7.800	24.478	18.326
2600	7.800	25.103	19.886
2800	7.800	25.681	21.446

1357.6 K, melting point; $\Delta H^\circ = 3.120$

2839 K, boiling point; $\Delta H^\circ = 71.9$

Cu(g)
Copper (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	39.743	0	80.600	71.113
400	4.968	41.203	.506	80.501	67.887
600	4.968	43.217	1.500	80.257	61.631
800	4.968	44.646	2.493	79.960	55.466
1000	4.968	45.755	3.487	79.615	49.381
1200	4.970	46.661	4.480	79.201	43.371
1400	4.977	47.427	5.475	75.549	37.535
1600	4.997	48.093	6.472	74.986	32.143
1800	5.041	48.684	7.475	74.429	26.819
2000	5.116	49.219	8.491	73.885	21.559

Dy(c,l)
Dysprosium

T	Cp°	S°	H°-H° ₂₉₈
298	6.720	17.900	0
400	6.710	19.870	.684
600	6.790	22.600	2.031
800	7.070	24.590	3.413
1000	7.590	26.220	4.875
1200	8.550	27.680	6.480
1400	9.870	29.090	8.317
1600	11.500	30.510	10.450
1657	11.990	30.930	11.119
1657	6.700	31.530	12.114
1682	6.700	31.630	12.281
1682	11.930	33.200	14.924
1800	11.930	34.010	16.331
2000	11.930	35.260	18.717

1657 K, transition point; $\Delta H^\circ = 0.995$

1682 K, melting point; $\Delta H^\circ = 2.643$

Dy(g)
Dysprosium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	46.794	0	69.400	60.785
400	4.968	48.254	.506	69.222	57.868
600	4.976	50.269	1.500	68.869	52.268
800	5.024	51.706	2.499	68.486	46.793
1000	5.131	52.838	3.514	68.039	41.421
1200	5.285	53.786	4.555	67.475	36.148
1400	5.463	54.614	5.629	66.712	30.978
1600	5.646	55.356	6.740	65.690	25.936
1800	5.822	56.031	7.887	60.956	21.318
2000	5.982	56.653	9.068	59.751	16.965

Er(c,l)
Erbium

T	Cp°	S°	H°-H° ₂₉₈
298	6.710	17.490	0
400	6.790	19.480	.688
600	6.970	22.260	2.063
800	7.270	24.300	3.485
1000	7.670	25.970	4.977
1200	8.180	27.410	6.560
1400	8.790	28.720	8.256
1600	9.520	29.940	10.085
1795	10.330	31.080	12.017
1795	9.250	33.730	16.774
1800	9.250	33.750	16.820
2000	9.250	34.730	18.671

1795 K, melting point; $\Delta H^\circ = 4.757$

Er(g)
Erbium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	46.347	0	75.800	67.196
400	4.968	47.807	.506	75.618	64.287
600	4.969	49.822	1.500	75.237	58.700
800	4.984	51.253	2.495	74.810	53.248
1000	5.042	52.370	3.496	74.319	47.919
1200	5.183	53.300	4.517	73.757	42.689
1400	5.441	54.116	5.577	73.121	37.567
1600	5.832	54.867	6.702	72.417	32.534
1800	6.351	55.583	7.918	66.898	27.599
2000	6.971	56.283	9.249	66.378	23.272

Eu(c,l,g)
Europium

T	Cp°	S°	H°-H° ₂₉₈
298	6.610	18.600	0
400	6.680	20.559	.677
600	7.240	23.369	2.065
800	7.980	25.535	3.573
1000	9.090	27.419	5.265
1090	9.780	28.231	6.114
1090	9.110	30.251	8.316
1200	9.110	31.127	9.318
1400	9.110	32.532	11.140
1600	9.110	33.749	12.962
1800	9.110	34.820	14.784
1800	5.019	54.034	49.369
2000	5.095	54.568	50.379

1090 K, melting point; $\Delta H^\circ = 2.202$

1800 K, boiling point; $\Delta H^\circ = 34.585$

Eu(g)
Europium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	45.097	0	41.900	34.000
400	4.968	46.557	.506	41.729	31.330
600	4.968	48.571	1.500	41.335	26.214
800	4.968	50.000	2.493	40.820	21.248
1000	4.968	51.109	3.487	40.122	16.432
1200	4.968	52.014	4.480	37.062	11.998
1400	4.971	52.780	5.474	36.234	7.887
1600	4.984	53.445	6.470	35.408	3.894
1800	5.019	54.034	7.469	34.585	0
2000	5.095	54.568	8.479	0	0

$F_2(g)$
Fluorine

T	C_p°	S°	$H^\circ - H_{298}^\circ$
298	7.481	48.443	0
400	7.883	50.700	.783
600	8.399	54.005	2.417
800	8.670	56.462	4.127
1000	8.829	58.415	5.878
1200	8.935	60.035	7.655
1400	9.012	61.418	9.450
1600	9.074	62.626	11.259
1800	9.126	63.698	13.079
2000	9.172	64.662	14.909
2200	9.214	65.538	16.747
2400	9.253	66.341	18.594
2600	9.290	67.083	20.448
2800	9.326	67.773	22.310
3000	9.361	68.418	24.179

$F(g)$
Fluorine (ideal monatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	5.437	37.917	0	18.860	14.777
400	5.361	39.505	.550	19.018	13.356
600	5.218	41.650	1.607	19.259	10.470
800	5.133	43.138	2.641	19.438	7.512
1000	5.083	44.277	3.663	19.584	4.515
1200	5.052	45.201	4.676	19.709	1.488
1400	5.032	45.978	5.684	19.819	-1.558
1600	5.018	46.649	6.689	19.920	-4.618
1800	5.009	47.240	7.692	20.013	-7.691
2000	5.001	47.767	8.693	20.099	-10.773
2200	4.996	48.244	9.692	20.179	-13.866
2400	4.992	48.678	10.691	20.254	-16.964
2600	4.988	49.078	11.689	20.325	-20.070
2800	4.986	49.447	12.687	20.392	-23.177
3000	4.984	49.791	13.683	20.453	-26.293

$Fe(c,l)$
Iron

T	C_p°	S°	$H^\circ - H_{298}^\circ$
298	5.970	6.520	0
400	6.540	8.354	.637
600	7.660	11.216	2.056
800	9.070	13.594	3.716
1000	12.950	15.920	5.814
1043	20.000	16.540	6.448
1185	9.900	17.967	8.030
1185	8.080	18.149	8.245
1200	8.110	18.250	8.367
1400	8.510	19.530	10.028
1600	8.910	20.693	11.770
1667	9.050	21.061	12.372
1667	9.830	21.181	12.572
1800	10.130	21.946	13.897
1811	10.170	22.008	14.012
1811	11.000	23.830	17.312
2000*	11.000	24.922	19.391
2200	11.000	25.970	21.591
2400	11.000	26.927	23.791
2600	11.000	27.808	25.991
2800	11.000	28.623	28.191
3000	11.000	29.382	30.391

*Data extrapolated above 1900 K.

1043 K, Curie point; $\Delta H^\circ = 0$

1185 K, transition point; $\Delta H^\circ = 0.215$

1667 K, transition point; $\Delta H^\circ = 0.200$

1811 K, melting point; $\Delta H^\circ = 3.300$

$Fe(g)$
Iron (ideal monatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	6.136	43.112	0	99.300	88.390
400	6.102	44.915	.625	99.288	84.664
600	5.784	47.331	1.814	99.058	77.389
800	5.529	48.957	2.944	98.528	70.238
1000	5.375	50.173	4.033	97.519	63.266
1200	5.302	51.145	5.099	96.032	56.558
1400	5.295	51.961	6.158	95.430	50.027
1600	5.343	52.671	7.221	94.751	43.586
1800	5.432	53.305	8.298	93.701	37.255
2000	5.548	53.883	9.396	89.305	31.383
2200	5.681	54.418	10.518	88.227	25.641
2400	5.823	54.919	11.669	87.178	19.997
2600	5.969	55.390	12.848	86.157	14.444
2800	6.116	55.838	14.056	85.165	8.963
3000	6.264	56.265	15.294	84.203	3.554

Ga(c,l)
Gallium

T	Cp°	S°	H°-H° ₂₉₈
298	6.250	9.758	0
303	6.540	9.858	.031
303	6.810	14.269	1.367
400	6.490	16.105	2.007
600	6.380	18.709	3.290
800	6.350	20.538	4.561
1000*	6.350	21.955	5.831
1200	6.350	23.112	7.101
1400	6.350	24.091	8.371
1600	6.350	24.939	9.641
1800	6.350	25.687	10.911
2000	6.350	26.356	12.181

*Data extrapolated above 900 K.

302.9 K, melting point; $\Delta H^\circ = 1.336$

Ga(g)
Gallium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	6.058	40.375	0	66.200	57.072
400	6.447	42.222	.641	64.834	54.387
600	6.290	44.829	1.926	64.836	49.164
800	5.909	46.585	3.145	64.784	43.946
1000	5.629	47.871	4.297	64.666	38.750
1200	5.445	48.880	5.403	64.502	33.580
1400	5.324	49.710	6.479	64.308	28.441
1600	5.242	50.415	7.535	64.094	23.332
1800	5.185	51.029	8.577	63.866	18.250
2000	5.143	51.573	9.610	63.629	13.195

Gd(c,l)
Gadolinium

T	Cp°	S°	H°-H° ₂₉₈
298	8.860	16.240	0
400	6.730	18.410	.753
600	6.960	21.180	2.112
800	7.380	23.240	3.545
1000	7.770	24.920	5.059
1200	8.250	26.380	6.658
1400	8.820	27.700	8.363
1533	9.250	28.520	9.565
1533	6.830	29.130	10.500
1585	6.830	29.350	10.855
1585	8.880	30.870	13.258
1600	8.880	30.950	13.391
1800	8.880	32.000	15.167
2000	8.880	32.930	16.943

291.8 K, Curie point; $\Delta H^\circ = 0$

1533 K, transition point; $\Delta H^\circ = 0.935$

1585 K, melting point; $\Delta H^\circ = 2.403$

Gd(g)
Gadolinium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	6.584	46.416	0	95.000	86.003
400	6.522	48.343	.668	94.915	82.942
600	6.319	50.952	1.953	94.841	76.978
800	6.079	52.736	3.193	94.648	71.051
1000	5.887	54.070	4.388	94.329	65.179
1200	5.793	55.134	5.554	93.896	59.391
1400	5.810	56.027	6.713	93.350	53.692
1600	5.923	56.809	7.885	89.494	48.120
1800	6.108	57.517	9.087	88.920	42.989
2000	6.337	58.172	10.331	88.388	37.904

Ge(c,l)
Germanium

T	Cp°	S°	H°-H° ₂₉₈
298	5.580	7.430	0
400	5.850	9.110	.585
600	6.030	11.530	1.775
800	6.190	13.280	2.996
1000	6.500	14.690	4.264
1200	6.860	15.910	5.599
1210	6.870	15.970	5.670
1210	6.600	23.270	14.500
1400	6.600	24.230	15.750
1600*	6.600	25.110	17.070
1800	6.600	25.890	18.390
2000	6.600	26.590	19.710

*Data extrapolated above 1500 K.

1210.4 K, melting point; $\Delta H^\circ = 8.830$

Ge(g)
Germanium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	7.345	40.104	0	89.500	79.758
400	7.426	42.283	.756	89.671	76.402
600	6.995	45.226	2.204	89.929	69.711
800	6.460	47.162	3.548	90.052	62.946
1000	6.059	48.558	4.797	90.033	56.165
1200	5.799	49.638	5.981	89.882	49.408
1400	5.646	50.519	7.124	80.874	44.069
1600	5.566	51.267	8.244	80.674	38.823
1800	5.531	51.920	9.353	80.463	33.609
2000	5.524	52.503	10.459	80.249	28.423

$H_2(g)$
Hydrogen

T	C_p°	S°	$H^\circ - H_{298}^\circ$
298	6.892	31.207	0
400	6.974	33.247	.707
600	7.009	36.082	2.106
800	7.080	38.107	3.514
1000	7.219	39.700	4.943
1200	7.407	41.033	6.405
1400	7.615	42.190	7.907
1600	7.821	43.220	9.451
1800	8.016	44.153	11.035
2000	8.193	45.007	12.656
2200	8.354	45.795	14.311
2400	8.499	46.529	15.996
2600	8.631	47.214	17.709
2800	8.752	47.858	19.448
3000	8.864	48.466	21.209

$H(g)$
Hydrogen (ideal monatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	4.968	27.392	0	52.103	48.588
400	4.968	28.852	.506	52.256	47.364
600	4.968	30.866	1.500	52.550	44.855
800	4.968	32.295	2.493	52.839	42.246
1000	4.968	33.404	3.487	53.118	39.565
1200	4.968	34.309	4.480	53.381	36.830
1400	4.968	35.075	5.474	53.624	34.051
1600	4.968	35.739	6.468	53.846	31.239
1800	4.968	36.324	7.461	54.047	28.401
2000	4.968	36.847	8.455	54.230	25.543
2200	4.968	37.321	9.448	54.396	22.664
2400	4.968	37.753	10.442	54.547	19.775
2600	4.968	38.151	11.436	54.685	16.870
2800	4.968	38.519	12.429	54.808	13.956
3000	4.968	38.862	13.423	54.922	11.035

$D_2(g)$
Deuterium (ideal diatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$
298	6.978	34.620	0
400	6.989	36.672	.711
600	7.079	39.519	2.116
800	7.290	41.582	3.551
1000	7.561	43.237	5.036
1200	7.830	44.640	6.575
1400	8.070	45.865	8.166
1600	8.275	46.957	9.801
1800	8.450	47.942	11.474
2000	8.598	48.840	13.179

$D(g)$
Deuterium (ideal monatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	4.968	29.455	0	52.992	49.371
400	4.968	30.915	.506	53.143	48.111
600	4.968	32.930	1.500	53.434	45.532
800	4.968	34.359	2.493	53.709	42.855
1000	4.968	35.467	3.487	53.961	40.112
1200	4.968	36.373	4.480	54.185	37.321
1400	4.968	37.139	5.474	54.383	34.494
1600	4.968	37.802	6.468	54.559	31.642
1800	4.968	38.387	7.461	54.716	28.767
2000	4.968	38.911	8.455	54.858	25.876

$He(g)$
Helium

T	C_p°	S°	$H^\circ - H_{298}^\circ$
298	4.968	30.125	0
400	4.968	31.585	.506
600	4.968	33.599	1.500
800	4.968	35.028	2.493
1000	4.968	36.137	3.487
1200	4.968	37.043	4.480
1400	4.968	37.809	5.474
1600	4.968	38.472	6.468
1800	4.968	39.057	7.461
2000	4.968	39.581	8.455
2200	4.968	40.054	9.448
2400	4.968	40.486	10.442
2600	4.968	40.884	11.436
2800	4.968	41.252	12.429
3000	4.968	41.595	13.423

Hf(c,l)
Hafnium

T	Cp°	S°	H°-H° ₂₉₈
298	6.150	10.410	0
400	6.340	12.240	.636
600	6.700	14.880	1.939
800	7.060	16.860	3.316
1000	7.430	18.470	4.765
1200	7.790	19.860	6.287
1400	8.160	21.090	7.882
1600	8.520	22.200	9.550
1800	8.890	23.230	11.291
2000	9.250	24.180	13.105
2013	9.270	24.240	13.225
2013*	7.887	25.040	14.835
2200	8.147	25.750	16.331
2400	8.679	26.480	18.009
2470	8.927	26.773	18.625
2470	8.000	29.033	24.305
2600	8.000	29.443	25.345
2800	8.000	30.036	26.945
3000	8.000	30.588	28.545

*Data estimated above 2013 K

2013 K, transition point; $\Delta H^\circ = 1.610$

2470 K, melting point; $\Delta H^\circ = 5.680$

Hf(g)
Hafnium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.972	44.643	0	148.000	137.793
400	5.010	46.108	.508	147.872	134.325
600	5.285	48.182	1.533	147.594	127.613
800	5.734	49.762	2.634	147.318	120.996
1000	6.196	51.092	3.827	147.062	114.440
1200	6.596	52.259	5.108	146.821	107.942
1400	6.906	53.300	6.460	146.578	101.484
1600	7.123	54.237	7.864	146.314	95.055
1800	7.260	55.085	9.304	146.013	88.674
2000	7.338	55.854	10.764	145.659	82.311
2200	7.379	56.556	12.236	143.905	76.132
2400	7.403	57.199	13.715	143.706	69.980

Hg(l,g)
Mercury

T	Cp°	S°	H°-H° ₂₉₈
298	6.687	18.140	0
400	6.552	20.084	.673
600	6.486	22.721	1.974
630	6.497	23.038	2.167
630	4.968	45.507	16.318
800	4.968	46.695	17.163
1000	4.968	47.804	18.157
1200	4.968	48.710	19.151
1400	4.968	49.476	20.144
1600	4.968	50.139	21.138
1800	4.968	50.724	22.131
2000	4.968	51.248	23.125

234.29 K, melting point; $\Delta H^\circ = 0.549$

629.81 K, boiling point; $\Delta H^\circ = 14.151$

Hg(g)
Mercury (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	41.792	0	14.670	7.618
400	4.968	43.252	.506	14.503	5.236
600	4.968	45.266	1.500	14.196	.669
800	4.968	46.695	2.493	0	0
1000	4.968	47.804	3.487	0	0
1200	4.968	48.710	4.481	0	0
1400	4.968	49.476	5.474	0	0
1600	4.968	50.139	6.468	0	0
1800	4.968	50.724	7.461	0	0
2000	4.968	51.248	8.455	0	0

Ho(c,l)
Holmium

T	Cp°	S°	H°-H° ₂₉₈
298	6.490	17.930	0
400	6.650	19.860	.670
600	6.760	22.590	2.016
800	6.950	24.550	3.378
1000	7.610	26.170	4.832
1200	8.580	27.640	6.447
1400	9.890	29.060	8.291
1600	11.540	30.480	10.429
1701*	12.460	31.210	11.641
1701	6.700	31.870	12.762
1743	6.700	32.040	13.043
1743	10.500	33.710	15.954
1800	10.500	34.050	16.553
2000	10.500	35.150	18.653

*Data for Ho(B) and Ho(l) estimated

1701 K, transition point; $\Delta H^\circ = 1.121$

1743 K, melting point; $\Delta H^\circ = 2.911$

Ho(g)
Holmium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.968	46.718	0	71.900	63.317
400	4.968	48.178	.506	71.736	60.409
600	4.969	50.192	1.500	71.384	54.823
800	4.978	51.623	2.494	71.016	49.358
1000	5.012	52.736	3.492	70.560	43.994
1200	5.083	53.656	4.501	69.954	38.735
1400	5.188	54.447	5.528	69.137	33.595
1600	5.320	55.148	6.578	68.049	28.580
1800	5.466	55.783	7.657	63.004	23.885
2000	5.616	56.367	8.765	62.012	19.578

I₂(c,l,g)
Iodine

T	Cp°	S°	H°-H° ₂₉₈
298	13.011	27.758	0
387	15.188	31.365	1.232
387	19.281	40.954	4.941
400	19.281	41.602	5.196
458	19.281	44.232	6.321
458	8.930	66.093	16.342
600	8.980	68.507	17.611
800	9.025	71.097	19.411
1000	9.061	73.115	21.220
1200	9.092	74.770	23.036
1400	9.122	76.174	24.857
1600	9.151	77.394	26.684
1800	9.179	78.473	28.517
2000	9.207	79.442	30.356
2200	9.234	80.320	32.200
2400	9.261	81.125	34.050
2600	9.289	81.867	35.905
2800	9.316	82.557	37.765
3000	9.343	83.200	39.631

386.8 K, melting point; ΔH° = 3.709
458.4 K, boiling point; ΔH° = 10.021

I(g)
Iodine (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.968	43.182	0	25.517	16.780
400	4.968	44.642	.506	23.425	13.889
600	4.968	46.656	1.500	18.212	10.770
800	4.968	48.086	2.493	18.305	8.275
1000	4.970	49.194	3.487	18.394	5.757
1200	4.977	50.101	4.482	18.481	3.222
1400	4.992	50.869	5.478	18.567	.672
1600	5.018	51.537	6.479	18.654	-1.890
1800	5.052	52.130	7.486	18.745	-4.464
2000	5.093	52.665	8.500	18.839	-7.049
2200	5.137	53.152	9.523	18.940	-9.642
2400	5.182	53.601	10.555	19.047	-12.245
2600	5.226	54.017	11.596	19.160	-14.857
2800	5.267	54.406	12.645	19.280	-17.477
3000	5.304	54.771	13.702	19.404	-20.110

I₂(g)
Iodine (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.814	62.277	0	14.919	4.627
400	8.901	64.881	.903	10.626	1.314
600	8.980	68.507	2.692	0	0
800	9.025	71.097	4.492	0	0
1000	9.061	73.115	6.301	0	0
1200	9.092	74.770	8.117	0	0
1400	9.122	76.174	9.938	0	0
1600	9.151	77.394	11.765	0	0
1800	9.179	78.473	13.598	0	0
2000	9.207	79.442	15.437	0	0
2200	9.234	80.320	17.281	0	0
2400	9.261	81.125	19.131	0	0
2600	9.289	81.867	20.986	0	0
2800	9.316	82.557	22.846	0	0
3000	9.343	83.200	24.712	0	0

In(c,l)
Indium

T	Cp°	S°	H°-H° ₂₉₈
298	6.389	13.820	0
400	6.925	15.763	.676
430	7.250	16.270	.886
430	7.050	18.085	1.666
600	7.010	20.430	2.862
800	6.970	22.441	4.260
1000*	6.950	23.993	5.651
1200	6.950	25.260	7.041
1400	6.950	26.332	8.431
1600	6.950	27.260	9.821
1800	6.950	28.078	11.211
2000	6.950	28.810	12.601

*Data extrapolated above 800 K.

429.78 K, melting point; $\Delta H^\circ = 0.780$

In(g)
Indium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH°	ΔG°
298	4.979	41.508	0	58.150	49.895
400	5.056	42.979	.510	57.984	47.098
600	5.512	45.104	1.562	56.850	42.046
800	6.062	46.768	2.721	56.611	37.149
1000	6.391	48.161	3.971	56.470	32.302
1200	6.482	49.337	5.261	56.370	27.478
1400	6.422	50.334	6.554	56.273	22.670
1600	6.295	51.183	7.826	56.155	17.878
1800	6.147	51.916	9.070	56.009	13.101
2000	6.003	52.556	10.285	55.834	8.342

Ir(c)
Iridium

T	Cp°	S°	H°-H° ₂₉₈
298	5.996	8.481	0
400	6.102	10.257	.616
600	6.362	12.779	1.862
800	6.640	14.647	3.162
1000	6.927	16.160	4.518
1200	7.221	17.448	5.933
1400	7.521	18.584	7.407
1600	7.830	19.608	8.942
1800	8.147	20.549	10.540
2000	8.475	21.424	12.202

2716 K, melting point; $\Delta H^\circ = 6.247$

Ir(g)
Iridium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH°	ΔG°
298	4.968	46.241	0	159.000	147.742
400	4.976	47.701	.506	158.890	143.912
600	5.075	49.733	1.509	158.647	136.475
800	5.314	51.222	2.546	158.384	129.124
1000	5.622	52.441	3.639	158.121	121.840
1200	5.933	53.494	4.795	157.862	114.607
1400	6.215	54.430	6.010	157.603	107.419
1600	6.455	55.276	7.278	157.336	100.267
1800	6.654	56.048	8.589	157.049	93.151
2000	6.815	56.758	9.937	156.735	86.067

K(c,l,g)
Potassium

T	Cp°	S°	H°-H° ₂₉₈
298	7.050	15.457	0
336	7.696	16.353	.284
336	7.707	18.012	.842
400	7.528	19.332	1.327
600	7.203	22.315	2.796
800	7.112	24.369	4.224
1000	7.256	25.967	5.657
1044	7.326	26.280	5.976
1044	4.968	44.521	25.014
1200	4.968	45.215	25.791
1400	4.970	45.981	26.784
1600	4.975	46.645	27.779
1800	4.988	47.231	28.775
2000	5.013	47.758	29.775
2200	5.057	48.238	30.781
2400	5.122	48.680	31.799
2600	5.213	49.094	32.832
2800	5.334	49.484	33.886
3000	5.489	49.857	34.968

336.35 K, melting point; $\Delta H^\circ = 0.558$

1043.7 K, boiling point to ideal monatomic gas; $\Delta H^\circ = 19.038$

K(g)
Potassium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.968	38.297	0	21.310	14.500
400	4.968	39.757	.506	20.489	12.319
600	4.968	41.771	1.500	20.014	8.340
800	4.968	43.200	2.493	19.579	4.514
1000	4.968	44.309	3.487	19.140	.798
1200	4.968	45.215	4.481	0	0
1400	4.970	45.981	5.474	0	0
1600	4.975	46.645	6.469	0	0
1800	4.988	47.231	7.465	0	0
2000	5.013	47.758	8.465	0	0
2200	5.057	48.238	9.471	0	0
2400	5.122	48.680	10.489	0	0
2600	5.213	49.094	11.522	0	0
2800	5.334	49.484	12.576	0	0
3000	5.489	49.857	13.658	0	0

K₂(g)
Potassium (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	9.057	59.666	0	30.374	21.802
400	9.121	62.336	.926	28.646	19.177
600	9.230	66.056	2.761	27.543	14.687
800	9.332	68.725	4.617	26.543	10.553
1000	9.432	70.818	6.494	25.554	6.670
1200	9.532	72.547	8.390	-12.818	8.642
1400	9.631	74.024	10.307	-12.887	12.226
1600	9.730	75.316	12.243	-12.941	15.817
1800	9.826	76.468	14.198	-12.978	19.411
2000	9.927	77.508	16.174	-13.002	23.014
2200	10.026	78.459	18.169	-13.019	26.618
2400	10.124	79.336	20.184	-13.040	30.218
2600	10.223	80.150	22.219	-13.071	33.828
2800	10.322	80.911	24.273	-13.125	37.435
3000	10.420	81.627	26.348	-13.214	41.047

Kr(g)
Krypton

T	Cp°	S°	H°-H° ₂₉₈
298	4.968	39.191	0
400	4.968	40.651	.506
600	4.968	42.665	1.500
800	4.968	44.094	2.493
1000	4.968	45.203	3.487
1200	4.968	46.109	4.480
1400	4.968	46.875	5.474
1600	4.968	47.538	6.468
1800	4.968	48.123	7.461
2000	4.968	48.647	8.455
2200	4.968	49.120	9.448
2400	4.968	49.552	10.442
2600	4.968	49.950	11.436
2800	4.968	50.318	12.429
3000	4.968	50.661	13.423

La(c,l)
Lanthanum

T	Cp°	S°	H°-H° ₂₉₈
298	6.480	13.600	0
400	6.550	15.510	.664
550	6.620	17.610	1.651
550	6.500	17.770	1.738
600	6.640	18.340	2.067
800	7.240	20.330	3.453
1000	7.900	22.020	4.966
1134	8.370	23.040	6.055
1134	9.480	23.700	6.801
1193	9.480	24.180	7.360
1193	8.200	25.420	8.841
1200	8.200	25.470	8.898
1400	8.200	26.730	10.538
1600*	8.200	27.830	12.178
1800	8.200	28.790	13.818
2000	8.200	29.660	15.458

*Data extrapolated above 1400 K.
550 K, transition point; ΔH° = 0.087
1134 K, transition point; ΔH° = 0.746
1193 K, melting point; ΔH° = 1.481

La(g) Lanthanum (ideal monatomic gas)					
T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	5.438	43.564	0	103.000	94.066
400	5.894	45.228	.578	102.914	91.027
600	6.455	47.736	1.819	102.752	85.114
800	6.874	49.650	3.152	102.699	79.243
1000	7.248	51.226	4.566	102.600	73.394
1200	7.497	52.572	6.042	100.144	67.622
1400	7.618	53.738	7.556	100.018	62.207
1600	7.657	54.758	9.084	99.906	56.821
1800	7.658	55.660	10.616	99.798	51.432
2000	7.648	56.467	12.146	99.688	46.074

Li(c,l,g) Lithium			
T	Cp°	S°	H°-H° ₂₉₈
298	5.887	6.954	0
400	6.599	8.774	.632
454	6.934	9.627	.998
454	7.265	11.207	1.715
600	7.060	13.216	2.763
800	6.916	15.218	4.155
1000	6.892	16.759	5.536
1200	6.868	18.013	6.912
1400	6.840	19.070	8.283
1600	6.800	19.981	9.647
1638	6.792	20.140	9.905
1638	4.970	41.605	45.065
1800	4.974	42.076	45.872
2000	4.983	42.601	46.868
2200	5.001	43.076	47.866
2400	5.031	43.513	48.869
2600	5.074	43.917	49.879
2800	5.134	44.295	50.900
3000	5.209	44.652	51.934

453.7 K, melting point; ΔH° = 0.717
1638 K, boiling point to ideal
monatomic gas; ΔH° = 35.160

Li(g) Lithium (ideal monatomic gas)					
T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.968	33.143	0	38.410	30.602
400	4.968	34.603	.506	38.284	27.952
600	4.968	36.618	1.500	37.147	23.106
800	4.968	38.047	2.493	36.748	18.485
1000	4.968	39.156	3.487	36.361	13.964
1200	4.968	40.061	4.481	35.979	9.521
1400	4.968	40.827	5.474	35.601	5.141
1600	4.970	41.491	6.468	35.231	.815
1800	4.974	42.076	7.462	0	0
2000	4.983	42.601	8.458	0	0
2200	5.001	43.076	9.456	0	0
2400	5.031	43.513	10.459	0	0
2600	5.074	43.917	11.469	0	0
2800	5.134	44.295	12.490	0	0
3000	5.209	44.652	13.524	0	0

Li ₂ (g) Lithium (ideal diatomic gas)					
T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.662	47.050	0	50.400	40.519
400	8.826	49.616	.890	50.026	37.199
600	9.022	53.236	2.677	47.551	31.469
800	9.136	55.848	4.493	46.583	26.253
1000	9.224	57.897	6.330	45.658	21.279
1200	9.301	59.585	8.182	44.758	16.487
1400	9.374	61.025	10.050	43.884	11.845
1600	9.444	62.281	11.932	43.038	7.328
1800	9.512	63.397	13.827	-27.517	9.842
2000	9.579	64.403	15.736	-27.600	13.998
2200	9.646	65.319	17.659	-27.673	18.160
2400	9.712	66.161	19.595	-27.743	22.333
2600	9.778	66.941	21.543	-27.815	26.507
2800	9.843	67.668	23.506	-27.894	30.688
3000	9.909	68.350	25.481	-27.987	34.875

Lu(c,l)
Lutetium

T	Cp°	S°	H°-H° ₂₉₈
298	6.400	12.160	0
400	6.420	14.060	.653
600	6.500	16.680	1.945
800	6.790	18.590	3.269
1000	7.240	20.150	4.670
1200	7.850	21.520	6.176
1400	8.640	22.790	7.822
1600	9.580	24.000	9.640
1800	10.680	25.190	11.663
1936	11.450	25.990	13.169
1936*	11.450	28.290	17.626
2000	11.450	28.670	18.355

*Fusion and Lu(l) data estimated.
1936 K, melting point; $\Delta H^\circ = 4.457$

Lu(g)
Lutetium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.986	44.142	0	102.200	92.671
400	5.065	45.618	.512	102.059	89.436
600	5.530	47.757	1.570	101.825	83.179
800	5.977	49.413	2.723	101.654	76.996
1000	6.231	50.778	3.948	101.478	70.850
1200	6.320	51.924	5.205	101.229	64.744
1400	6.314	52.898	6.469	100.847	58.696
1600	6.268	53.738	7.728	100.288	52.707
1800	6.209	54.473	8.976	99.513	46.804
2000	6.150	55.124	10.211	94.056	41.148

Mg(c,l,g)
Magnesium

T	Cp°	S°	H°-H° ₂₉₈
298	5.950	7.810	0
400	6.240	9.600	.621
600	6.800	12.240	1.926
800	7.360	14.270	3.342
922	7.710	15.340	4.261
922	7.680	17.660	6.400
1000	7.880	18.290	7.010
1200	8.400	19.770	8.640
1363	8.820	20.860	10.040
1363	4.968	43.051	40.290
1400	4.968	43.185	40.474
1600	4.968	43.848	41.468
1800	4.968	44.433	42.461
2000	4.969	44.957	43.455

922 K, melting point; $\Delta H^\circ = 2.139$
1363 K, boiling point; $\Delta H^\circ = 30.250$

Mg(g)
Magnesium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	35.501	0	35.000	26.744
400	4.968	36.961	.506	34.885	23.941
600	4.968	38.975	1.500	34.574	18.533
800	4.968	40.404	2.493	34.151	13.244
1000	4.968	41.513	3.487	31.477	8.254
1200	4.968	42.419	4.481	30.841	3.662
1400	4.968	43.185	5.474	0	0
1600	4.968	43.848	6.468	0	0
1800	4.968	44.433	7.461	0	0
2000	4.969	44.957	8.455	0	0

Mg₂(g)
Magnesium (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	7.658	58.282	0	68.590	55.870
400	7.376	60.489	.764	68.112	51.596
600	7.151	63.428	2.212	66.950	43.581
800	7.066	65.472	3.633	65.539	35.993
1000	7.026	67.044	5.042	59.612	29.148
1200	7.005	68.323	6.445	57.755	23.215
1400	6.991	69.402	7.844	-4.514	19.241
1600	6.983	70.335	9.242	-5.104	22.674
1800	6.977	71.157	10.638	-5.694	26.182
2000	6.973	71.892	12.032	-6.288	29.756

Mn(c,l)
Manganese

T	Cp°	S°	H°-H° ₂₉₈
298	6.280	7.650	0
400	6.760	9.560	.664
600	7.630	12.470	2.104
800	8.350	14.760	3.704
980	8.850	16.510	5.254
980	8.980	17.050	5.786
1000	9.010	17.230	5.966
1200	9.210	18.890	7.787
1360	9.370	20.060	9.274
1360	10.300	20.430	9.781
1400	10.380	20.730	10.195
1410	10.400	20.810	10.299
1410	10.810	21.130	10.748
1517	11.020	21.930	11.916
1517*	11.000	23.830	14.798
1600	11.000	24.420	15.711
1800	11.000	25.720	17.911
2000	11.000	26.880	20.111

*Fusion and Mn(l) data estimated.

980 K, transition point; $\Delta H^\circ = 0.532$

1360 K, transition point; $\Delta H^\circ = 0.507$

1410 K, transition point; $\Delta H^\circ = 0.449$

1517 K, melting point; $\Delta H^\circ = 2.882$

Mn(g)
Manganese (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	41.493	0	67.100	57.010
400	4.968	42.953	.506	66.942	53.585
600	4.968	44.967	1.500	66.496	46.998
800	4.968	46.396	2.493	65.889	40.580
1000	4.968	47.505	3.487	64.621	34.346
1200	4.968	48.410	4.480	63.793	28.369
1400	4.968	49.176	5.474	62.379	22.555
1600	4.969	49.840	6.468	57.857	17.185
1800	4.971	50.425	7.462	56.651	12.182
2000	4.977	50.949	8.456	55.445	7.307

Mo(c,l)
Molybdenum

T	Cp°	S°	H°-H° ₂₉₈
298	5.750	6.850	0
400	5.980	8.573	.598
600	6.315	11.066	1.830
800	6.539	12.915	3.116
1000	6.766	14.396	4.445
1200	7.068	15.656	5.827
1400	7.395	16.770	7.273
1600	7.763	17.781	8.788
1800	8.200	18.720	10.383
2000	8.717	19.610	12.074
2200	9.327	20.468	13.877
2400	10.089	21.311	15.814
2600	10.977	22.153	17.920
2800	11.982	23.002	20.212
2890	12.500	23.389	21.314
2890	8.190	26.080	29.091
3000	8.190	26.386	29.992

2890 K, melting point; $\Delta H^\circ = 7.777$

Mo(g)
Molybdenum (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	43.461	0	157.500	146.584
400	4.968	44.921	.506	157.408	142.869
600	4.968	46.935	1.500	157.170	135.649
800	4.968	48.365	2.493	156.877	128.517
1000	4.968	49.473	3.487	156.542	121.465
1200	4.970	50.379	4.481	156.154	114.486
1400	4.977	51.146	5.475	155.702	107.576
1600	4.998	51.811	6.472	155.184	100.736
1800	5.043	52.402	7.476	154.593	93.965
2000	5.125	52.937	8.492	153.918	87.264
2200	5.254	53.432	9.529	153.152	80.631
2400	5.440	53.896	10.597	152.283	74.079
2600	5.689	54.341	11.709	151.289	67.600
2800	6.005	54.774	12.877	150.165	61.203
3000	6.391	55.201	14.116	141.624	55.179

$N_2(g)$
Nitrogen

T	C_p°	S°	$H^\circ - H_{298}^\circ$
298	6.961	45.770	0
400	6.991	47.818	.710
600	7.196	50.685	2.126
800	7.513	52.798	3.596
1000	7.815	54.508	5.130
1200	8.060	55.955	6.718
1400	8.250	57.213	8.350
1600	8.396	58.324	10.015
1800	8.508	59.320	11.706
2000	8.597	60.221	13.417
2200	8.668	61.044	15.144
2400	8.726	61.801	16.883
2600	8.775	62.501	18.634
2800	8.815	63.153	20.393
3000	8.850	63.762	22.159

$N(g)$
Nitrogen (ideal monatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	4.968	36.613	0	112.970	108.877
400	4.968	38.073	.506	113.121	107.455
600	4.968	40.088	1.500	113.407	104.560
800	4.968	41.517	2.493	113.665	101.571
1000	4.968	42.626	3.487	113.892	98.520
1200	4.968	43.531	4.480	114.091	95.427
1400	4.968	44.297	5.474	114.269	92.302
1600	4.968	44.961	6.468	114.431	89.152
1800	4.968	45.546	7.461	114.578	85.983
2000	4.969	46.069	8.455	114.717	82.800
2200	4.971	46.543	9.449	114.847	79.601
2400	4.975	46.975	10.443	114.972	76.393
2600	4.982	47.374	11.439	115.092	73.171
2800	4.993	47.743	12.436	115.209	69.943
3000	5.010	48.088	13.436	115.326	66.705

$Na(c,l,g)$
Sodium

T	C_p°	S°	$H^\circ - H_{298}^\circ$
298	6.730	12.298	0
371	7.468	13.841	.515
371	7.596	15.517	1.137
400	7.531	16.086	1.356
600	7.124	19.056	2.818
800	6.918	21.072	4.219
1000	6.918	22.612	5.599
1177	7.091	23.752	6.835
1177	4.968	43.535	30.120
1200	4.968	43.631	30.236
1400	4.968	44.398	31.229
1600	4.968	45.061	32.223
1800	4.970	45.646	33.217
2000	4.973	46.170	34.211
2200	4.979	46.644	35.206
2400	4.992	47.078	36.203
2600	5.013	47.478	37.203
2800	5.044	47.851	38.209
3000	5.089	48.200	39.222

371 K, melting point; $\Delta H^\circ = 0.622$

1177 K, boiling point to ideal
monatomic gas; $\Delta H^\circ = 23.285$

$Na(g)$
Sodium (ideal monatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	4.968	36.714	0	25.755	18.475
400	4.968	38.174	.506	24.905	16.070
600	4.968	40.188	1.500	24.437	11.758
800	4.968	41.617	2.493	24.029	7.593
1000	4.968	42.726	3.487	23.643	3.529
1200	4.968	43.632	4.481	0	0
1400	4.968	44.398	5.474	0	0
1600	4.968	45.061	6.468	0	0
1800	4.970	45.646	7.462	0	0
2000	4.973	46.170	8.456	0	0
2200	4.979	46.644	9.451	0	0
2400	4.992	47.078	10.448	0	0
2600	5.013	47.478	11.448	0	0
2800	5.044	47.851	12.454	0	0
3000	5.089	48.200	13.467	0	0

$\text{Na}_2(\text{g})$
Sodium (ideal diatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.963	54.994	0	32.870	23.807
400	9.043	57.640	.917	31.075	20.888
600	9.150	61.328	2.737	29.971	16.041
800	9.237	63.973	4.576	29.008	11.545
1000	9.319	66.043	6.432	28.104	7.285
1200	9.399	67.749	8.303	-19.299	4.117
1400	9.477	69.204	10.191	-19.397	8.032
1600	9.555	70.474	12.094	-19.482	11.955
1800	9.633	71.604	14.013	-19.551	15.887
2000	9.711	72.623	15.948	-19.604	19.830
2200	9.788	73.552	17.897	-19.645	23.774
2400	9.865	74.407	19.863	-19.673	27.725
2600	9.942	75.200	21.844	-19.692	31.674
2800	10.020	75.940	23.840	-19.708	35.626
3000	10.097	76.634	25.851	-19.723	39.575

$\text{Nb}(\text{g})$
Niobium (ideal monatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.208	44.490	0	175.200	164.529
400	7.086	46.595	.729	175.318	160.864
600	6.704	49.395	2.108	175.459	153.604
800	6.402	51.280	3.417	175.491	146.307
1000	6.185	52.684	4.674	175.432	139.018
1200	6.034	53.797	5.895	175.296	131.764
1400	5.941	54.720	7.092	175.092	124.524
1600	5.902	55.510	8.275	174.813	117.325
1800	5.917	56.205	9.456	174.467	110.162
2000	5.981	56.832	10.645	174.056	103.032
2200	6.089	57.406	11.851	173.580	95.951
2400	6.234	57.942	13.083	173.042	88.917
2600	6.407	58.448	14.347	172.439	81.938
2800	6.599	58.930	15.647	165.589	75.121
3000	6.802	59.392	16.987	165.329	68.693

$\text{Nb}(\text{c}, \text{l})$
Niobium

T	C_p°	S°	$H^\circ - H_{298}^\circ$
298	5.880	8.700	0
400	6.090	10.460	.611
600	6.280	12.970	1.849
800	6.480	14.800	3.126
1000	6.680	16.270	4.442
1200	6.890	17.520	5.799
1400	7.160	18.600	7.200
1600	7.470	19.580	8.662
1800	7.810	20.480	10.189
2000	8.200	21.320	11.789
2200	8.620	22.120	13.471
2400	9.090	22.890	15.241
2600	9.590	23.640	17.108
2740	9.970	24.150	18.476
2740*	8.000	26.450	24.778
2800	8.000	26.620	25.258
3000	8.000	27.180	26.858

*Fusion and Nb(l) data estimated.
2740 K, melting point; $\Delta H^\circ = 6.302$

$\text{Nd}(\text{c}, \text{l})$
Neodymium

T	C_p°	S°	$H^\circ - H_{298}^\circ$
298	6.550	17.100	0
400	6.880	19.070	.683
600	7.660	22.000	2.134
800	8.710	24.340	3.765
1000	10.030	26.420	5.635
1128	10.990	27.680	6.980
1128	10.660	28.320	7.704
1200	10.660	28.980	8.472
1289	10.660	29.740	9.420
1289	10.520	31.060	11.127
1400	10.520	31.930	12.295
1600	10.520	33.330	14.399
1800	10.520	34.570	16.503
2000	10.520	35.680	18.607

1128 K, transition point; $\Delta H^\circ = 0.724$
1289 K, melting point; $\Delta H^\circ = 1.707$

$\text{Nd}(\text{g})$
Neodymium (ideal monatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	5.280	45.243	0	78.300	69.909
400	5.672	46.849	.558	78.175	67.063
600	6.285	49.275	1.758	77.924	61.559
800	6.643	51.137	3.054	77.589	56.151
1000	6.868	52.645	4.407	77.072	50.847
1200	7.033	53.912	5.798	75.626	45.708
1400	7.168	55.006	7.218	73.223	40.917
1600	7.287	55.972	8.664	72.565	36.338
1800	7.391	56.836	10.132	71.929	31.850
2000	7.480	57.619	11.619	71.312	27.434

Ne(g)
Neon

T	Cp°	S°	H°-H° ₂₉₈
298	4.968	34.947	0
400	4.968	36.407	.506
600	4.968	38.421	1.500
800	4.968	39.850	2.493
1000	4.968	40.959	3.487
1200	4.968	41.865	4.480
1400	4.968	42.631	5.474
1600	4.968	43.294	6.468
1800	4.968	43.879	7.461
2000	4.968	44.403	8.455
2200	4.968	44.876	9.448
2400	4.968	45.308	10.442
2600	4.968	45.706	11.436
2800	4.968	46.074	12.429
3000	4.968	46.417	13.423

Ni(c,l)
Nickel

T	Cp°	S°	H°-H° ₂₉₈
298	6.210	7.140	0
400	6.810	9.050	.664
600	8.330	12.050	2.156
631	9.520	12.490	2.425
800	7.410	14.270	3.691
1000	7.700	15.950	5.201
1200	8.050	17.390	6.775
1400	8.460	18.660	8.425
1600	8.910	19.820	10.162
1728	9.210	20.520	11.321
1728	9.300	22.890	15.421
1800	9.300	23.270	16.091
2000	9.300	24.250	17.951

631 K, Curie point; $\Delta H^\circ = 0$

1728 K, melting point; $\Delta H^\circ = 4.100$

Ni(g)
Nickel (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	5.583	43.519	0	102.800	91.954
400	5.702	45.175	.574	102.710	88.260
600	5.912	47.531	1.738	102.382	81.093
800	5.971	49.243	2.929	102.037	74.059
1000	5.937	50.573	4.120	101.719	67.096
1200	5.865	51.649	5.301	101.326	60.215
1400	5.781	52.547	6.465	100.840	53.398
1600	5.698	53.313	7.613	100.251	46.662
1800	5.622	53.980	8.745	95.454	40.176
2000	5.556	54.569	9.863	94.712	34.074

Np(c,l)
Neptunium

T	Cp°	S°	H°-H° ₂₉₈
298	7.080	12.060	0
400	8.127	14.266	.767
553	10.572	17.258	2.191
553*	9.400	19.681	3.531
600	9.400	20.448	3.972
800	9.400	23.152	5.852
849	9.400	23.711	6.313
849	8.700	25.195	7.573
912	8.700	25.818	8.121
912	10.850	27.178	9.361
1000	10.850	28.177	10.316
1200	10.850	30.155	12.486
1400	10.850	31.828	14.656
1600	10.850	33.277	16.826
1800	10.850	34.555	18.996
2000	10.850	35.698	21.166
2200	10.850	36.732	23.336
2400	10.850	37.676	25.506

*Data above 553 K are estimated except fusion data.

553 K, transition point; $\Delta H^\circ = 1.340$

849 K, transition point; $\Delta H^\circ = 1.260$

912 K, melting point; $\Delta H^\circ = 1.240$

Np(g)
Neptunium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.977	47.229	0	111.100	10.614
400	5.033	48.698	.509	11.842	97.069
600	5.377	50.793	1.545	108.673	90.466
800	5.961	52.417	2.676	107.924	84.512
1000	6.616	53.817	3.934	104.718	79.078
1200	7.237	55.079	5.320	103.934	74.025
1400	7.795	56.237	6.824	103.268	69.095
1600	8.293	57.311	8.434	102.708	64.254
1800	8.740	58.315	10.138	102.242	59.474
2000	9.139	59.256	11.927	101.861	54.745
2200	9.495	60.145	13.791	101.555	50.046
2400	9.807	60.984	15.722	101.316	45.377

O₂(g)
Oxygen

T	Cp°	S°	H°-H° ₂₉₈
298	7.021	49.005	0
400	7.196	51.090	.723
600	7.670	54.097	2.209
800	8.062	56.360	3.785
1000	8.334	58.190	5.426
1200	8.525	59.728	7.113
1400	8.670	61.053	8.833
1600	8.795	62.219	10.580
1800	8.909	63.262	12.350
2000	9.020	64.206	14.143
2200	9.129	65.071	15.958
2400	9.235	65.870	17.795
2600	9.337	66.613	19.652
2800	9.435	67.309	21.529
3000	9.528	67.963	23.426

O(g)
Oxygen (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	5.237	38.468	0	59.554	55.390
400	5.134	39.991	.528	59.721	53.942
600	5.049	42.053	1.544	59.993	50.991
800	5.015	43.501	2.550	60.211	47.955
1000	4.999	44.618	3.552	60.393	44.870
1200	4.990	45.528	4.550	60.548	41.751
1400	4.984	46.297	5.548	60.685	38.607
1600	4.981	46.962	6.544	60.808	35.444
1800	4.978	47.549	7.540	60.919	32.267
2000	4.978	48.073	8.536	61.019	29.079
2200	4.978	48.548	9.531	61.106	25.878
2400	4.981	48.981	10.527	61.184	22.673
2600	4.986	49.380	11.524	61.252	19.461
2800	4.994	49.750	12.522	61.312	16.244
3000	5.004	50.094	13.522	61.363	13.025

O₃(g)
Oxygen, ozone (ideal triatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	9.378	57.080	0	34.200	39.098
400	10.455	59.992	1.012	34.128	40.785
600	11.916	64.536	3.263	34.150	44.115
800	12.704	68.083	5.733	34.256	47.421
1000	13.151	70.971	8.323	34.384	50.693
1200	13.426	73.395	10.982	34.513	53.949
1400	13.611	75.479	13.687	34.638	57.178
1600	13.743	77.305	16.423	34.753	60.391
1800	13.843	78.930	19.182	34.857	63.590
2000	13.922	80.393	21.959	34.944	66.777

Os(c)
Osmium

T	Cp°	S°	H°-H° ₂₉₈
298	5.905	7.800	0
400	5.998	9.548	.606
600	6.180	12.015	1.824
800	6.362	13.817	3.078
1000	6.544	15.256	4.369
1200	6.726	16.465	5.695
1400	6.908	17.516	7.059
1600	7.090	18.450	8.459
1800	7.272	19.296	9.895
2000	7.454	20.071	11.367

3300 K, melting point; ΔH° = 7.6

Os(g)
Osmium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.968	46.000	0	189.000	177.611
400	4.974	47.461	.506	188.900	173.735
600	5.043	49.487	1.506	188.682	166.199
800	5.231	50.961	2.532	188.454	158.739
1000	5.522	52.158	3.606	188.237	151.335
1200	5.866	53.195	4.744	188.049	143.973
1400	6.211	54.125	5.952	187.893	136.640
1600	6.521	54.975	7.226	187.767	129.327
1800	6.782	55.759	8.557	187.662	122.029
2000	6.998	56.485	9.936	187.569	114.741

P(c,1,1/4P₄(g))
Phosphorus (white)

T	Cp°	S°	H°-H° ₂₉₈
298	5.698	9.820	0
317	5.820	10.179	.110
317	6.292	10.674	.267
400*	6.292	12.131	.787
550	6.292	14.109	1.731
550	4.627	19.396	4.639
600	4.684	19.803	4.872
800	4.804	21.169	5.822
1000	4.861	22.248	6.789
1200	4.894	23.137	7.765
1400	4.913	23.893	8.746
1600	4.926	24.550	9.730
1800	4.935	25.131	10.716
2000	4.941	25.651	11.703

*Data extrapolated 400-550 K.

317.3 K, melting point; ΔH° = 0.157

550 K, boiling point; ΔH°
= 2.908/mol of P.

P(c)
Phosphorus, red

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	5.069	5.460	0	-4.200	-2.900
300	5.082	5.491	.009	-4.202	-2.893
400	5.540	7.019	.542	-4.445	-2.400
500	5.852	8.292	1.112	-4.504	-1.882
600	6.165	9.386	1.713	-7.359	-1.109
700	6.500	10.361	2.346	-7.198	-0.079

704 K, sublimation point; ΔH° = 7.1

P(g)
Phosphorus (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.968	38.980	0	75.620	66.926
400	4.968	40.440	.506	75.339	64.015
600	4.968	42.454	1.500	72.248	58.657
800	4.968	43.883	2.493	72.291	54.120
1000	4.968	44.992	3.487	72.318	49.574
1200	4.969	45.898	4.481	72.336	45.023
1400	4.974	46.664	5.475	72.349	40.470
1600	4.987	47.329	6.471	72.361	35.915
1800	5.015	47.918	7.471	72.375	31.358
2000	5.062	48.449	8.478	72.395	26.799

P₂(g)
Phosphorus (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.657	52.110	0	34.370	24.689
400	8.050	54.418	.801	33.597	21.535
600	8.485	57.776	2.460	27.086	16.184
800	8.690	60.248	4.180	26.906	12.578
1000	8.800	62.200	5.930	26.722	9.018
1200	8.868	63.811	7.697	26.537	5.493
1400	8.914	65.182	9.476	26.354	2.000
1600	8.949	66.374	11.262	26.172	-1.466
1800	8.976	67.430	13.055	25.993	-4.909
2000	8.998	68.377	14.852	25.816	-8.334

P₄(g)
Phosphorus (ideal tetratomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	16.051	66.893	0	14.125	5.892
400	17.510	71.837	1.717	12.694	3.369
600	18.735	79.212	5.363	0	0
800	19.214	84.676	9.164	0	0
1000	19.445	88.991	13.033	0	0
1200	19.574	92.549	16.936	0	0
1400	19.652	95.572	20.859	0	0
1600	19.703	98.200	24.795	0	0
1800	19.738	100.523	28.739	0	0
2000	19.764	102.604	32.689	0	0

Pa(c,l)
Protactinium

T	Cp°	S°	H°-H° ₂₉₈
298*	6.601	12.400	0
400	6.903	14.332	.688
600	7.497	17.293	2.128
800	8.091	19.531	3.686
1000	8.685	21.401	5.364
1200	9.279	23.037	7.160
1400	9.873	24.511	9.076
1443	10.001	24.812	9.503
1443	9.500	25.912	11.090
1600	9.500	26.893	12.581
1800	9.500	28.012	14.481
1845	9.500	28.247	14.909
1845	11.300	29.845	17.859
2000	11.300	30.757	19.610
2200	11.300	31.834	21.870
2400	11.300	32.817	24.130

*All data estimated.

1443 K, transition point; ΔH° = 1.587

1845 K, melting point; ΔH° = 2.950

Pa(g)
Protactinium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	5.476	47.308	0	145.000	134.592
400	5.813	48.966	.575	144.887	131.053
600	6.328	51.424	1.791	144.663	124.184
800	6.797	53.309	3.104	144.418	117.396
1000	7.233	54.874	4.508	144.144	110.671
1200	7.603	56.226	5.993	143.833	104.006
1400	7.905	57.422	7.545	143.469	97.394
1600	8.153	58.494	9.151	141.570	91.008
1800	8.364	59.467	10.803	141.322	84.703
2000	8.548	60.357	12.495	137.885	78.685
2200	8.712	61.180	14.221	137.351	72.790
2400	8.859	61.945	15.979	136.849	66.942

Pb(c,l)
Lead

T	Cp°	S°	H°-H° ₂₉₈
298	6.370	15.490	0
400	6.530	17.380	.655
600	7.030	20.120	2.013
601	7.030	20.130	2.017
601	7.320	22.040	3.164
800	7.170	24.120	4.610
1000	7.020	25.700	6.028
1200	6.880	26.970	7.417
1400*	6.840	28.020	8.788
1600	6.840	28.920	10.156
1800	6.840	29.740	11.524
2000	6.840	30.460	12.892

*Data extrapolated above 1300 K.

600.65 K, melting point; $\Delta H^\circ = 1.147$

Pd(c,l)
Palladium

T	Cp°	S°	H°-H° ₂₉₈
298	6.188	9.013	0
400	6.359	10.855	.639
600	6.643	13.488	1.940
800	6.903	15.435	3.295
1000	7.161	17.003	4.701
1200	7.421	18.332	6.159
1400	7.686	19.496	7.670
1600	7.956	20.539	9.234
1800	8.231	21.492	10.852
1827	8.269	21.615	11.075
1827	9.060	23.788	15.045
2000	9.060	24.608	16.612
2200	9.060	25.471	18.424
2400	9.060	26.260	20.236

1827 K, melting point; $\Delta H^\circ = 3.970$

Pb(g)
Lead (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	41.890	0	46.750	38.879
400	4.968	43.350	.506	46.601	36.213
600	4.968	45.365	1.500	46.237	31.090
800	4.969	46.794	2.493	44.633	26.494
1000	4.978	47.903	3.488	44.210	22.007
1200	5.017	48.814	4.487	43.820	17.607
1400	5.113	49.594	5.499	43.461	13.257
1600	5.290	50.287	6.537	43.131	8.944
1800	5.554	50.924	7.620	42.846	4.715
2000	5.899	51.527	8.764	42.622	.488

Pb₂(g)
Lead (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	8.825	67.216	0	79.500	68.696
400	8.964	69.830	.907	79.097	65.069
600	9.115	73.496	2.716	78.190	58.236
800	9.219	76.133	4.549	74.829	52.515
1000	9.309	78.200	6.402	73.846	47.046
1200	9.393	79.905	8.273	72.939	41.781
1400	9.475	81.359	10.159	72.083	36.636
1600	9.555	82.629	12.063	71.251	31.589
1800	9.635	83.759	13.982	70.434	26.732
2000	9.714	84.779	15.916	69.632	21.914

Pd(g)
Palladium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	39.902	0	90.400	81.190
400	4.968	41.362	.506	90.267	78.064
600	4.969	43.376	1.500	89.960	72.027
800	4.984	44.807	2.494	89.599	66.101
1000	5.084	45.928	3.499	89.198	60.273
1200	5.380	46.877	4.541	88.782	54.528
1400	5.939	47.745	5.668	88.398	48.849
1600	6.743	48.588	6.933	88.099	43.221
1800	7.688	49.436	8.375	87.923	37.624
2000	8.632	50.295	10.008	83.796	32.422
2200	9.442	51.158	11.819	83.795	27.284
2400	10.033	52.006	13.770	83.934	22.144

Pr(c,l)
Praseodymium

T	Cp°	S°	H°-H° ₂₉₈
298	6.560	17.670	0
400	6.790	19.630	.679
600	7.530	22.500	2.103
800	8.500	24.800	3.705
1000	9.650	26.820	5.514
1068	10.010	27.460	6.183
1068	9.190	28.170	6.940
1200	9.190	29.240	8.153
1204	9.190	29.280	8.190
1204	10.270	30.640	9.836
1400	10.270	32.190	11.849
1600*	10.270	33.560	13.904
1800	10.270	34.770	15.958
2000	10.270	35.860	18.012

*Data extrapolated above 1400 K.
1068 K, transition point; $\Delta H^\circ = 0.757$
1204 K, melting point; $\Delta H^\circ = 1.646$

Pt(c,l)
Platinum

T	Cp°	S°	H°-H° ₂₉₈
298	6.180	9.950	0
400	6.330	11.789	.638
600	6.580	14.401	1.928
800	6.830	16.328	3.269
1000	7.080	17.879	4.659
1200	7.330	19.192	6.100
1400	7.590	20.342	7.593
1600	7.840	21.371	9.135
1800	8.090	22.309	10.729
2000	8.340	23.175	12.372
2042	8.370	23.349	12.725
2042*	8.300	25.649	17.421
2200	8.300	26.268	18.733

*Fusion and Pt(l) data estimated.
2042 K, melting point; $\Delta H^\circ = 4.696$

Pt(g)
Platinum (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	6.102	45.960	0	135.100	124.364
400	6.459	47.815	.644	135.106	120.696
600	6.260	50.417	1.926	135.098	113.488
800	5.877	52.164	3.138	134.969	106.300
1000	5.609	53.444	4.285	134.726	99.161
1200	5.447	54.451	5.389	134.389	92.078
1400	5.358	55.283	6.469	133.976	85.059
1600	5.318	55.996	7.535	133.500	78.100
1800	5.310	56.621	8.598	132.969	71.207
2000	5.326	57.182	9.661	132.389	64.375
2200	5.356	57.691	10.729	127.096	57.965

Pr(g)
Praseodymium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	5.105	45.339	0	85.000	76.750
400	5.385	46.876	.533	84.854	73.956
600	5.987	49.177	1.673	84.570	68.564
800	6.413	50.962	2.916	84.211	63.281
1000	6.662	52.423	4.226	83.712	58.109
1200	6.771	53.649	5.571	82.418	53.127
1400	6.783	54.695	6.928	80.079	48.572
1600	6.739	55.598	8.281	79.377	44.116
1800	6.671	56.388	9.622	78.664	39.752
2000	6.598	57.087	10.949	77.937	35.483

Pu(c,l)
Plutonium

T	Cp°	S°	H°-H° ₂₉₈
298	7.850	13.420	0
395	9.253	15.796	.821
395	8.098	17.872	1.641
400	8.124	17.974	1.682
400	8.540	19.492	2.348
480	8.406	19.773	2.483
588	9.135	21.550	3.431
588	8.880	21.789	3.571
600	8.880	21.968	3.677
730	8.880	23.709	4.831
730	8.500	23.737	4.851
752	8.500	23.989	5.038
752	8.230	24.574	5.478
800	8.230	25.084	5.874
913	8.230	26.171	6.804
913	10.100	26.910	7.479
1000	10.100	27.830	8.357
1200	10.100	29.671	10.377
1400*	10.100	31.228	12.397
1600	10.100	32.577	14.417
1800	10.100	33.766	16.437
2000	10.100	34.830	18.457
2200	10.100	35.793	20.477
2400	10.100	36.672	22.497

*Data extrapolated above 1200 K.

395 K, transition point; $\Delta H^\circ = 0.820$

480 K, transition point; $\Delta H^\circ = 0.135$

588 K, transition point; $\Delta H^\circ = 0.140$

730 K, transition point; $\Delta H^\circ = 0.020$

752 K, transition point; $\Delta H^\circ = 0.440$

913 K, melting point; $\Delta H^\circ = 0.675$

Pu(g)
Plutonium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.984	42.317	0	82.500	73.884
400	5.103	43.795	.512	81.330	71.002
600	5.823	45.981	1.596	80.419	66.011
800	6.842	47.794	2.861	79.487	61.319
1000	7.840	49.429	4.330	78.473	56.874
1200	8.789	50.943	5.994	78.117	52.591
1400	9.695	52.367	7.843	77.946	48.351
1600	10.520	53.716	9.866	77.949	44.127
1800	11.217	54.997	12.042	78.105	39.889
2000	11.769	56.208	14.343	78.386	35.630
2200	12.196	57.351	16.741	78.764	31.336
2400	12.539	58.427	19.216	79.219	27.007

Rb(c,l,g)
Rubidium

T	Cp°	S°	H°-H° ₂₉₈
298	7.424	18.350	0
313	7.744	18.710	.110
313	8.222	20.386	.634
400	7.856	22.371	1.336
600	7.251	25.426	2.841
800	6.932	27.463	4.255
975	6.900	28.829	5.460
975	4.968	46.510	22.690
1000	4.968	46.638	22.817
1200	4.968	47.544	23.811
1400	4.970	48.310	24.804
1600	4.976	48.974	25.799
1800	4.992	49.561	26.795
2000	5.022	50.088	27.797

312.64 K, melting point; $\Delta H^\circ = 0.524$

974.5 K, boiling point to ideal

monatomic gas; $\Delta H^\circ = 17.230$

Rb(g)
Rubidium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	40.626	0	19.330	12.688
400	4.968	42.086	.506	18.500	10.614
600	4.968	44.100	1.500	17.989	6.785
800	4.968	45.529	2.493	17.568	3.115
1000	4.968	46.638	3.487	0	0
1200	4.968	47.544	4.481	0	0
1400	4.970	48.310	5.474	0	0
1600	4.976	48.974	6.469	0	0
1800	4.992	49.561	7.465	0	0
2000	5.022	50.088	8.467	0	0

Re(c)
Rhenium

T	Cp°	S°	H°-H° ₂₉₈
298	6.035	8.730	0
400	6.188	10.527	.623
600	6.441	13.083	1.886
800	6.703	14.972	3.200
1000	6.965	16.496	4.567
1200	7.225	17.789	5.986
1400	7.485	18.922	7.457
1600	7.745	19.938	8.980
1800	8.005	20.866	10.555
2000	8.265	21.723	12.182

3453 K, melting point; $\Delta H^\circ = 7.9$

Re(g)
Rhenium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.968	45.131	0	184.000	173.147
400	4.968	46.591	.506	183.883	169.457
600	4.968	48.606	1.500	183.614	162.300
800	4.968	50.035	2.493	183.293	155.243
1000	4.968	51.143	3.487	182.920	148.273
1200	4.969	52.049	4.480	182.494	141.382
1400	4.974	52.815	5.475	182.018	134.568
1600	4.989	53.480	6.470	181.490	127.823
1800	5.025	54.070	7.471	180.916	121.149
2000	5.097	54.602	8.483	180.301	114.543

Rh(c,l)
Rhodium

T	Cp°	S°	H°-H° ₂₉₈
298	5.952	7.542	0
400	6.257	9.335	.622
600	6.740	11.967	1.923
800	7.167	13.965	3.315
1000	7.587	15.609	4.790
1200	8.032	17.031	6.351
1400	8.528	18.306	8.006
1600	9.103	19.481	9.768
1800	9.784	20.591	11.654
2000	10.597	21.663	13.690
2200	11.569	22.717	15.904
2237	11.769	22.912	16.336
2237	12.090	25.753	22.692
2400	12.090	26.603	24.663

2237 K, melting point; ΔH° = 6.356

Rh(g)
Rhodium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	5.022	44.387	0	133.100	122.115
400	5.173	45.882	.518	132.996	118.377
600	5.617	48.061	1.596	132.773	111.117
800	6.034	49.736	2.763	132.548	103.931
1000	6.329	51.117	4.002	132.312	96.804
1200	6.505	52.288	5.287	132.036	89.728
1400	6.594	53.298	6.598	131.692	82.703
1600	6.629	54.181	7.921	131.253	75.733
1800	6.636	54.963	9.248	130.694	68.824
2000	6.630	55.662	10.574	129.984	61.986

Ru(c,l)
Ruthenium

T	Cp°	S°	H°-H° ₂₉₈
298	5.730	6.839	0
400	6.041	8.568	.600
600	6.485	11.107	1.855
800	6.827	13.021	3.188
1000	7.122	14.577	4.583
1200	7.413	15.901	6.036
1400	7.734	17.067	7.550
1600	8.121	18.124	9.134
1800	8.610	19.107	10.805
2000	9.235	20.045	12.587
2200	10.030	20.961	14.510
2400	11.032	21.875	16.613
2600	12.273	22.806	18.939
2607	12.322	22.839	19.025
2607	12.400	26.368	28.225
2800	12.400	27.253	30.618
3000	12.400	28.109	33.098

2607 K, melting point; ΔH° = 9.2

Ru(g)
Ruthenium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	5.144	44.550	0	153.600	142.356
400	5.414	46.099	.537	153.537	138.525
600	5.918	48.395	1.673	153.418	131.045
800	6.203	50.142	2.889	153.301	123.604
1000	6.298	51.539	4.142	153.159	116.197
1200	6.301	52.688	5.402	152.966	108.822
1400	6.293	53.658	6.661	152.711	101.484
1600	6.318	54.500	7.922	152.388	94.186
1800	6.392	55.248	9.192	151.987	86.933
2000	6.510	55.927	10.481	151.494	79.730
2200	6.660	56.554	11.798	150.888	72.583
2400	6.829	57.141	13.147	150.134	65.496
2600	7.005	57.695	14.530	149.191	58.480
2800	7.178	58.220	15.948	138.930	52.222
3000	7.341	58.721	17.401	137.903	46.067

S(c,l)
Sulfur

T	Cp°	S°	H°-H° ₂₉₈
298	5.425	7.661	0
368	5.795	8.846	.394
368	5.921	9.106	.490
388	6.015	9.423	.609
388	7.423	10.486	1.022
400	7.687	10.709	1.110
432	12.860	11.340	1.373
600	8.200	14.362	2.904
718	7.694	15.790	3.841

368.3 K, transition point; $\Delta H^\circ = 0.096$

388.36 K, melting point; $\Delta H^\circ = 0.413$

432.02 K, transition point; $\Delta H^\circ = 0$

717.82 K, boiling point; mixed
polymeric gases

S(g)
Sulfur (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	5.658	40.086	0	50.845	47.019
400	5.553	41.735	0.571	51.010	45.685
600	5.339	43.943	1.659	51.260	42.965
800	5.210	45.460	2.713	51.448	40.171
1000	5.136	46.614	3.747	51.599	37.333
1200	5.093	47.546	4.769	51.722	34.468
1400	5.069	48.329	5.785	51.826	31.584
1600	5.062	49.005	6.798	51.911	28.687
1800	5.068	49.602	7.811	51.982	25.779
2000	5.085	50.137	8.826	52.044	22.864
2200	5.111	50.622	9.845	52.098	19.944
2400	5.144	51.068	10.871	52.151	17.019
2600	5.181	51.482	11.903	52.201	14.087
2800	5.219	51.867	12.943	52.254	11.155
3000	5.258	52.228	13.991	52.310	8.218

S₂(g)
Sulfur (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈
298	7.765	54.506	0
400	8.148	56.845	0.812
600	8.553	60.236	2.487
800	8.756	62.727	4.219
1000	8.909	64.697	5.986
1200	9.057	66.335	7.783
1400	9.205	67.742	9.609
1600	9.348	68.980	11.464
1800	9.479	70.089	13.347
2000	9.595	71.094	15.255
2200	9.691	72.013	17.184
2400	9.775	72.860	19.131
2600	9.842	73.645	21.093
2800	9.898	74.377	23.067
3000	9.949	75.061	25.051

S₂(g)
Sulfur (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	7.765	54.506	0	30.710	19.027
300	7.774	54.555	.014	30.704	18.954
400	8.148	56.845	.812	29.302	15.131
500	8.392	58.691	1.639	28.255	11.706
600	8.553	60.236	2.487	27.389	8.482
700	8.666	61.563	3.348	26.650	5.390
717	8.682	61.781	3.503	26.531	4.852

S₃(g)
Sulfur (ideal triatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	11.493	65.275	0	-11.793	-6.878
400	12.354	68.785	1.218	-11.793	-5.200
600	13.137	73.968	3.780	-11.743	-1.912
800	13.457	77.797	6.444	-11.678	1.357
1000	13.614	80.818	9.152	-11.620	4.608
1200	13.702	83.309	11.885	-11.583	7.850
1400	13.757	85.425	14.631	-11.576	11.088
1600	13.792	87.265	17.386	-11.603	14.325
1800	13.817	88.891	20.148	-11.666	17.571
2000	13.834	90.348	22.913	-11.763	20.824
2200	13.848	91.667	25.681	-11.888	24.087
2400	13.857	92.872	28.451	-12.038	27.365
2600	13.865	93.982	31.224	-12.209	30.654
2800	13.871	95.009	33.997	-12.396	33.962
3000	13.876	95.967	36.772	-12.598	37.276

$S_4(g)$
Sulfur (ideal tetratomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	15.761	70.128	0	-29.003	-17.410
400	17.225	74.985	1.687	-28.940	-13.458
600	18.553	82.264	5.286	-28.691	-5.766
800	19.097	87.686	9.058	-28.383	1.831
1000	19.366	91.980	12.908	-28.067	9.347
1200	19.517	95.525	16.797	-27.772	16.802
1400	19.609	98.541	20.710	-27.511	24.209
1600	19.670	101.163	24.639	-27.292	31.583
1800	19.712	103.483	28.577	-27.120	38.931
2000	19.742	105.561	32.523	-26.990	46.264
2200	19.764	107.444	36.473	-26.898	53.582
2400	19.781	109.164	40.428	-26.837	60.897
2600	19.795	110.748	44.386	-26.803	68.206
2800	19.805	112.216	48.346	-26.791	75.515
3000	19.814	113.582	52.308	-26.797	82.823

$S_6(g)$
Sulfur (ideal hexatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	26.901	84.555	0	-68.126	-44.583
400	28.846	92.766	2.851	-67.711	-36.603
600	30.403	104.813	8.804	-66.703	-21.246
800	30.995	113.652	14.952	-65.831	-6.208
1000	31.278	120.603	21.182	-64.902	8.586
1200	31.434	126.321	27.455	-64.020	23.201
1400	31.529	131.174	33.751	-63.202	37.671
1600	31.591	135.388	40.064	-62.454	52.029
1800	31.633	139.112	46.387	-61.780	66.299
2000	31.664	142.446	52.717	-61.174	80.498
2200	31.687	145.465	59.052	-60.626	94.637
2400	31.704	148.223	65.391	-60.128	108.729
2600	31.718	150.761	71.733	-59.672	122.780
2800	31.728	153.112	78.077	-59.250	136.803
3000	31.737	155.301	84.424	-58.855	150.791

$S_5(g)$
Sulfur (ideal pentatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	21.331	80.629	0	-135.796	-129.956
400	23.035	87.163	2.269	-134.954	-120.085
600	24.478	96.826	7.045	-132.898	-125.080
800	25.046	103.957	12.005	-130.573	-122.819
1000	25.322	109.579	17.045	-128.118	-121.163
1200	25.475	114.210	22.126	-125.592	-120.006
1400	25.569	118.145	27.231	-123.028	-119.279
1600	25.630	121.563	32.351	-120.440	-118.921
1800	25.673	124.585	37.482	-117.841	-118.885
2000	25.703	127.291	42.620	-115.241	-119.138
2200	25.725	129.742	47.763	-112.646	-119.657
2400	25.743	131.981	52.909	-110.065	-120.411
2600	25.756	134.042	58.059	-107.494	-121.371
2800	25.767	135.951	63.212	-104.941	-122.535
3000	25.775	137.729	68.366	-102.407	-123.884

$S_7(g)$
Sulfur (ideal heptatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	31.990	95.508	0	-81.816	-53.413
400	34.276	105.268	3.388	-81.270	-43.794
600	36.112	119.580	10.460	-80.061	-25.313
800	36.811	130.078	17.762	-78.821	-7.247
1000	37.145	138.332	25.161	-77.606	10.501
1200	37.329	145.122	32.610	-76.446	28.014
1400	37.441	150.806	40.088	-75.359	45.336
1600	37.515	155.890	47.584	-74.356	62.508
1800	37.565	160.312	55.093	-73.437	79.562
2000	37.602	164.272	62.610	-72.599	96.516
2200	37.628	167.857	70.132	-71.828	113.387
2400	37.649	171.132	77.660	-71.114	130.193
2600	37.665	174.146	85.192	-70.450	146.940
2800	37.677	176.938	92.726	-69.825	163.644
3000	37.688	179.538	100.262	-69.233	180.294

$S_8(g)$
Sulfur (ideal octatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	37.186	101.741	0	-98.959	-64.289
400	39.761	113.073	3.934	-98.273	-52.550
600	41.844	129.664	12.132	-96.775	-30.007
800	42.639	141.826	20.591	-95.244	-7.978
1000	43.020	151.386	29.161	-93.742	13.660
1200	43.230	159.250	37.788	-92.303	35.005
1400	43.359	165.924	46.447	-90.948	56.114
1600	43.442	171.720	55.128	-89.687	77.033
1800	43.500	176.840	63.822	-88.525	97.804
2000	43.541	181.426	72.527	-87.452	118.448
2200	43.572	185.577	81.238	-86.457	138.988
2400	43.595	189.369	89.955	-85.528	159.442
2600	43.613	192.859	98.676	-84.655	179.820
2800	43.628	196.092	107.400	-83.827	200.138
3000	43.639	199.103	116.127	-83.036	220.387

$Sb(c,l)$
Antimony

T	C_p°	S°	$H^\circ - H_{298}^\circ$
298	6.030	10.880	0
400	6.200	12.680	.623
600	6.480	15.240	1.890
800	7.020	17.170	3.235
904	7.400	19.050	3.984
904	7.500	23.310	8.734
1000	7.500	24.060	9.454
1200	7.500	25.430	10.954
1400*	7.500	26.590	12.454
1600	7.500	27.590	13.954
1800	7.500	28.470	15.454

*Data extrapolated above 1200 K.
903.9 K, melting point; $\Delta H^\circ = 4.750$

$Sb(g)$
Antimony (ideal monatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	4.968	43.059	0	62.700	53.106
400	4.968	44.519	.506	62.583	49.847
600	4.968	46.533	1.500	62.310	43.534
800	4.968	47.962	2.493	61.958	37.324
1000	4.970	49.071	3.487	56.733	31.722
1200	4.979	49.978	4.482	56.228	26.770
1400	5.004	50.747	5.479	55.725	21.905
1600	5.056	51.418	6.485	55.231	17.106
1800	5.140	52.018	7.504	54.750	12.364

$Sb_2(g)$
Antimony (ideal diatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.690	60.900	0	56.300	44.630
400	8.794	63.470	.892	55.946	40.702
600	8.976	67.056	2.660	55.180	33.234
800	8.904	69.612	4.438	54.268	26.050
1000	8.916	71.600	6.220	43.612	20.132
1200	8.926	73.228	8.004	42.396	15.554
1400	8.928	74.604	9.790	41.182	11.188
1600	8.932	75.796	11.576	39.968	6.982
1800	8.934	76.848	13.364	38.756	2.922

$Sb_4(g)$
Antimony (ideal tetratomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.352	83.652	0	49.000	37.035
400	19.552	89.368	1.984	48.492	33.033
600	19.716	97.336	5.912	47.352	25.526
800	19.788	103.020	9.864	45.924	18.452
1000	19.816	107.436	13.824	25.008	13.812
1200	19.832	111.052	17.792	22.976	11.778
1400	19.840	114.108	21.756	20.940	10.093
1600	19.848	116.760	25.728	18.912	8.672
1800	19.852	119.096	29.696	16.880	7.491

$Sc(c,l)$
Scandium

T	C_p°	S°	$H^\circ - H_{298}^\circ$
298	6.100	8.280	0
400	6.290	10.100	.632
600	6.570	12.700	1.916
800	6.960	14.650	3.267
1000	7.460	16.240	4.708
1200	8.060	17.680	6.258
1400	8.750	18.950	7.938
1600	9.550	20.170	9.766
1608	9.580	20.220	9.842
1608	10.570	20.820	10.800
1800	10.570	22.000	12.829
1812	10.570	22.070	12.956
1812*	10.570	23.930	16.325
2000	10.570	24.970	18.312
2200	10.570	25.980	20.426
2400	10.570	26.900	22.540
2600	10.570	27.750	24.654
2800	10.570	28.530	26.768
3000	10.570	29.260	28.882

*Data for Sc(l) estimated.
1608 K, transition point; $\Delta H^\circ = 0.958$
1812 K, melting point; $\Delta H^\circ = 3.369$

Sc(g)
Scandium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	5.283	41.749	0	90.300	80.321
400	5.148	43.279	.530	90.198	76.926
600	5.049	45.344	1.548	89.932	70.346
800	5.013	46.791	2.554	89.587	63.874
1000	4.997	47.908	3.555	89.147	57.479
1200	4.989	48.818	4.553	88.595	51.229
1400	4.989	49.587	5.551	87.913	45.021
1600	5.001	50.254	6.549	87.083	38.949
1800	5.034	50.844	7.553	85.024	33.105
2000	5.099	51.378	8.565	80.553	27.737
2200	5.208	51.869	9.595	79.469	22.513
2400	5.369	52.328	10.652	78.412	17.385

Se(c,l)
Selenium

T	Cp°	S°	H°-H° ₂₉₈
298	5.987	10.144	0
400	6.319	11.950	.627
494	6.525	13.308	1.234
494	8.592	16.286	2.706
600	8.238	17.916	3.595
800	7.956	20.232	5.203
958	8.312	21.690	6.480

494.3 K, melting point; ΔH° = 1.472
958 K, boiling point, mixed polymeric
gases.

Se(g)
Selenium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.990	42.210	0	39.600	35.691
400	5.140	43.700	.517	39.611	34.354
600	5.280	45.820	1.560	39.644	31.715
800	5.380	47.350	2.628	39.703	29.071
1000	5.470	48.560	3.713	39.787	26.402
1200	5.550	49.560	4.814	39.896	23.721
1400	5.620	50.430	5.931	40.034	21.000
1600	5.700	51.180	7.063	40.198	18.278
1800	5.770	51.860	8.210	40.389	15.521
2000	5.840	52.470	9.372	40.607	12.747

Se₂(g)
Selenium (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈
298	9.800	58.200	0
400	10.030	61.120	1.013
600	10.110	65.210	3.032
800	10.060	68.120	5.050
1000	9.970	70.350	7.053
1200	9.860	72.160	9.035
1400	9.740	73.670	10.995
1600	9.620	74.960	12.931
1800	9.500	76.090	14.843
2000	9.380	77.080	16.730

Se₂(g)
Selenium (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	9.800	58.200	0	33.300	21.997
400	10.030	61.120	1.013	33.059	18.171
600	10.110	65.210	3.032	29.142	11.515
800	10.060	68.120	5.050	27.944	5.819

Se₃(g)
Selenium (ideal triatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	13.520	75.270	0	-7.850	-4.263
400	13.860	79.300	1.398	-7.972	-3.020
600	14.190	84.990	4.206	-8.192	-0.497
800	14.400	89.100	7.065	-8.360	2.104
1000	14.570	92.330	9.962	-8.468	4.727
1200	14.730	95.000	12.892	-8.510	7.378
1400	14.890	97.290	15.854	-8.488	10.012
1600	15.040	99.280	18.846	-8.400	12.656
1800	15.190	101.060	21.869	-8.246	15.209
2000	15.340	102.670	24.921	-8.024	17.876

$\text{Se}_4(\text{g})$
Selenium (ideal tetratomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.190	90.610	0	-22.800	-15.111
400	19.490	96.310	1.974	-22.852	-12.480
600	19.700	104.260	5.896	-22.968	-7.272
800	19.770	109.930	9.844	-23.056	-2.008
1000	19.800	114.350	13.802	-23.104	3.246
1200	19.820	117.960	17.765	-23.105	8.527
1400	19.840	121.020	21.731	-23.059	13.789
1600	19.850	123.670	25.699	-22.963	19.037
1800	19.850	126.010	29.669	-22.817	24.289
2000	19.860	128.100	33.640	-22.620	29.500

$\text{Se}_7(\text{g})$
Selenium (ideal heptatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	35.490	116.240	0	-82.150	-56.074
400	36.480	126.850	3.677	-82.018	-47.190
600	37.170	141.800	11.056	-81.706	-29.845
800	37.420	152.530	18.519	-81.306	-12.594
1000	37.540	160.890	26.016	-80.820	4.515
1200	37.600	167.740	33.530	-80.243	21.542
1400	37.640	173.540	41.054	-79.578	38.449
1600	37.670	178.570	48.586	-78.823	55.241
1800	37.690	183.010	56.122	-77.979	71.971
2000	37.710	186.980	63.663	-77.042	88.558

$\text{Se}_5(\text{g})$
Selenium (ideal pentatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.210	92.080	0	-50.250	-34.323
400	24.920	99.320	2.510	-50.273	-28.881
600	25.410	109.540	7.554	-50.276	-18.185
800	25.590	116.880	12.657	-50.218	-7.482
1000	25.670	122.600	17.784	-50.098	3.177
1200	25.720	127.280	22.924	-49.914	13.831
1400	25.750	131.250	28.072	-49.665	24.430
1600	25.770	134.690	33.224	-49.354	34.982
1800	25.790	137.730	38.380	-48.978	45.513
2000	25.800	140.450	43.539	-48.536	55.964

$\text{Se}_8(\text{g})$
Selenium (ideal octatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	41.560	126.950	0	-96.200	-64.641
400	42.510	139.340	4.294	-95.958	-53.902
600	43.170	156.720	12.875	-95.453	-32.981
800	43.400	169.180	21.534	-94.866	-12.226
1000	43.510	178.880	30.227	-94.185	8.335
1200	43.570	186.820	38.935	-93.405	28.779
1400	43.610	193.530	47.654	-92.526	49.084
1600	43.640	199.360	56.379	-91.545	69.223
1800	43.660	204.500	65.109	-90.463	89.285
2000	43.670	209.100	73.842	-89.278	109.162

$\text{Se}_6(\text{g})$
Selenium (ideal hexatomic gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	30.180	103.610	0	-67.600	-46.434
400	30.890	112.610	3.119	-67.520	-39.220
600	31.380	125.240	9.356	-67.340	-25.106
800	31.560	134.300	15.652	-67.098	-11.050
1000	31.640	141.350	21.972	-66.787	2.913
1200	31.690	147.120	28.305	-66.400	16.832
1400	31.720	152.010	34.646	-65.939	30.661
1600	31.740	156.250	40.991	-65.402	44.406
1800	31.750	159.990	47.339	-64.790	58.114
2000	31.760	163.330	53.691	-64.099	71.721

$\text{Si}(\text{c,l})$
Silicon

T	C_p°	S°	$H^\circ - H_{298}^\circ$
298	4.780	4.500	0
400	5.300	5.980	.516
600	5.820	8.240	1.634
800	6.130	9.960	2.830
1000	6.330	11.360	4.078
1200	6.470	12.520	5.359
1400	6.600	13.530	6.666
1600	6.710	14.410	7.997
1687	6.770	14.780	8.583
1687	6.100	21.940	20.665
1800	6.100	22.340	21.354
2000	6.100	22.980	22.574

1687 K, melting point; $\Delta H^\circ = 12.082$

Si(g)
Silicon (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	5.318	40.121	0	107.700	97.080
400	5.166	41.660	.533	107.717	93.445
600	5.056	43.729	1.553	107.619	86.326
800	5.019	45.178	2.560	107.430	79.256
1000	5.011	46.296	3.562	107.184	72.248
1200	5.027	47.211	4.566	106.907	65.278
1400	5.063	47.988	5.574	106.608	58.367
1600	5.113	48.668	6.592	106.295	51.482
1800	5.171	49.273	7.620	93.966	45.487
2000	5.232	49.821	8.660	93.786	40.104

Si₂(g)
Silicon (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.234	54.895	0	141.000	127.316
400	8.658	57.375	.861	140.829	122.663
600	9.499	61.045	2.676	140.408	113.669
800	10.151	63.875	4.647	139.987	104.823
1000	10.453	66.178	6.713	139.557	96.099
1200	10.507	68.091	8.812	139.094	87.433
1400	10.447	69.707	10.908	138.576	78.870
1600	10.354	71.096	12.988	137.994	70.352
1800	10.268	72.311	15.050	113.342	63.606
2000	10.200	73.389	17.097	112.949	58.091

Si₃(g)
Silicon (ideal triatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	13.158	64.002	0	152.000	134.930
400	13.811	67.971	1.377	152.603	129.003
600	14.371	73.696	4.205	153.754	116.952
800	14.594	77.865	7.104	154.859	104.519
1000	14.702	81.134	10.035	155.918	91.824
1200	14.766	83.821	12.982	156.943	78.894
1400	14.814	86.101	15.940	157.941	65.813
1600	14.863	88.082	18.908	158.913	52.565
1800	14.926	89.836	21.886	141.855	40.468
2000	15.007	91.413	24.879	143.018	29.132

*All data estimated except formation enthalpy at 298 K.

Sm(c,l)
Samarium

T	Cp°	S°	H°-H° ₂₉₈
298	7.060	16.630	0
400	7.930	18.810	.759
600	9.750	22.400	2.542
800	10.520	25.330	4.577
1000	10.820	27.710	6.710
1190	11.560	29.640	8.831
1190	11.220	30.270	9.575
1200	11.220	30.370	9.687
1345	11.220	31.650	11.314
1345*	12.000	33.180	13.374
1400	12.000	33.660	14.034
1600	12.000	35.260	16.434
1800	12.000	36.670	18.834
2000	12.000	37.940	21.234

*Data for Sm(l) estimated.

1190 K, transition point; ΔH° = 0.744

1345 K, melting point; ΔH° = 2.060

Sm(g)
Samarium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.255	43.722	0	49.400	41.323
400	7.283	45.857	.740	49.381	38.562
600	7.368	48.826	2.205	49.063	33.207
800	7.399	50.952	3.684	48.507	28.009
1000	7.318	52.597	5.157	47.847	22.960
1200	7.143	53.917	6.605	46.318	18.062
1400	6.922	55.001	8.011	43.377	13.500
1600	6.695	55.911	9.373	42.339	9.297
1800	6.490	56.687	10.691	41.257	5.226
2000	6.323	57.362	11.972	40.138	1.294

Sn(β, l)
lin

T	Cp°	S°	H°-H° ₂₉₈
298	6.450	12.236	0
400	6.891	14.194	.679
505	7.345	15.851	1.428
505	7.100	19.177	3.108
600	6.875	20.374	3.764
800	6.800	22.337	5.128
1000	6.800	23.854	6.488
1200	6.800	25.094	7.848
1400*	6.800	26.143	9.208
1600	6.800	27.050	10.568
1800	6.800	27.851	11.928
2000	6.800	28.567	13.288

*Data extrapolated above 1300 K.

286.2 K, transition point; ΔH° = 0.470

505.12 K, melting point; ΔH° = 1.680

Sn(g)
lin (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	5.081	40.244	0	71.990	63.639
400	5.470	41.784	.535	71.846	60.810
600	6.663	44.224	1.746	69.972	55.662
800	7.565	46.278	3.178	70.040	50.887
1000	7.910	48.012	4.734	70.236	46.078
1200	7.858	49.454	6.316	70.458	41.226
1400	7.623	50.649	7.866	70.648	36.340
1600	7.344	51.649	9.362	70.784	31.426
1800	7.086	52.498	10.805	70.867	26.502
2000	6.869	53.233	12.200	70.902	21.570

Sr(c, l, g)
Strontium

T	Cp°	S°	H°-H° ₂₉₈
298*	6.393	12.500	0
400	6.790	14.434	.671
600	7.650	17.343	2.112
800	8.800	19.692	3.751
828	8.990	19.998	4.000
828	9.000	20.215	4.180
1000	9.000	21.915	5.728
1041	9.000	22.277	6.097
1041	8.400	24.160	8.057
1200	8.400	25.353	9.392
1400	8.400	26.648	11.072
1600	8.400	27.770	12.752
1654	8.400	28.049	13.207
1654	4.978	47.836	45.937
1800	4.991	48.257	46.664
2000	5.031	48.785	47.666

*Data for Sr(c, l) estimated.

828 K, transition point; ΔH° = 0.180

1041 K, melting point; ΔH° = 1.960

1654.1 K, boiling point; ΔH° = 32.730

Sr(g)
Strontium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.968	39.323	0	39.200	31.203
400	4.968	40.783	.506	39.035	28.495
600	4.968	42.797	1.500	38.588	23.316
800	4.968	44.227	2.493	37.942	18.314
1000	4.968	45.335	3.487	36.959	13.539
1200	4.968	46.241	4.480	34.288	9.222
1400	4.969	47.007	5.474	33.602	5.099
1600	4.974	47.671	6.468	32.916	1.074
1800	4.991	48.257	7.464	0	0
2000	5.031	48.785	8.466	0	0

Ta(c,l)
Tantalum

T	Cp°	S°	H°-H ₂₉₈ °
298	6.060	9.920	0
400	6.220	11.728	.627
600	6.330	14.272	1.882
800	6.450	16.109	3.160
1000	6.570	17.561	4.462
1200	6.690	18.770	5.788
1400	6.850	19.813	7.142
1600	7.040	20.740	8.531
1800	7.230	21.579	9.956
2000	7.450	22.351	11.423
2200	7.710	23.073	12.938
2400	8.000	23.756	14.508
2600	8.360	24.410	16.143
2800	8.830	25.046	17.860
3000	9.470	25.676	19.685
3200	10.650	26.318	21.678
3258	11.230	26.515	22.305
3258*	10.000	28.835	29.865
3400	10.000	29.262	31.285

*Data for Ta(l) estimated.
3258 K, melting point; $\Delta H^\circ = 7.560$

Ta(g)
Tantalum (ideal monatomic gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔH_f°	ΔG_f°
298	4.985	44.242	0	186.900	176.667
400	5.081	45.717	.512	186.785	173.189
600	5.541	47.855	1.569	186.587	166.437
800	6.109	49.528	2.735	186.475	159.740
1000	6.621	50.947	4.009	186.447	153.061
1200	7.043	52.193	5.377	186.489	146.381
1400	7.377	53.305	6.820	186.578	139.689
1600	7.633	54.308	8.323	186.692	132.983
1800	7.831	55.219	9.870	186.814	126.262
2000	7.992	56.052	11.453	186.930	119.528

Tb(c,l)
Terbium

T	Cp°	S°	H°-H ₂₉₈ °
298	6.910	17.520	0
400	6.820	19.530	.698
600	7.160	22.310	2.074
800	7.840	24.470	3.574
1000	8.580	26.290	5.215
1200	9.370	27.920	7.004
1400	10.330	29.440	8.970
1560	11.180	30.600	10.692
1560	6.640	31.370	11.892
1600	6.640	31.540	12.157
1630	6.640	31.660	12.357
1630	11.110	33.240	14.937
1800	11.110	34.340	16.827
2000	11.110	35.510	19.049

1560 K, transition point; $\Delta H^\circ = 1.200$
1630 K, melting point; $\Delta H^\circ = 2.580$

Tb(g)
Terbium (ideal monatomic gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔH_f°	ΔG_f°
298	5.895	48.552	0	92.900	83.648
400	5.790	50.267	.594	92.796	80.501
600	5.781	52.606	1.748	92.574	74.396
800	5.936	54.287	2.918	92.244	68.390
1000	6.164	55.636	4.127	91.812	62.466
1200	6.408	56.781	5.384	91.280	56.647
1400	6.637	57.786	6.689	90.619	50.935
1600	6.835	58.686	8.037	88.780	45.346
1800	6.997	59.501	9.421	85.494	40.204
2000	7.123	60.244	10.833	84.684	35.216

Te(c,l)
Tellurium

T	Cp°	S°	H°-H ₂₉₈ °
298	6.140	11.880	0
400	6.680	13.760	.653
600	7.730	16.670	2.094
723	8.380	18.170	3.085
723	9.000	23.950	7.265
800	9.000	24.860	7.960
1000	9.000	26.870	9.760
1200*	9.000	28.510	11.560

*Data extrapolated 1100 - 1262 K.
722.65 K, melting point; $\Delta H^\circ = 4.180$
1262 K, boiling point; mixed polymeric
gases.

Te(g)
Tellurium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.970	43.640	0	31.435	27.647
400	4.930	45.100	.504	31.491	26.341
600	4.950	47.100	1.491	31.574	23.750
800	5.020	48.530	2.488	31.633	21.133
1000	5.100	49.660	3.500	31.676	18.501
1200	5.180	50.600	4.527	31.701	15.862
1400	5.270	51.400	5.572	31.713	13.226
1600	5.350	52.110	6.634	31.731	10.579
1800	5.440	52.740	7.712	31.768	7.945
2000	5.520	53.320	8.809	31.833	5.293

Te₂(g)
Tellurium (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈
298	8.680	61.870	0
400	8.870	64.450	.895
600	9.210	68.120	2.704
800	9.540	70.810	4.579
1000	9.850	72.970	6.518
1200	10.170	74.800	8.521
1400	10.490	76.390	10.587
1600	10.430	77.780	12.676
1800	10.370	79.010	14.757
2000	10.280	80.100	16.822

Te₂(g)
Tellurium (ideal diatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.680	61.870	0	38.330	26.968
400	8.870	64.450	.895	37.919	23.147
600	9.210	68.120	2.704	36.846	15.978
800	9.540	70.810	4.579	26.989	10.117
1000	9.850	72.970	6.518	25.328	6.098
1200	10.170	74.800	8.521	23.731	2.395
1262	10.269	75.314	9.155	23.249	1.297

Th(c,l)
Thorium

T	Cp°	S°	H°-H° ₂₉₈
298	6.532	12.760	0
400	6.761	14.712	.677
600	7.171	17.532	2.071
800	7.564	19.649	3.544
1000	7.950	21.378	5.096
1200	8.329	22.861	6.724
1400	8.704	24.174	8.427
1600	9.075	25.360	10.205
1633	9.135	25.546	10.506
1633	8.420	26.073	11.366
1800	8.898	26.915	12.812
2000	9.470	27.882	14.649
2023	9.536	27.991	14.867
2023	11.000	29.622	18.167
2200	11.000	30.545	20.114
2400	11.000	31.502	22.314

1633 K, transition point; ΔH° = 0.860

2023 K, melting point; ΔH° = 3.300

Th(g)
Thorium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.969	45.425	0	142.730	132.991
400	4.982	46.886	.507	142.560	129.690
600	5.171	48.932	1.517	142.176	123.336
800	5.679	50.482	2.597	141.783	117.117
1000	6.398	51.825	3.803	141.437	110.990
1200	7.154	53.059	5.159	141.165	104.927
1400	7.838	54.214	6.659	140.962	98.906
1600	8.409	55.299	8.286	140.811	92.909
1800	8.871	56.317	10.016	139.934	87.010
2000	9.238	57.272	11.828	139.909	81.129
2200	9.532	58.167	13.706	136.322	75.554
2400	9.770	59.007	15.637	136.053	70.041

Ti(c,l)
Titanium

T	Cp°	S°	H°-H° ₂₉₈
298	5.980	7.320	0
400	6.310	9.130	.627
600	6.770	11.770	1.934
800	7.250	13.790	3.336
1000	7.710	15.460	4.832
1156	8.100	16.600	6.063
1156	6.995	17.480	7.080
1200	7.098	17.743	7.390
1400	7.507	18.869	8.852
1600	7.932	19.898	10.394
1800	8.525	20.864	12.036
1945	9.146	21.547	13.315
1945	11.050	23.244	16.615
2000	11.050	23.552	17.223
2200	11.050	24.605	19.433
2400	11.050	25.567	21.643
2600	11.050	26.451	23.853
2800	11.050	27.270	26.063
3000	11.050	28.033	28.273

1156 K, transition point; $\Delta H^\circ = 1.017$
 1945 K, melting point; $\Delta H^\circ = 3.300$

Tl(c,l,g)
Thallium

T	Cp°	S°	H°-H° ₂₉₈
298	6.290	15.340	0
400	6.560	17.220	.653
507	7.090	18.830	1.380
507	7.650	19.010	1.470
577	7.810	20.010	2.011
577	7.100	21.720	3.001
600	7.100	22.000	3.164
800	7.100	24.040	4.584
1000*	7.100	25.630	6.004
1200	7.100	26.920	7.424
1400	7.100	28.020	8.844
1600	7.100	28.970	10.264
1746	7.100	29.590	11.301
1746	5.234	52.050	50.516
1800	5.270	52.213	50.798
2000	5.420	52.776	51.866

*Data extrapolated 900 K to 1746 K.
 507 K, transition point; $\Delta H^\circ = 0.090$
 577 K, melting point; $\Delta H^\circ = 0.990$
 1746 K, boiling point; $\Delta H^\circ = 39.215$

Ti(g)
Titanium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	5.839	43.066	0	113.000	102.342
400	5.522	44.733	.577	112.950	98.709
600	5.237	46.909	1.648	112.714	91.631
800	5.128	48.398	2.683	112.347	84.661
1000	5.096	49.538	3.704	111.872	77.794
1200	5.132	50.469	4.726	110.336	71.065
1400	5.237	51.267	5.762	109.910	64.553
1600	5.403	51.977	6.825	109.431	58.105
1800	5.616	52.625	7.926	108.890	51.720
2000	5.864	53.229	9.074	104.851	45.497
2200	6.132	53.801	10.273	103.840	39.609
2400	6.413	54.346	11.527	102.884	33.814
2600	6.701	54.871	12.839	101.986	28.094
2800	6.993	55.378	14.208	101.145	22.443
3000	7.286	55.871	15.636	100.363	16.849

Tl(g)
Thallium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	43.226	0	43.250	34.936
400	4.968	44.685	.506	43.103	32.117
600	4.968	46.700	1.500	41.586	26.766
800	4.969	48.129	2.493	41.159	21.888
1000	4.975	49.238	3.487	40.733	17.125
1200	4.998	50.147	4.484	40.310	12.438
1400	5.053	50.921	5.489	39.895	7.834
1600	5.144	51.601	6.508	39.494	3.284
1800	5.270	52.213	7.549	0	0
2000	5.420	52.776	8.617	0	0

Tm(c,l)
Thulium

T	Cp°	S°	H°-H° ₂₉₈
298	6.460	17.690	0
400	6.490	19.590	.660
600	6.590	22.230	1.963
800	7.080	24.180	3.321
1000	7.520	25.820	4.786
1200	7.890	27.220	6.328
1400	8.250	28.470	7.942
1600	8.600	29.590	9.628
1800	8.930	30.620	11.382
1818	8.960	30.710	11.543
1818	9.890	32.930	15.568
2000	9.890	33.870	17.386

1818 K, melting point; $\Delta H^\circ = 4.025$

Tm(g)
Thulium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	4.968	45.412	0	55.500	47.235
400	4.968	46.872	.506	55.346	44.433
600	4.968	48.886	1.500	55.037	39.043
800	4.968	50.316	2.493	54.672	33.763
1000	4.969	51.424	3.487	54.201	28.597
1200	4.973	52.330	4.481	53.653	23.521
1400	4.984	53.098	5.476	53.034	18.555
1600	5.007	53.764	6.475	52.347	13.669
1800	5.047	54.356	7.480	51.598	8.873
2000	5.112	54.891	8.496	46.610	4.568

U(c,l)
Uranium

T	Cp°	S°	H°-H° ₂₉₈
298	6.612	12.000	0
400	7.095	14.009	.690
600	8.308	17.101	2.231
800	9.988	19.709	4.052
942	11.481	21.457	5.574
942	10.260	22.165	6.241
1000	10.260	22.778	6.836
1049	10.260	23.269	7.338
1049	9.150	24.353	8.475
1200	9.150	25.583	9.857
1400	9.150	26.994	11.687
1408	9.150	27.046	11.760
1408	11.630	28.598	13.945
1600	11.630	30.084	16.178
1800*	11.630	31.454	18.504
2000	11.630	32.679	20.830
2200	11.630	33.788	23.156
2400	11.630	34.800	25.482
2600	11.630	35.731	27.808
2800	11.630	36.593	30.134
3000	11.630	37.395	32.460
3200	11.630	38.146	34.786
3400	11.630	38.851	37.112

*Data extrapolated above 1600 K.

942 K, transition point; $\Delta H^\circ = 0.667$

1049 K, transition point; $\Delta H^\circ = 1.137$

1408 K, melting point; $\Delta H^\circ = 2.185$

U(g)
Uranium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	5.663	47.724	0	127.000	116.349
400	5.724	49.402	.582	126.884	112.727
600	5.593	51.700	1.714	126.483	105.724
800	5.580	53.302	2.828	125.776	98.902
1000	5.796	54.566	3.962	124.126	92.338
1200	6.199	55.656	5.159	122.302	86.214
1400	6.731	56.651	6.450	121.763	80.243
1600	7.340	57.588	7.856	118.678	74.672
1800	7.992	58.490	9.389	117.885	69.220
2000	8.659	59.367	11.054	117.224	63.848
2200	9.321	60.223	12.852	116.696	58.539
2400	9.957	61.062	14.781	116.299	53.270

V(c,l)
Vanadium

T	Cp°	S°	H°-H° ₂₉₈
298	5.950	6.915	0
400	6.270	8.713	.624
600	6.570	11.317	1.910
800	6.850	13.243	3.251
1000	7.190	14.808	4.655
1200	7.600	16.154	6.132
1400	8.080	17.360	7.698
1600	8.570	18.470	9.363
1800	9.130	19.512	11.132
2000	9.780	20.507	13.022
2190	10.550	21.426	14.949
2190	11.043	23.920	20.410
2200	11.043	23.970	20.520
2400	11.043	24.931	22.728
2600	11.043	25.815	24.937
2800	11.043	26.633	27.145
3000	11.043	27.395	29.354

2190 K, melting point; $\Delta H^\circ = 5.461$

V(g)
Vanadium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	6.217	43.544	0	123.200	112.279
400	5.891	45.319	.615	123.191	108.549
600	5.804	47.674	1.775	123.065	101.251
800	5.949	49.363	2.950	122.899	94.003
1000	6.032	50.701	4.150	122.695	86.802
1200	6.026	51.801	5.357	122.425	79.649
1400	5.974	52.727	6.558	122.060	72.546
1600	5.912	53.520	7.746	121.583	65.503
1800	5.865	54.214	8.923	120.991	58.527
2000	5.842	54.830	10.094	120.272	51.626
2200	5.851	55.387	11.262	113.942	44.825
2400	5.893	55.898	12.436	112.908	38.587
2600	5.968	56.372	13.622	111.885	32.437
2800	6.076	56.818	14.826	110.881	26.363
3000	6.216	57.242	16.054	109.900	20.359

W(c)
Tungsten

T	Cp°	S°	H°-H° ₂₉₈
298	5.800	7.800	0
400	6.000	9.540	.602
600	6.220	12.010	1.826
800	6.370	13.820	3.084
1000	6.500	15.260	4.370
1200	6.660	16.460	5.685
1400	6.830	17.510	7.033
1600	6.990	18.430	8.414
1800	7.140	19.260	9.827
2000	7.300	20.020	11.272
2200	7.460	20.720	12.749
2400	7.630	21.380	14.257
2600	7.780	22.000	15.799
2800	7.940	22.580	17.370
3000	8.100	23.140	18.976

3680 K, melting point; $\Delta H^\circ = 8.5$

W(g)
Tungsten (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	5.092	41.549	0	203.400	193.338
400	5.536	43.099	.538	203.336	189.912
600	7.251	45.641	1.804	203.378	183.199
800	9.026	47.985	3.442	203.758	176.426
1000	9.855	50.109	5.348	204.378	169.529
1200	9.787	51.910	7.324	205.039	162.499
1400	9.297	53.384	9.236	205.603	155.379
1600	8.721	54.588	11.037	206.023	148.170
1800	8.205	55.584	12.728	206.301	140.918
2000	7.796	56.427	14.326	206.454	133.640
2200	7.499	57.155	15.854	206.505	126.348
2400	7.304	57.798	17.333	206.476	119.073
2600	7.197	58.378	18.781	206.382	111.799
2800	7.167	58.910	20.217	206.247	104.523
3000	7.200	59.405	21.652	206.076	97.281

Xe(g)
Xenon

T	Cp°	S°	H°-H° ₂₉₈
298	4.968	40.530	0
400	4.968	41.989	.506
600	4.968	44.004	1.500
800	4.968	45.433	2.493
1000	4.968	46.542	3.487
1200	4.968	47.447	4.480
1400	4.968	48.213	5.474
1600	4.968	48.877	6.468
1800	4.968	49.462	7.461
2000	4.968	49.985	8.455
2200	4.968	50.459	9.448
2400	4.968	50.891	10.442
2600	4.968	51.289	11.436
2800	4.968	51.657	12.429
3000	4.968	51.999	13.423

Y(c,l)
Yttrium

T	Cp°	S°	H°-H° ₂₉₈
298	6.340	10.620	0
400	6.490	12.500	.653
600	6.820	15.200	1.983
800	7.180	17.210	3.383
1000	7.530	18.850	4.855
1200	7.900	20.250	6.398
1400	8.250	21.500	8.012
1600	8.610	22.620	9.699
1752	8.950	23.420	11.031
1752	8.360	24.100	12.224
1799	8.360	24.320	12.617
1799	10.300	25.830	15.341
1800	10.300	25.840	15.351
2000*	10.300	26.920	17.411
2200	10.300	27.910	19.471
2400	10.300	28.800	21.531

*Data extrapolated above 1900 K.

1752 K, transition point; $\Delta H^\circ = 1.193$ 1799 K, melting point; $\Delta H^\circ = 2.724$ Y(g)
Yttrium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔH_f°	ΔG_f°
298	6.181	42.869	0	100.700	91.085
400	6.045	44.672	.625	100.672	87.803
600	5.638	47.042	1.791	100.508	81.403
800	5.388	48.626	2.891	100.208	75.075
1000	5.248	49.812	3.953	99.798	68.836
1200	5.169	50.761	4.994	99.296	62.683
1400	5.127	51.554	6.023	98.711	56.635
1600	5.119	52.238	7.047	98.048	50.659
1800	5.152	52.842	8.074	93.423	44.819
2000	5.235	53.389	9.111	92.400	39.462
2200	5.377	53.894	10.172	91.401	34.236
2400	5.584	54.370	11.267	90.436	29.068

Yb(c,l,g)
Ytterbium

T	Cp°	S°	H°-H° ₂₉₈
298	6.390	14.300	0
400	6.600	16.200	.659
553	8.290	18.540	1.768
600	7.130	19.120	2.102
800	7.370	21.200	3.551
1000	7.640	22.870	5.051
1033	7.660	23.120	5.305
1033	8.640	23.530	5.723
1097	8.640	24.050	6.276
1097	8.790	25.720	8.106
1200	8.790	26.500	9.010
1400	8.790	27.860	10.768
1467	8.790	28.270	11.357
1467	4.968	49.267	42.157
1600	4.968	49.698	42.818
1800	4.969	50.284	43.811
2000	4.973	50.807	44.805

553 K, transition point; $\Delta H^\circ = 0$ 1033 K, transition point; $\Delta H^\circ = 0.418$ 1097 K, melting point; $\Delta H^\circ = 1.830$ 1467 K, boiling point; $\Delta H^\circ = 30.800$

Yb(g)
Ytterbium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.968	41.352	0	36.350	28.284
400	4.968	42.812	.506	36.197	25.552
600	4.968	44.826	1.500	35.748	20.324
800	4.968	46.255	2.493	35.292	15.248
1000	4.968	47.364	3.487	34.786	10.292
1200	4.968	48.269	4.480	31.820	5.697
1400	4.968	49.035	5.474	31.056	1.411
1600	4.968	49.698	6.468	0	0
1800	4.969	50.284	7.461	0	0
2000	4.973	50.807	8.455	0	0

Zn(c,l,g)
Zinc

T	Cp°	S°	H°-H° ₂₉₈
298	6.070	9.950	0
400	6.285	11.765	.629
600	6.809	14.405	1.935
693	7.069	15.400	2.580
693	7.500	17.927	4.330
800	7.500	19.008	5.135
1000	7.500	20.681	6.635
1180	7.500	21.925	7.985
1180	4.968	25.285	35.550
1200	4.968	45.368	35.650
1400	4.968	46.134	36.644
1600	4.968	46.797	37.638
1800	4.968	47.382	38.632
2000	4.968	47.905	39.626

692.73 K, melting point; ΔH° = 1.750
1180 K, boiling point; ΔH° = 27.565

Zn(g)
Zinc (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.968	38.451	0	31.170	22.672
400	4.968	39.911	.506	31.047	19.789
600	4.968	41.925	1.500	30.735	14.223
800	4.968	43.354	2.493	28.528	9.051
1000	4.968	44.463	3.487	28.022	4.240
1200	4.968	45.368	4.480	0	0
1400	4.968	46.134	5.474	0	0
1600	4.968	46.797	6.468	0	0
1800	4.968	47.382	7.461	0	0
2000	4.968	47.905	8.455	0	0

Zr(c,l)
Zirconium

T	Cp°	S°	H°-H° ₂₉₈
298	6.186	9.320	0
400	6.546	11.195	.651
600	7.027	13.944	2.010
800	7.446	16.023	3.458
1000	7.846	17.728	4.987
1136	8.114	18.745	6.072
1136	6.683	19.582	7.023
1200	6.786	19.952	7.454
1400	7.107	21.022	8.843
1600	7.428	21.992	10.297
1800	7.749	22.885	11.815
2000	8.071	23.718	13.397
2125	8.271	24.213	14.418
2125*	8.000	26.566	19.418
2200	8.000	26.843	20.018
2400	8.000	27.540	21.618
2600	8.000	28.180	23.218
2800	8.000	28.773	24.818
3000	8.000	29.325	26.418

*Data estimated for Zr(l).

1136 K, transition point; ΔH° = 0.951

2125 K, melting point; ΔH° = 5.000

Zr(g)
Zirconium (ideal monatomic gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	6.367	43.315	0	148.300	138.164
400	6.612	45.229	.664	148.313	134.699
600	6.464	47.897	1.979	148.269	127.897
800	6.198	49.717	3.243	148.085	121.130
1000	6.121	51.088	4.472	147.785	114.425
1200	6.225	52.211	5.704	146.550	107.839
1400	6.428	53.185	6.968	146.425	101.397
1600	6.655	54.059	8.276	146.279	94.972
1800	6.865	54.855	9.629	146.114	88.568
2000	7.046	55.588	11.021	145.924	82.184
2200	7.202	56.267	12.446	140.728	75.995
2400	7.341	56.899	13.900	140.582	70.120
2600	7.475	57.492	15.382	140.464	64.253
2800	7.609	58.051	16.890	140.372	58.394
3000	7.749	58.581	18.426	140.308	52.540

Antimonides

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

Sources of data from general references are listed below, with the reference given immediately after each formula:

GaSb(c) (30), InSb(c,l) (30), USb_2 (c) (33), U_3Sb_4 (c) (33).

Additional sources:

AlSb(c,l):

Samokhval, V. V., and A. A. Vecher. Thermodynamic Properties of Aluminum Antimonide. Russ. J. Phys. Chem. (Engl. Transl.), v. 42, 1968, pp. 340-341.

Sirota, N. N., and V. Z. Golodushko. (Determination of the Dissociation Pressure of Gallium Phosphide and Aluminum Antimonide.) Tezisy Dokl.-Vses. Konf. Khim. Svyazi Poluprovodn. i Polimet., 5th, 1974, p. 98.

AlSb(c,l), GaSb(c,l), InSb(c,l):

Lichter, B. D., and P. Sommelet. Thermal Properties of A^{III}B^V Compounds. II. High-Temperature Heat Contents and Heats of Fusion of InSb, GaSb, and AlSb. Trans. Metall. Soc. AIME, v. 245, 1969, pp. 99-105.

Piesbergen, U. (The Average Atomic Heats of the A^{III}B^V Semiconductors AlSb, GaAs, GaSb, InP, InAs, InSb and the Atomic Heat of the Element Ge Between 12 and 273°K.) Z. Naturforsch., A, v. 18, 1963, pp. 141-147.

CrSb(c,l):

Alles, A., B. Falk, E. F. Westrum, Jr., and F. Gronvold. Heat Capacity and Thermodynamic Properties of $CrSb_2$ from 5 to 1050 K. Magnetic Transition and Enthalpy of Decomposition. J. Chem. Thermodyn., v. 10, 1978, pp. 103-116.

$FeSb_2$ (c,l):

Gronvold, F., A. J. Highe, and E. F. Westrum, Jr. Heat Capacity and Thermodynamic Properties of $FeSb_2$ from 5 to 1021.2 K. Enthalpy of Decomposition. J. Chem. Thermodyn., v. 9, 1977, pp. 773-782.

USb_2 (c):

Westrum, E. F., Jr., J. A. Sommers, D. B. Downie, and F. Gronvold. Cryogenic Heat Capacities and Neel Transitions of Two Uranium Pnictides, UAs_2 and USb_2 . Thermodynamics of Nuclear Materials 1974. Int. At. Energy Agency, v. 2, 1975, pp. 409-418.

U_3Sb_4 (c):

Alles, A. Heat Capacities, Thermodynamics, and Magnetic Transitions of Some Uranium and Chromium Pnictides. Ph. D. Thesis, Univ. MI, Ann Arbor, MI, 1975, 119 pp.

AlSb(c,l)
Aluminum monoantimonide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.260	15.360	0	-12.200	-11.515
400	11.680	18.760	1.180	-12.252	-11.272
600	12.090	23.580	3.560	-12.414	-10.752
800	12.500	27.110	6.020	-12.700	-10.156
1000	12.910	29.940	8.560	-20.489	-8.780
1200	13.320	32.330	11.180	-20.887	-6.399
1330	13.590	33.720	12.930	-21.099	-4.828
1330	17.800	48.450	32.520	-1.509	-4.828
1400	17.800	49.360	33.770	-1.315	-4.993

1330 K, melting point; ΔH° = 19.590

CdSb(c,l)
Cadmium monoantimonide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	12.023	22.850	0	-3.190	-3.068
300	12.032	22.924	.022	-3.190	-3.065
400	12.496	26.449	1.248	-3.211	-3.023
500	12.960	29.288	2.521	-3.229	-2.973
600	13.424	31.692	3.840	-4.723	-2.906
700	13.888	33.796	5.206	-4.726	-2.602
729	14.023	34.362	5.611	-4.723	-2.514
729	21.070	46.022	14.111	3.777	-2.514
800	19.790	47.922	15.562	4.234	-3.152
900	17.987	50.148	17.451	4.693	-4.098

729 K, melting point; ΔH° = 8.500

CrSb₂(c,l)
Chromium diantimonide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	19.660	27.460	0	-4.450	-4.465
300	19.680	27.580	.036	-4.446	-4.464
400	20.420	33.350	2.042	-4.245	-4.501
500	20.800	37.950	4.107	-4.056	-4.581
600	20.860	41.750	6.190	-3.911	-4.709
700	21.200	44.990	8.290	-3.816	-4.845
800	21.720	47.850	10.435	-3.755	-5.003
900	22.260	50.440	12.635	-3.725	-5.156
904	22.280	50.540	12.724	-13.225	-5.156
904	22.280	50.610	12.790	-13.159	-5.156
991	22.810	52.680	14.760	-13.153	-4.390
991	33.090	61.080	23.083	-4.830	-4.390
1000	34.000	61.370	23.374	-4.736	-4.386

904 K, transition point to CrSb₂ + Sb(l) phase;
ΔH° = 0.066

991.3 K, peritectic decomposition point; ΔH° = 8.323

FeSb₂(c,l)
Iron diantimonide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	19.080	25.980	0	-7.080	-6.394
300	19.090	26.100	.035	-7.078	-6.389
400	19.580	31.660	1.969	-6.994	-6.172
500	19.960	36.070	3.946	-6.953	-5.971
600	20.450	39.740	5.964	-6.952	-5.778
700	21.210	42.950	8.044	-6.985	-5.577
800	22.120	45.840	10.210	-7.056	-5.381
900	23.110	48.500	12.470	-7.198	-5.159
1000	24.800	51.010	14.855	-16.947	-3.917
1021	25.410	51.540	15.385	-17.046	-3.644
1021	33.590	64.180	28.295	-4.136	-3.644
1030	33.590	64.470	28.585	-4.055	-3.647

1021.2 K, peritectic decomposition point; ΔH° = 12.910

GaSb(c,l)
Gallium monoantimonide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.600	18.180	0	-10.000	-9.267
400	11.922	21.634	1.198	-11.432	-8.572
600	12.500	26.578	3.640	-11.540	-7.117
800	13.058	30.252	6.196	-11.600	-5.635
985	13.570	33.020	8.660	-16.417	-3.822
985	15.000	48.816	24.220	-.857	-3.822
1000	15.000	49.044	24.444	-.841	-3.870
1200	15.000	51.778	27.444	-.611	-4.494

985 K, melting point; ΔH° = 15.560

InSb(c,l)
Indium monoantimonide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.824	20.600	0	-7.300	-6.078
300	11.838	20.674	.022	-7.301	-6.069
400	12.390	24.162	1.236	-7.363	-5.651
500	12.720	26.966	2.492	-8.218	-5.086
600	12.964	29.308	3.778	-8.274	-4.457
700	13.166	31.320	5.084	-8.327	-3.813
797	13.340	33.040	6.370	-8.383	-3.188
797	16.000	47.356	17.780	3.027	-3.188
800	16.000	47.418	17.828	3.033	-3.213
900	16.000	49.302	19.428	3.217	-4.002
1000	16.000	50.988	21.028	-1.377	-4.312

797 K, melting point; ΔH° = 11.410

$USb_2(c)$
Uranium diantimonide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.160	33.810	0	-42.000	-42.015
300	19.170	33.930	.030	-42.004	-42.019
400	19.840	39.530	1.980	-41.964	-42.028
500	20.290	44.010	3.990	-41.944	-42.044
600	20.630	47.750	6.040	-41.971	-42.072
700	20.800	50.940	8.110	-42.087	-42.074

$U_3Sb_4(c)$
Triuranium tetraantimonide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	44.980	83.600	0	-108.000	-109.216
300	45.010	83.880	.083	-107.997	-109.220
400	46.310	97.010	4.653	-107.933	-109.638
500	47.120	107.440	9.327	-107.975	-110.060
600	47.960	116.090	14.077	-108.176	-110.472
700	48.960	123.600	18.917	-108.576	-110.846
800	50.220	130.200	23.877	-109.219	-111.133
900	51.460	136.200	28.957	-110.166	-111.325

Arsenides

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

Sources of data from general references are listed below, with the reference given immediately after each formula:

$Cd_3As_2(c)$ (30), $InAs(c,l)$ (30), $U_3As_4(c)$ (33).

Additional sources:

$Cd_3As_2(c)$:

Demidenko, A. F., G. N. Danilenko, V. E. Danilenko, V. B. Lazarev, V. Ya. Shevchenko, S. F. Marenkin, and S. E. Kozlov. Specific Heat and Thermodynamic Properties of Compounds A_3B_2 . Inorg. Mater. (Engl. Transl.), v. 13, 1977, pp. 181-183.

Lazarev, B. V., V. F. Ponomarev, S. F. Marenkin, and G. A. Sharpataya. Thermographic Study of Polymorphous Transitions in Cadmium and Zinc Arsenides. Inorg. Mater. (Engl. Transl.), v. 18, 1982, pp. 454-457.

$GaAs(c,l)$:

Dash, A. J., A. Finch, P. J. Gardner, and M. Cottrell. Heat Capacity of Gallium Arsenide. J. Chem. and Eng. Data, v. 19, 1974, pp. 113-114.

Foxon, C. T., J. A. Harvey, and B. A. Joyce. The Evaporization of GaAs under Equilibrium and Nonequilibrium Conditions Using a Modulated Beam Technique. J. Phys. and Chem. Solids, v. 34, 1973, pp. 1693-1701.

Lichter, B. D., and P. Sommelet. Thermal Properties of $A^{III}B^V$ Compounds: II. High-Temperature Heat Contents and Heats of Fusion of InAs and GaAs. Trans. Metall. Soc. AIME, v. 245, 1969, pp. 99-105.

Penish, M. B. Thermodynamic Evaluation of the Simple Solution Treatment of the Gallium-Phosphorus, Indium-Phosphorus, and Gallium-Arsenide Systems. J. Cryst. Growth, v. 27, 1974, pp. 6-20.

Piesbergen, U. (The Average Atomic Heats of the $A^{III}B^V$ Semiconductors AlSb, GaAs, InP, InAs, InSb and the Atomic Heat of the Element Ga Between 12 and 273° K.) Z. Naturforsch., A, v. 18, 1963, pp. 141-147.

Pupp, C., J. J. Murray, and R. F. Pottier. Vapor Pressure of Arsenic Over InAs(c) and GaAs(c). The Enthalpies of Formation of InAs(c) and GaAs(c). J. Chem. Thermodyn., v. 6, 1974, pp. 123-124.

$InAs(c,l)$:

Lichter, B. D., and P. Sommelet. Thermal Properties of $A^{III}B^V$ Compounds: II. High-Temperature Heat Contents and Heats of Fusion of InAs and GaAs. Trans. Metall. Soc. AIME, v. 245, 1969, pp. 99-105.

Piesbergen, U. (The Average Atomic Heats of the $A^{III}B^V$ Semiconductors AlSb, GaAs, InP, InAs, InSb and the Atomic Heat of the Element Ga Between 12 and 273° K.) Z. Naturforsch., A, v. 18, 1963, pp. 141-147.

Sirota, N. N., A. M. Antyukhov, V. V. Novikov, and V. A. Fyodorov. Thermodynamic Functions of $(InP)_x(InAs)_{1-x}$ From 5 to 300 K. Cryst. Res. and Technol., v. 17, 1982, pp. 279-287.

$\text{UAs}_2(\text{c})$:

Westrum, E. F., Jr., J. A. Sommers, D. B. Downie, and F. Gronvold. Cryogenic Heat Capacities and Neel Transitions of Two Uranium Pnictides, UAs_2 and USb_2 . Thermodynamics of Nuclear Materials 1974, Int. At. Energy Agency, v. 2, 1975, pp. 409-418.

$\text{U}_3\text{As}_8(\text{c})$:

Alles, A. Heat Capacities, Thermodynamics, and Magnetic Transitions of Some Uranium and Chromium Pnictides. Ph. D. Thesis, Univ. MI, Ann Arbor, MI, 1975, 119 pp.

$\text{Cd}_3\text{As}_2(\text{c})$
Tricadmium diarsenide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	29.950	49.500	0	-10.000	-8.596
300	29.970	49.690	.055	-10.000	-8.587
400	31.050	58.470	3.115	-10.045	-8.109
500	32.140	65.490	6.260	-10.118	-7.619
507	45.000	65.980	6.505	-10.102	-7.586
550	32.850	68.660	7.920	-10.103	-7.374

507 K, transition point; $\Delta H^\circ = 0$

$\text{GaAs}(\text{c}, \text{l})$
Gallium arsenide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.182	15.340	0	-18.400	-17.520
400	11.660	18.700	1.166	-19.852	-16.772
600	12.150	23.512	3.542	-19.999	-15.197
800	12.714	27.086	6.030	-20.075	-13.582
1000	13.264	29.982	8.628	-28.172	-10.797
1200	13.798	32.448	11.334	-27.724	-7.364
1400	14.320	34.614	14.146	-27.172	-4.012
1513	14.608	35.736	15.780	-26.815	-2.155
1513*	15.000	52.378	40.960	-1.635	-2.155
1600	15.000	53.218	42.266	-1.312	-2.195

*Heat capacity of liquid estimated

1513 K, melting point; $\Delta H^\circ = 25.180$

$\text{InAs}(\text{c}, \text{l})$
Indium arsenide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.380	18.080	0	-14.000	-12.726
400	12.062	21.528	1.196	-14.091	-12.279
600	12.920	26.592	3.700	-15.013	-11.027
800	13.606	30.404	6.354	-15.050	-9.689
1000	14.242	33.510	9.140	-23.080	-7.195
1200	14.860	36.160	12.050	-22.548	-4.064
1210	14.890	36.284	12.200	-22.517	-3.911
1210	16.000	50.806	29.770	-4.947	-3.911
1300	16.000	51.952	31.210	-4.578	-3.846

1210 K, melting point; $\Delta H^\circ = 17.570$

$\text{UAs}_2(\text{c})$
Uranium diarsenide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	19.110	29.410	0	-60.000	-60.102
300	19.110	29.530	.030	-60.004	-60.109
400	19.470	35.070	1.960	-59.960	-60.148
500	19.790	39.440	3.920	-59.962	-60.193
600	19.970	43.060	5.910	-60.023	-60.231
700	20.240	46.170	7.920	-60.161	-60.264

*Enthalpy of formation at 298 K estimated

$\text{U}_3\text{As}_4(\text{c})$
Triuranium tetraarsenide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	44.820	73.870	0	-172.000	-173.113
300	44.840	74.150	.083	-171.997	-173.121
400	45.630	87.160	4.607	-171.931	-173.512
500	46.360	97.420	9.205	-171.993	-173.900
600	47.100	105.940	13.875	-172.222	-174.270
700	47.810	113.250	18.625	-172.636	-174.572
800	48.460	119.700	23.435	-173.297	-174.831
900	49.360	125.400	28.325	-207.282	-174.014
1000	50.610	130.700	33.325	-209.459	-170.217

Borides

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

Source of data for $MgB_4(c)$, $TaB_2(c,l)$, and $ZrB_2(c,l)$:

Barin, I., and O. Knacke. Thermochemical Properties of Inorganic Substances. Springer-Verlag, 1973, 921 pp.

All other data were from reference 1.

$\text{AlB}_2(\text{c})$
Aluminum diboride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	10.431	8.300	0	-16.000	-15.614
400	12.814	11.735	1.197	-16.056	-15.474
600	15.354	17.458	4.037	-16.255	-15.144
800	17.133	22.127	7.291	-16.530	-14.728
1000	18.693	26.120	10.876	-19.369	-14.060
1200	20.166	29.660	14.763	-19.446	-12.998

$\text{AlB}_{12}(\text{c})$
Aluminum dodecaboride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	35.750	28.400	0	-48.000	-49.402
400	48.750	40.942	4.379	-48.094	-49.875
600	61.333	63.376	15.529	-48.803	-50.643
800	69.313	82.165	28.629	-49.872	-51.060
1000	75.960	98.360	43.169	-53.326	-51.057
1200	82.083	112.755	58.979	-53.710	-50.616
1400	87.959	125.852	75.986	-53.605	-50.062
1600	93.703	137.973	94.154	-53.047	-49.682
1800	99.370	149.338	113.462	-52.033	-49.167
2000	104.990	160.098	133.899	-50.562	-49.058
2200	110.579	170.367	155.456	-48.643	-48.982
2400	116.146	180.228	178.129	-190.016	-46.002

$\text{CeB}_6(\text{c})$
Cerium hexaboride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	24.691	17.700	0	-84.000	-81.627
400	30.266	25.839	2.835	-83.769	-80.857
600	35.058	39.154	9.434	-83.882	-79.408
800	37.660	49.620	16.723	-84.544	-77.808
1000	39.630	58.242	24.458	-86.191	-76.023
1200	41.350	65.622	32.559	-88.533	-73.763
1400	42.953	72.118	40.991	-89.595	-71.196
1600	44.493	77.955	49.736	-90.698	-68.546
1800	45.997	83.282	58.785	-91.839	-65.635
2000	47.478	88.205	68.133	-93.017	-62.727

$\text{CoB}(\text{c})$
Cobalt monoboride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.277	7.300	0	-22.500	-22.115
400	9.979	9.999	.940	-22.507	-21.987
600	11.613	14.392	3.117	-22.559	-21.714
800	12.640	17.880	5.547	-22.781	-21.397
1000	13.491	20.794	8.162	-22.977	-21.041
1200	14.273	23.324	10.939	-23.331	-20.624

$\text{Co}_2\text{B}(\text{c})$
Dicobalt monoboride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	14.096	14.300	0	-30.000	-29.562
400	16.345	18.793	1.563	-30.009	-29.418
600	18.597	25.895	5.081	-30.067	-29.104
800	20.079	31.456	8.954	-30.434	-28.727
1000	21.339	36.074	13.098	-30.755	-28.289
1200	22.511	40.069	17.484	-31.408	-27.735
1400	23.642	43.625	22.100	-32.726	-27.049

$\text{CrB}(\text{c})$
Chromium monoboride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.561	5.750	0	-18.000	-17.609
400	10.158	8.515	.962	-17.951	-17.485
600	11.758	12.970	3.170	-17.905	-17.263
800	12.812	16.503	5.632	-17.906	-17.044
1000	13.708	19.460	8.285	-17.892	-16.832
1200	14.542	22.034	11.111	-17.899	-16.620

$\text{CrB}_2(\text{c})$
Chromium diboride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	12.809	6.250	0	-22.500	-21.838
400	13.901	10.167	1.360	-22.375	-21.638
600	16.045	16.209	4.354	-22.425	-21.266
800	18.189	21.118	7.778	-22.528	-20.854
1000	20.333	25.407	11.630	-22.472	-20.439
1200	22.477	29.304	15.911	-22.247	-20.056

$\text{FeB}(\text{c})$
Iron monoboride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	12.000	6.620	0	-17.000	-16.609
400	12.156	10.168	1.230	-16.729	-16.523
600	12.464	15.155	3.692	-16.568	-16.471
800	12.771	18.783	6.216	-16.768	-16.415
1000	13.079	21.666	8.801	-17.438	-16.264
1200	13.387	24.078	11.448	-18.567	-15.925
1400	13.694	26.164	14.156	-18.802	-15.462
1600	14.002	28.013	16.925	-19.116	-14.972
1800	14.309	29.680	19.756	-19.810	-14.399

$\text{Fe}_2\text{B}(\text{c})$
Diiron monoboride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.004	13.540	0	-17.000	-17.149
400	18.340	18.878	1.851	-16.745	-16.681
600	19.000	26.439	5.585	-16.731	-16.675
800	19.660	31.995	9.451	-17.249	-16.591
1000	20.320	36.453	13.449	-18.604	-16.297
1200	20.980	40.216	17.579	-20.803	-15.626
1400	21.640	43.500	21.841	-21.145	-14.733
1600	22.300	46.433	26.235	-21.576	-13.795

$\text{HfB}_2(\text{c})$
Hafnium diboride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.820	10.200	0	-80.300	-79.397
400	14.518	14.099	1.358	-80.222	-79.102
600	16.960	20.511	4.537	-80.110	-78.569
800	18.387	25.596	8.080	-80.072	-78.053
1000	19.520	29.824	11.873	-80.042	-77.556
1200	20.538	33.474	15.880	-80.003	-77.068
1400	21.500	36.713	20.084	-79.958	-76.574

$\text{MgB}_2(\text{c})$
Magnesium diboride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.430	8.600	0	-22.000	-21.395
400	13.000	12.190	1.248	-22.017	-21.189
600	14.670	17.808	4.030	-22.304	-20.725
800	15.900	22.199	7.089	-22.789	-20.124
1000	17.140	25.881	10.394	-25.466	-19.217
1200	18.270	29.106	13.935	-26.001	-17.932
1400	19.400	32.007	17.702	-56.632	-15.727

$\text{MgB}_4(\text{c})$
Magnesium tetraboride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	16.770	12.410	0	-25.100	-24.790
400	19.211	17.706	1.841	-25.168	-24.682
600	22.441	26.141	6.023	-25.819	-24.320
800	25.114	32.969	10.783	-26.731	-23.674
1000	27.625	38.844	15.059	-29.751	-22.625

$\text{MnB}(\text{c})$
Manganese monoboride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.561	7.750	0	-18.000	-17.609
400	10.158	10.515	.962	-18.024	-17.474
600	11.758	14.970	3.170	-18.138	-17.178
800	12.812	18.503	5.632	-18.340	-16.830
1000	13.708	21.460	8.285	-19.106	-16.416
1200	14.542	24.034	11.111	-19.324	-15.861

$\text{MnB}_2(\text{c})$
Manganese diboride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	12.816	8.250	0	-22.500	-21.838
400	13.908	12.169	1.361	-22.447	-21.627
600	16.052	18.213	4.357	-22.655	-21.181
800	18.196	23.125	7.781	-22.959	-20.643
1000	20.340	27.416	11.635	-23.681	-20.027
1200	22.484	31.314	15.917	-23.666	-19.303

$\text{NiB}(\text{c})$
Nickel monoboride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.277	7.200	0	-24.000	-23.597
400	9.979	9.899	.940	-24.046	-23.454
600	11.613	14.292	3.117	-24.243	-23.128
800	12.640	17.780	5.547	-24.412	-22.716
1000	13.491	20.694	8.162	-24.464	-22.288
1200	14.273	23.224	10.939	-24.484	-21.849

$\text{Ni}_4\text{B}_3(\text{c})$
Tetranickel triboride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	30.622	27.400	.0	-74.500	-72.893
400	36.332	37.294	3.443	-74.679	-72.321
600	41.816	53.190	11.320	-75.416	-71.030
800	45.261	65.714	20.044	-76.024	-69.419
1000	48.117	76.127	29.387	-76.192	-67.759
1200	50.741	85.134	39.275	-76.269	-66.050
1400	53.255	93.145	49.676	-76.314	-64.337

$TaB_2(c)$
Tantalum diboride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	11.500	10.600	0	-50.000	-49.362
400	13.759	14.334	1.300	-49.971	-49.149
600	15.909	20.370	4.292	-49.998	-48.737
800	17.246	25.139	7.614	-50.082	-48.298
1000	18.348	29.108	11.175	-50.137	-47.844
1200	19.357	32.544	14.947	-50.137	-47.394
1400	20.323	35.601	18.915	-50.087	-46.934
1600	21.265	38.376	23.074	-49.999	-46.505
1800	22.194	40.934	27.420	-49.874	-46.049
2000	23.114	43.320	31.951	-49.718	-45.656
2200	24.029	45.566	36.665	-49.539	-45.256
2400	24.940	47.696	41.562	-73.300	-44.356
2600	25.848	49.728	46.641	-72.856	-41.963
2800	26.755	51.677	51.902	-72.312	-39.639
3000	27.660	53.554	57.343	-71.696	-37.310

$TiB(c)$
Titanium monoboride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	7.092	8.300	0	-38.300	-38.172
400	9.640	10.771	.863	-38.386	-38.110
600	11.608	15.128	3.025	-38.413	-37.968
800	12.168	18.560	5.414	-38.490	-37.802
1000	12.408	21.304	7.874	-38.683	-37.607
1200	12.506	23.577	10.367	-39.971	-37.336
1400	12.570	25.509	12.875	-40.207	-36.875
1600	12.634	27.192	15.395	-40.570	-36.384
1800	12.698	28.684	17.929	-41.076	-35.020
2000	12.762	30.025	20.475	-45.171	-35.117

$TiB_2(c)$
Titanium diboride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	10.583	6.808	0	-77.400	-76.407
400	13.119	10.310	1.220	-77.451	-76.059
600	15.814	16.208	4.147	-77.595	-75.338
800	17.225	20.966	7.462	-77.810	-74.543
1000	18.377	24.936	11.024	-79.058	-73.694
1200	19.427	28.380	14.806	-79.280	-72.772
1400	20.375	31.448	18.788	-79.324	-71.579
1600	21.219	34.225	22.949	-79.387	-70.598
1800	21.959	36.768	27.269	-79.505	-69.468
2000	22.595	39.115	31.726	-83.143	-68.269

$UB_2(c)$
Uranium diboride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	13.693	13.170	0	-39.300	-38.808
400	17.370	17.796	1.612	-39.030	-38.681
600	19.562	25.358	5.357	-38.582	-38.616
800	20.309	31.098	9.351	-38.537	-38.640
1000	20.972	35.698	13.476	-39.510	-38.590
1200	21.886	39.597	17.757	-40.696	-38.241
1400	23.165	43.062	22.255	-40.592	-37.831
1600	24.858	46.261	27.050	-42.970	-37.141
1800	26.989	49.308	32.228	-42.914	-36.387
2000	29.568	52.281	37.876	-42.500	-35.704
2200	32.603	55.237	44.085	-41.637	-35.057

$UB_4(c)$
Uranium tetraboride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	18.860	17.000	0	-58.700	-58.509
400	24.018	23.359	2.217	-58.469	-58.481
600	28.498	34.070	7.530	-58.217	-58.558
800	30.969	42.629	13.493	-58.331	-58.651
1000	32.860	49.749	19.881	-59.355	-58.646
1200	34.522	55.889	26.622	-60.527	-58.350

$UB_{12}(c)$
Uranium dodecaboride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	40.531	33.400	0	-103.500	-104.836
400	56.152	47.821	5.037	-103.025	-105.366
600	67.474	73.161	17.611	-102.568	-106.684
800	71.912	93.257	31.603	-103.165	-107.955
1000	74.360	109.588	46.249	-105.187	-108.957
1200	76.024	123.300	61.296	-107.837	-109.465

$VB(c)$
Vanadium monoboride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.609	7.000	0	-33.100	-32.705
400	9.967	9.739	.953	-33.093	-32.571
600	11.464	14.091	3.109	-33.105	-32.309
800	12.488	17.535	5.509	-33.110	-32.040
1000	13.321	20.414	8.092	-33.088	-31.774
1200	14.031	22.907	10.829	-33.051	-31.519
1400	14.924	25.138	13.726	-33.002	-31.263
1600	15.866	27.192	16.804	-32.930	-31.029
1800	16.888	29.119	20.078	-32.823	-30.784
2000	17.992	30.954	23.564	-32.681	-30.575
2200	19.178	32.724	27.280	-37.973	-30.348
2400	20.445	34.447	31.241	-49.764	-29.402

$\text{VB}_2(\text{c})$
Vanadium diboride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.229	7.200	0	-48.700	-47.944
400	13.721	10.884	1.283	-48.685	-47.689
600	16.382	17.005	4.320	-48.698	-47.191
800	18.076	21.963	7.775	-48.712	-46.680
1000	19.323	26.138	11.521	-48.684	-46.174
1200	20.282	29.747	15.483	-48.645	-45.685
1400	21.464	32.964	19.660	-48.598	-45.188
1600	22.696	35.909	24.047	-48.558	-44.748
1800	24.008	38.657	28.743	-48.427	-44.224
2000	25.402	41.258	33.683	-48.285	-43.787
2200	26.878	43.748	38.910	-53.576	-43.320
2400	28.435	46.153	44.439	-77.343	-41.876

$\text{V}_3\text{B}_4(\text{c})$
Trivanadium tetraboride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	28.445	21.190	0	-116.300	-114.751
400	33.655	30.352	3.188	-116.272	-114.229
600	39.311	45.176	10.538	-116.308	-113.203
800	43.054	57.024	18.793	-116.332	-112.152
1000	45.966	66.956	27.706	-116.259	-111.111
1200	48.315	75.552	37.142	-116.146	-110.110
1400	51.312	83.231	47.113	-116.001	-109.100
1600	54.428	90.281	57.683	-115.790	-108.160
1800	57.787	96.886	78.900	-105.472	-97.174
2000	61.389	103.159	80.814	-115.044	-106.320
2200	65.236	109.188	93.470	-130.922	-105.398
2400	69.327	115.038	106.924	-178.268	-102.056

$\text{V}_2\text{B}_3(\text{c})$
Divanadium triboride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.837	14.200	0	-82.500	-81.349
400	23.688	20.523	2.236	-82.478	-80.961
600	27.847	31.095	7.429	-82.503	-80.200
800	30.565	39.499	13.284	-82.522	-79.420
1000	32.645	46.552	19.614	-82.471	-78.647
1200	34.283	52.654	26.313	-82.395	-77.902
1400	36.388	58.102	33.386	-82.300	-77.151
1600	38.563	63.101	40.879	-82.160	-76.450
1800	40.898	67.776	48.822	-81.949	-75.707
2000	43.397	72.213	57.249	-81.664	-75.062
2200	46.058	76.473	66.192	-92.247	-74.368
2400	48.882	80.601	75.683	-127.804	-71.978

$\text{V}_5\text{B}_6(\text{c})$
Pentavanadium hexaboride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	45.663	18.200	0	-182.500	-175.095
400	53.590	32.840	5.094	-182.458	-172.576
600	62.240	56.368	16.757	-182.517	-167.627
800	68.031	75.105	29.811	-182.552	-162.640
1000	72.609	90.795	43.890	-182.435	-157.670
1200	76.379	104.377	58.801	-182.247	-152.759
1400	81.161	116.519	74.567	-182.003	-147.842
1600	86.162	127.679	91.292	-181.649	-143.039
1800	91.567	138.135	109.058	-181.116	-138.159
2000	97.378	148.080	127.946	-180.402	-133.492
2200	103.596	157.649	148.036	-206.862	-128.716
2400	110.221	166.945	169.411	-277.791	-120.087

$\text{V}_3\text{B}_2(\text{c})$
Trivanadium diboride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	23.207	20.780	0	-72.600	-71.770
400	26.148	28.052	2.528	-72.588	-71.489
600	29.475	39.339	8.117	-72.621	-70.934
800	31.877	48.158	14.260	-72.629	-70.364
1000	33.961	55.499	20.847	-72.568	-69.803
1200	35.875	61.862	27.833	-72.459	-69.267
1400	38.232	67.571	35.246	-72.308	-68.739
1600	40.768	72.839	43.142	-72.089	-68.263
1800	43.547	77.799	51.569	-71.765	-67.774
2000	46.569	82.541	60.577	-71.335	-67.375
2200	49.836	87.131	70.213	-87.213	-66.931
2400	53.347	91.616	80.527	-110.611	-64.586

$\text{ZrB}_2(\text{c})$
Zirconium diboride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.561	8.590	0	-77.100	-76.042
400	13.772	12.339	1.305	-77.090	-75.684
600	15.599	18.324	4.269	-77.249	-74.957
800	16.531	22.949	7.409	-77.605	-74.138
1000	17.205	26.713	10.865	-78.072	-73.217
1200	17.777	29.902	14.365	-79.485	-72.153
1400	18.300	32.682	17.973	-79.830	-70.898
1600	18.799	35.158	21.683	-80.256	-69.610
1800	19.282	37.400	25.491	-80.762	-68.225
2000	19.756	39.457	29.395	-81.348	-66.826
2200	20.224	41.361	33.393	-86.991	-65.163
2400	20.688	43.141	37.484	-111.588	-62.630
2600	21.149	44.815	41.668	-112.004	-58.535
2800	21.608	46.399	45.944	-112.328	-54.441
3000	22.065	47.906	50.311	-112.561	-50.284

Bromides

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

Source of data: reference 25.

AgBr(c,l)
Silver bromide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	13.050	25.600	0	-24.038	-23.215
400	13.730	29.520	1.360	-27.438	-22.221
600	17.680	35.560	4.365	-26.576	-19.768
700	30.400	39.060	6.650	-25.389	-18.712
700	14.460	41.960	8.680	-23.359	-18.712
800	14.360	43.890	10.125	-23.030	-18.072
1000	14.060	47.060	12.965	-22.475	-16.901
1200	13.780	49.600	15.755	-22.051	-15.822

700 K, melting point; ΔH° = 2.030

AlBr(g)
Aluminum monobromide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.509	57.244	0	3.800	-5.824
400	8.710	59.776	.878	-0.069	-8.328
600	8.892	63.345	2.640	-0.466	-12.372
800	8.961	65.912	4.425	-0.976	-16.268
1000	9.011	67.918	6.222	-4.189	-19.837
1200	9.048	69.564	8.028	-4.804	-22.908
1400	9.080	70.961	9.841	-5.414	-25.876
1600	9.109	72.176	11.660	-6.022	-28.760
1800	9.137	73.250	13.485	-6.625	-31.565
2000	9.163	74.214	15.315	-7.226	-34.303

AlBr₃(c,l)
Aluminum tribromide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	24.040	43.080	0	-122.160	-116.714
300	24.100	43.220	.050	-122.171	-116.672
371	27.030	48.590	1.840	-132.777	-114.147
371	29.870	55.850	4.530	-130.087	-114.148
400	29.870	58.130	5.410	-129.772	-112.893
500	29.870	64.800	8.400	-128.729	-108.795

370.6 K, melting point; ΔH° = 2.690

529 K, boiling point to dimer; ΔH°(sublimation,
298 K) = 20.4 per mole of dimer.

AlBr₃(g)
Aluminum tribromide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.015	83.492	0	-98.100	-104.703
400	18.732	88.898	1.875	-109.246	-104.675
600	19.326	96.627	5.692	-109.359	-102.364
800	19.557	102.223	9.583	-109.551	-100.007
1000	19.667	106.600	13.507	-112.436	-97.404
1200	19.729	110.192	17.447	-112.722	-94.370
1400	19.766	113.236	21.397	-113.006	-91.288
1600	19.791	115.877	25.353	-113.294	-88.166
1800	19.808	118.209	29.313	-113.583	-85.009
2000	19.820	120.297	33.275	-113.878	-81.819

(AlBr₃)₂(g)
Dimeric aluminum tribromide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	40.037	130.763	0	-224.000	-226.407
400	41.513	142.761	4.162	-245.881	-222.725
600	42.682	159.857	12.603	-245.300	-211.271
800	43.123	172.205	21.189	-244.880	-199.998
1000	43.334	181.853	29.837	-249.849	-188.438
1200	43.450	189.765	38.517	-249.620	-176.174
1400	43.520	196.468	47.214	-249.392	-163.950
1600	43.567	202.283	55.923	-249.170	-151.762
1800	43.598	207.416	64.640	-248.952	-139.600
2000	43.621	212.011	73.362	-248.744	-127.460

AsBr₃(g)
Arsenic tribromide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.980	86.860	0	-31.000	-38.083
300	18.900	86.980	.035	-31.025	-38.128
400	19.300	92.480	1.948	-42.076	-38.231
500	19.500	96.810	3.889	-42.070	-37.270
600	19.610	100.370	5.845	-42.074	-36.306
700	19.680	103.400	7.810	-42.088	-35.346
800	19.720	106.030	9.780	-42.114	-34.379
900	19.760	108.360	11.754	-50.420	-33.190
1000	19.780	110.440	13.731	-50.286	-31.281

BBr(g)
Boron monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.837	53.750	0	56.900	46.718
400	8.216	56.111	.819	53.260	43.987
600	8.604	59.526	2.506	53.180	39.359
800	8.783	62.029	4.247	52.963	34.786
1000	8.883	64.000	6.015	52.674	30.275
1200	8.947	65.626	7.798	52.331	25.821
1400	8.994	67.009	9.592	51.938	21.436
1600	9.032	68.212	11.395	51.492	17.102
1800	9.064	69.278	13.205	50.993	12.845
2000	9.092	70.235	15.020	50.441	8.622

$\text{BBr}_2(\text{g})$
Boron dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	11.486	70.402	0	15.000	5.276
400	12.248	73.892	1.211	7.614	3.468
600	13.035	79.030	3.751	7.502	1.414
800	13.385	82.834	6.397	7.296	-.582
1000	13.564	85.842	9.094	7.037	-2.523
1200	13.666	88.325	11.818	6.733	-4.411
1400	13.729	90.436	14.558	6.380	-6.237
1600	13.771	92.272	17.308	5.972	-8.020
1800	13.799	93.896	20.065	5.510	-9.731
2000	13.820	95.351	22.827	4.992	-11.408

*Enthalpy of formation at 298 K estimated.

$\text{BBr}_3(\text{g})$
Boron tribromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	16.198	77.487	0	-48.800	-55.213
400	17.358	82.423	1.713	-59.821	-55.140
600	18.545	89.720	5.321	-59.750	-52.817
800	19.074	95.137	9.089	-59.729	-50.507
1000	19.345	99.425	12.934	-59.739	-48.201
1200	19.499	102.967	16.819	-59.785	-45.894
1400	19.595	105.980	20.730	-59.872	-43.568
1600	19.659	108.602	24.656	-60.013	-41.239
1800	19.703	110.920	28.592	-60.206	-38.870
2000	19.735	112.997	32.536	-60.455	-36.496

BaBr(g)
Barium monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.842	64.599	0	-26.400	-35.789
400	8.915	67.209	.905	-30.370	-38.202
600	8.983	70.838	2.695	-31.489	-41.906
800	9.024	73.428	4.496	-32.502	-45.234
1000	9.056	75.445	6.304	-33.545	-48.297
1200	9.086	77.099	8.119	-36.496	-50.775
1400	9.115	78.502	9.938	-37.523	-53.076
1600	9.146	79.721	11.764	-38.546	-55.226
1800	9.184	80.800	13.597	-39.563	-57.251
2000	9.235	81.771	15.439	-40.574	-59.165

$\text{BaBr}_2(\text{c,l})$
Barium dibromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	18.380	35.000	0	-181.000	-176.141
400	19.085	40.506	1.910	-188.103	-173.014
600	20.075	48.441	5.831	-187.975	-165.519
800	20.925	54.334	9.932	-187.583	-158.097
1000	21.734	59.091	14.198	-187.067	-150.784
1130	22.251	61.778	17.057	-188.553	-145.851
1130	23.689	68.645	24.817	-180.793	-145.851
1200	23.981	70.078	26.486	-180.447	-143.697
1400	24.816	73.837	31.366	-179.319	-137.658
1600	25.650	77.205	36.412	-178.030	-131.792
1800	26.485	80.275	41.626	-176.577	-126.100
2000	27.320	83.108	47.006	-174.963	-120.575

*Heat capacity at 298 K estimated.

1130 K, melting point; $\Delta H^\circ = 7.760$

$\text{BaBr}_2(\text{g})$
Barium dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.630	81.729	0	-105.000	-114.073
400	13.751	85.754	1.395	-112.618	-115.628
600	13.839	91.349	4.156	-113.650	-116.939
800	13.870	95.335	6.927	-114.588	-117.903
1000	13.884	98.432	9.703	-115.562	-118.620
1200	13.892	100.964	12.480	-118.453	-118.766
1400	13.897	103.106	15.259	-119.426	-118.741
1600	13.900	104.962	18.039	-120.403	-118.576
1800	13.902	106.599	20.819	-121.384	-118.290
2000	13.904	108.064	23.600	-122.369	-117.893

BeBr(g)
Beryllium monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.791	54.594	0	28.700	18.523
400	8.178	56.942	.815	24.935	15.813
600	8.585	60.346	2.497	24.686	11.303
800	8.776	62.845	4.235	24.357	6.887
1000	8.884	64.816	6.002	23.969	2.564
1200	8.954	66.442	7.786	23.506	-1.680
1400	9.006	67.827	9.582	22.962	-5.829
1600	9.047	69.032	11.388	18.839	-9.807
1800	9.083	70.100	13.201	18.333	-13.375
2000	9.114	71.058	15.020	17.831	-16.854

$\text{BeBr}_2(\text{c})$
Beryllium dibromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	15.780	24.000	0	-85.000	-80.632
300	15.810	24.090	.029	-85.011	-80.606
400	16.880	28.794	1.664	-92.054	-77.677
500	17.880	32.674	3.405	-91.696	-74.126
600	18.550	35.996	5.228	-91.306	-70.643
700	19.050	38.895	7.109	-90.893	-67.236

*Data estimated.

752 K, sublimation point to monomer; $\Delta H^\circ(298 \text{ K}) = 30.2$

781 $\pm$ 15 K, melting point; $\Delta H^\circ = 2.4 \pm 2$

$\text{BeBr}_2(\text{g})$
Beryllium dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.742	65.439	0.000	-54.800	-62.787
400	13.340	69.272	1.330	-62.188	-64.002
600	14.023	74.827	4.075	-62.259	-64.895
800	14.358	78.913	6.917	-62.378	-65.760
1000	14.537	82.138	9.808	-62.541	-66.587
1200	14.643	84.798	12.727	-62.772	-67.380
1400	14.709	87.061	15.662	-63.082	-68.118
1600	14.753	89.028	18.609	-66.973	-68.719
1800	14.784	90.768	21.563	-67.248	-68.938
2000	14.806	92.326	24.522	-67.523	-69.093

$\text{BiBr}_3(\text{c,l})$
Bismuth tribromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	24.100	46.700	0	-66.000	-59.611
300	24.120	46.849	.045	-66.016	-59.569
400	25.470	53.973	2.524	-76.521	-55.240
431	25.880	55.889	3.320	-76.332	-53.597
431	21.000	57.734	4.115	-75.537	-53.597
492	21.000	60.501	5.390	-75.469	-50.511
492	34.560	70.517	10.315	-70.544	-50.511
500	34.470	71.096	10.602	-70.424	-50.174
600	33.420	77.288	13.997	-71.769	-45.982
700	32.370	82.362	17.286	-70.512	-41.785
800	31.320	86.615	20.471	-69.348	-37.756
900	30.270	90.243	23.550	-68.284	-33.879
1000	29.210	93.378	26.524	-67.319	-30.104

*Heat capacity at 298 K estimated.

431 K, transition point; $\Delta H^\circ = 0.795$

491.7 K, melting point; $\Delta H^\circ = 4.925$

$\text{BiBr}_3(\text{g})$
Bismuth tribromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.410	91.850	0	-37.500	-44.573
400	19.610	97.590	1.991	-48.553	-44.719
600	19.750	105.590	5.931	-51.335	-42.529
800	19.810	111.280	9.891	-51.428	-39.568
1000	19.830	115.650	13.847	-51.496	-36.553
1200	19.840	119.390	17.835	-51.519	-33.684
1400	19.850	122.380	21.791	-51.579	-30.627

CBr(g)
Carbon monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.614	55.770	0	122.000	111.204
400	8.876	58.344	.893	118.507	108.242
600	9.012	61.977	2.686	118.721	103.055
800	9.041	64.574	4.492	118.750	97.825
1000	9.056	66.593	6.301	118.666	92.599
1200	9.069	68.245	8.114	118.514	87.401
1400	9.083	69.644	9.929	118.315	82.230
1600	9.098	70.858	11.747	118.082	77.091
1800	9.113	71.930	13.568	117.824	71.982
2000	9.129	72.891	15.392	117.545	66.904

$\text{CBr}_4(\text{c,l,g})$
Carbon tetrabromide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	35.134	50.800	0	4.450	11.406
320	35.696	53.305	.774	4.390	11.918
320	43.885	57.699	2.180	5.796	11.918
363	42.182	63.129	4.031	-7.569	13.993
363	36.600	65.743	4.980	-6.620	13.993
400	36.600	69.295	6.334	-6.014	16.059
463	36.600	74.648	8.640	-5.010	19.457
463	23.705	95.580	18.328	4.678	19.457
600	24.505	101.838	21.638	5.056	23.778
800	25.050	108.973	26.601	5.560	29.942
1000	25.321	114.595	31.640	6.007	35.981
1200	25.473	119.226	36.721	6.416	41.940
1400	25.567	123.160	41.826	6.790	47.831

320 K, transition point; $\Delta\text{H}^\circ = 1.406$

363 K, melting point; $\Delta\text{H}^\circ = 0.949$

463 K, boiling point; $\Delta\text{H}^\circ = 9.688$

$\text{CBr}_4(\text{g})$
Carbon tetrabromide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	21.782	85.526	0	19.000	15.602
400	23.195	92.144	2.297	4.499	17.432
600	24.505	101.838	7.088	5.056	23.778
800	25.050	108.973	12.051	5.560	29.942
1000	25.321	114.595	17.090	6.007	35.981
1200	25.473	119.226	22.171	6.416	41.940
1400	25.567	123.160	27.276	6.790	47.831

$\text{CaBr}(\text{g})$
Calcium monobromide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.695	60.416	0	-11.800	-21.426
400	8.828	62.992	.893	-15.672	-23.929
600	8.942	66.597	2.672	-16.104	-27.970
800	8.999	69.178	4.466	-16.903	-31.814
1000	9.040	71.190	6.270	-17.756	-35.455
1200	9.073	72.841	8.082	-20.660	-38.740
1400	9.103	74.242	9.899	-21.148	-41.714
1600	9.132	75.460	11.723	-21.633	-44.627
1800	9.161	76.537	13.552	-58.654	-46.536
2000	9.193	77.504	15.388	-58.730	-45.185

$\text{CaBr}_2(\text{c,l})$
Calcium dibromide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	17.670	31.000	0	-163.200	-158.633
400	18.640	36.348	1.856	-170.246	-155.606
600	19.410	44.070	5.670	-169.529	-148.443
800	20.010	49.734	9.610	-169.075	-141.489
1000	20.800	54.279	13.687	-168.555	-134.662
1015	20.870	54.590	14.000	-168.525	-134.154
1015	27.000	61.437	20.950	-161.575	-134.154
1200	27.000	65.958	25.945	-161.915	-129.131
1400	27.000	70.120	31.345	-159.726	-123.838
1600	27.000	73.725	36.745	-157.543	-118.868
1800	27.000	76.905	42.145	-191.904	-113.228
2000	27.000	79.750	47.545	-189.329	-104.625

*Data 298-1015 K estimated.

1015 K, melting point; $\Delta\text{H}^\circ = 6.950$

$\text{CaBr}_2(\text{g})$
Calcium dibromide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	14.433	75.200	0	-92.000	-100.611
400	14.630	79.473	1.481	-99.421	-102.031
600	14.778	85.439	4.425	-99.574	-103.309
800	14.832	89.699	7.387	-100.098	-104.484
1000	14.858	93.011	10.356	-100.686	-105.525
1200	14.872	95.722	13.329	-103.331	-106.264
1400	14.880	98.015	16.304	-103.567	-106.732
1600	14.886	100.002	19.281	-103.807	-107.175
1800	14.889	101.756	22.259	-140.590	-106.646
2000	14.892	103.325	25.237	-140.437	-102.883

$\text{CdBr}_2(\text{c,l})$
Cadmium dibromide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	18.320	32.800	0	-75.570	-70.812
300*	18.330	32.913	.034	-75.580	-70.781
400	19.080	38.286	1.903	-82.588	-67.728
500	19.840	42.624	3.849	-82.188	-64.058
600	20.600	46.308	5.871	-83.227	-60.453
700	21.360	49.541	7.968	-82.733	-56.701
800	22.120	52.442	10.142	-82.164	-53.017
841	22.430	53.560	11.060	-81.908	-51.522
841	24.300	63.035	19.030	-73.938	-51.522
900	24.300	64.677	20.459	-73.456	-49.969
1000	24.300	67.237	22.889	-72.636	-47.401

*Data 300-800 K estimated.

841.2 K, melting point; $\Delta\text{H}^\circ = 7.970$

$\text{CeBr}_3(\text{c,l})$
Cerium tribromide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	24.100	49.500	0	-211.000	-204.361
400	24.911	56.702	2.498	-221.587	-199.893
600	26.183	67.050	7.611	-220.549	-189.267
800	27.347	74.743	12.965	-219.444	-179.003
1000	28.479	80.967	18.548	-218.999	-169.033
1005	28.507	81.109	18.690	-218.970	-168.784
1005	36.500	93.477	31.120	-206.540	-168.784
1200	36.500	99.950	38.237	-205.122	-161.548

*Heat capacity at 298 K estimated.

1005 K, melting point; $\Delta \text{H}^\circ = 12.430$

$\text{CeBr}_3(\text{g})$
Cerium tribromide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	19.135	95.186	0	-142.700	-149.682
400	19.497	100.865	1.969	-153.816	-149.787
600	20.017	108.870	5.921	-153.938	-147.749
800	20.478	114.694	9.973	-154.136	-145.656
1000	20.781	119.299	14.101	-155.146	-143.512
1200	20.915	123.102	18.273	-156.786	-140.994
1400	20.932	126.329	22.460	-157.118	-138.334
1600	20.885	129.121	26.642	-157.464	-135.632
1800	20.807	131.577	30.811	-157.828	-132.886
2000	20.721	133.765	34.964	-158.216	-130.093

$\text{CrBr}_3(\text{c})$
Chromium tribromide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	23.050	38.162	0	-103.400	-96.824
300*	23.070	38.305	.043	-103.417	-96.783
400	23.840	45.057	2.392	-114.012	-92.376
500	24.320	50.433	4.802	-113.547	-87.020
600	24.680	54.900	7.252	-113.087	-81.757
700	24.970	58.726	9.735	-112.630	-76.570
800	25.220	62.077	12.245	-112.174	-71.449
900	25.470	65.063	14.779	-111.719	-66.388
1000	25.700	67.758	17.338	-111.262	-61.377

*Data above 298 K estimated.

$\text{CrBr}_4(\text{g})$
Chromium tetrabromide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	24.218	99.739	0	-61.800	-68.160
400	24.885	106.974	2.509	-76.432	-67.324
600	25.395	117.180	7.546	-76.215	-62.818
800	25.584	124.515	12.647	-76.089	-58.371
1000	25.674	130.235	17.774	-76.042	-53.953
1200	25.723	134.921	22.914	-76.122	-49.524

* CrBr_4 stable only in presence of $\text{Br}_2(\text{g})$.

$\text{CsBr}(\text{c,l})$
Cesium monobromide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	12.440	27.020	0	-96.990	-93.549
400	12.751	30.721	1.283	-101.120	-91.462
600	13.682	36.045	3.916	-100.863	-86.679
800	15.372	40.193	6.807	-100.346	-82.022
909	16.645	42.233	8.550	-99.899	-79.552
909	18.600	48.438	14.190	-94.259	-79.552
1000	18.600	50.212	15.883	-109.730	-77.307
1200	18.600	53.604	19.603	-107.906	-70.993
1400	18.600	56.471	23.323	-106.086	-64.985

909 K, melting point; $\Delta \text{H}^\circ = 5.640$

$\text{CuBr}(\text{c,l})$
Copper monobromide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	13.084	22.969	0	-25.240	-24.302
400	13.746	26.911	1.368	-28.615	-23.272
600	18.919	32.921	4.359	-27.747	-20.760
657	33.288	35.135	5.755	-26.968	-20.126
657	17.500	36.809	6.855	-25.868	-20.126
741	17.500	38.914	8.325	-25.315	-19.425
741	13.900	39.602	8.835	-24.805	-19.425
759	13.900	39.936	9.085	-24.752	-19.295
759	15.136	41.543	10.305	-23.532	-19.295
800	14.862	42.332	10.920	-23.370	-19.070
1000	13.831	45.528	13.781	-22.747	-18.073
1200	13.308	47.996	16.486	-22.352	-17.178
1400	13.293	50.040	19.138	-25.252	-16.242

657 K, transition point; $\Delta \text{H}^\circ = 1.100$ 741 K, transition point; $\Delta \text{H}^\circ = 0.510$ 759 K, melting point; $\Delta \text{H}^\circ = 1.220$

CuBr(g)
Copper monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.641	59.319	0	29.300	19.400
400	8.794	61.882	0.889	25.446	16.801
600	8.926	65.477	2.663	25.097	12.551
800	8.990	68.054	4.455	24.706	8.427
1000	9.033	70.065	6.257	24.269	4.406
1200	9.068	71.715	8.068	23.771	.481
1400	9.099	73.115	9.884	20.034	-3.261
1600	9.127	74.332	11.707	19.388	-6.544
1800	9.155	75.409	13.535	18.746	-9.749
2000	9.182	76.375	15.369	18.107	-12.880

$(\text{CuBr})_3(\text{g})$
Trimeric copper monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	30.770	108.000	0	-36.200	-45.043
400	31.080	117.088	3.150	-47.278	-45.792
600	31.490	129.776	9.411	-47.386	-45.032
800	31.680	138.864	15.730	-47.619	-44.215
1000	31.730	145.940	22.073	-47.991	-43.325
1200	31.750	151.728	28.421	-48.572	-42.340

$\text{CuBr}_2(\text{c})$
Copper dibromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.100	30.800	0	-33.100	-29.074
300	18.100	30.912	.034	-33.110	-29.048
400	18.400	36.173	1.863	-40.117	-26.240
500	18.700	40.316	3.720	-39.754	-22.814
600	18.900	43.742	5.599	-39.389	-19.459

$\text{DyBr}_3(\text{g})$
Dysprosium tribromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.093	96.555	0	-129.100	-136.281
400	19.426	102.219	1.964	-140.233	-136.454
600	19.696	110.154	5.880	-140.319	-134.545
800	19.881	115.845	9.837	-140.426	-132.602
1000	20.077	120.303	13.833	-140.590	-130.630
1200	20.265	123.980	17.868	-140.868	-128.613
1400	20.418	127.116	21.937	-141.352	-126.540
1600	20.527	129.850	26.032	-142.116	-124.379
1800	20.595	132.272	30.145	-146.615	-121.826
2000	20.628	134.444	34.268	-147.617	-119.032

$\text{ErBr}_3(\text{g})$
Erbium tribromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.083	96.409	0	-130.500	-137.760
400	19.419	102.071	1.963	-141.637	-137.956
600	19.666	110.001	5.876	-141.755	-136.094
800	19.755	115.672	9.820	-141.915	-134.185
1000	19.797	120.085	13.775	-142.150	-132.222
1200	19.820	123.697	17.737	-142.479	-130.208
1400	19.834	126.753	21.703	-142.925	-128.123
1600	19.843	129.402	25.670	-143.513	-125.971
1800	19.849	131.740	29.639	-149.010	-123.732
2000	19.853	133.831	33.610	-149.629	-120.878

$\text{EuBr}_2(\text{c,l})$
Europium dibromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.700	32.700	0	-172.000	-165.358
400	20.100	38.540	2.030	-178.922	-161.636
600	20.900	46.840	6.130	-177.980	-153.192
800	21.700	52.970	10.390	-177.016	-145.079
956	22.300	56.890	13.820	-176.287	-138.926
956	29.000	63.180	19.830	-170.277	-138.926
1000	26.000	64.350	20.970	-169.927	-137.496
1200	26.000	69.090	26.170	-170.585	-130.931
1400	26.000	73.100	31.370	-169.018	-124.448

956 K, melting point; $\Delta H^\circ = 6.010$

$\text{EuBr}_2(\text{g})$
Europium dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.500	80.600	0	-89.000	-96.639
400	14.670	84.890	1.486	-96.466	-97.720
600	14.800	90.870	4.436	-96.674	-98.304
800	14.890	95.140	7.404	-97.002	-98.801
1000	15.000	98.470	10.393	-97.504	-99.193
1200	15.160	101.220	13.409	-100.346	-99.248
1400	15.340	103.570	16.459	-100.929	-99.017

$\text{EuBr}_3(\text{c})$
Europium tribromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	26.440	43.700	0	-180.000	-171.214
300*	26.460	43.864	.049	-180.012	-171.158
400	27.200	51.584	2.734	-190.355	-166.047
500	27.900	57.736	5.492	-189.600	-160.056
600	28.500	62.883	8.317	-188.816	-154.218

*Data above 298 K estimated.

667 K, decomposes on vaporization; $\text{Br}_2(\text{g})$ pressure = 1 atm.

$\text{FeBr}_2(\text{c}, \text{l})$
Iron dibromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.176	33.620	0	-59.500	-56.733
400	19.718	39.331	1.981	-66.431	-54.343
600	20.782	47.527	6.031	-65.570	-48.486
650	21.048	49.201	7.076	-65.360	-47.072
650	21.048	49.335	7.176	-65.260	-47.072
800	21.846	53.805	10.393	-64.656	-42.940
964	22.719	57.959	14.048	-64.125	-38.545
964*	25.500	70.407	26.048	-52.125	-38.545
1000	25.500	71.342	26.966	-51.980	-38.040
1200	25.500	75.991	32.066	-51.238	-35.318

*Enthalpy of fusion and heat capacity of liquid estimated.

650 K, transition point; $\Delta H^\circ = 0.10$

964 K, melting point; $\Delta H^\circ = 12.0$

1207 K, boiling point to equilibrium mixture of monomer and dimer; $\Delta H^\circ = 29.4$

$\text{FeBr}_2(\text{g})$
Iron dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	14.496	80.604	0	-9.900	-21.142
400	14.669	84.891	1.486	-17.326	-23.462
600	14.802	90.869	4.436	-17.565	-26.486
800	14.886	95.138	7.404	-18.045	-29.395
1000	15.004	98.472	10.393	-18.953	-32.143
1200	15.164	101.221	13.409	-20.295	-34.651
1400	15.344	103.572	16.459	-20.717	-37.010
1600	15.523	105.632	19.546	-21.189	-39.304
1800	15.682	107.470	22.667	-22.016	-41.519
2000	15.812	109.129	25.817	-26.186	-43.298

*Data except enthalpy of formation at 298 K estimated.

$(\text{FeBr}_2)_2(\text{g})$
Dimeric iron dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	31.234	123.304	0	-60.500	-71.682
400	31.479	132.522	3.195	-75.129	-72.497
600	31.659	145.326	9.512	-75.190	-71.186
800	31.759	154.447	15.854	-75.744	-69.782
1000	31.888	161.547	22.218	-77.174	-68.157
1200	32.063	167.376	28.612	-79.496	-66.128
1400	32.270	172.333	35.045	-80.007	-63.858
1600	32.482	176.656	41.521	-80.649	-61.507
1800	32.681	180.494	48.037	-82.029	-59.032
2000	32.850	183.946	54.591	-90.115	-55.715

*Data except enthalpy of formation at 298 K estimated.

$\text{GdBr}_3(\text{c}, \text{l})$
Gadolinium tribromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	23.200	45.400	0	-198.100	-190.524
400	24.125	52.365	2.416	-208.850	-185.713
600	24.720	62.285	7.314	-207.966	-174.323
800	25.076	69.442	12.291	-207.104	-163.238
1000	25.836	75.108	17.371	-206.236	-152.381
1058	26.192	76.574	18.880	-205.965	-149.253
1058	33.300	85.189	27.995	-196.850	-149.253
1200	33.300	89.383	32.724	-195.190	-142.979

1058 K, melting point; $\Delta H^\circ = 9.115$

$\text{GdBr}_3(\text{g})$
Gadolinium tribromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.103	95.321	0	-127.000	-134.308
400	19.431	100.987	1.965	-138.201	-134.513
600	19.671	108.920	5.880	-138.299	-132.638
800	19.758	114.593	9.824	-138.471	-130.726
1000	19.799	119.007	13.780	-138.727	-128.771
1200	19.821	122.619	17.742	-139.072	-126.744
1400	19.835	125.675	21.708	-139.527	-124.644
1600	19.843	128.324	25.676	-143.313	-122.430
1800	19.849	130.662	29.645	-143.851	-119.782
2000	19.854	132.754	33.615	-144.396	-117.091

$\text{GeBr}_4(\text{g})$
Germanium tetrabromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.340	94.660	0	-71.700	-76.015
400	24.920	101.900	2.510	-86.325	-74.483
600	25.460	112.130	7.560	-86.005	-68.624
800	25.600	119.480	12.670	-85.692	-62.882
1000	25.520	125.180	17.780	-85.448	-57.214
1200	25.290	129.820	22.870	-85.303	-51.576

$\text{HBr}(\text{g})$
Hydrogen bromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	6.965	47.463	0	-8.695	-12.771
400	6.984	49.512	.710	-12.476	-13.392
600	7.139	52.367	2.120	-12.651	-13.811
800	7.423	54.458	3.575	-12.793	-14.175
1000	7.725	56.147	5.090	-12.892	-14.508
1200	7.989	57.580	6.662	-12.954	-14.825
1400	8.205	58.828	8.282	-12.990	-15.134
1600	8.378	59.935	9.941	-13.012	-15.438
1800	8.517	60.931	11.631	-13.024	-15.742
2000	8.630	61.834	13.346	-13.033	-16.043
2200	8.724	62.661	15.082	-13.040	-16.344
2400	8.803	63.424	16.835	-13.047	-16.643
2600	8.870	64.131	18.602	-13.056	-16.942
2800	8.929	64.790	20.382	-13.067	-17.240
3000	8.980	65.408	22.173	-13.080	-17.538

$\text{HfBr}_4(\text{c})$
Hafnium tetrabromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	30.500	57.000	0	-183.140	-175.338
300	30.530	57.190	.055	-183.162	-175.289
400	32.040	66.180	3.185	-197.141	-169.759
500	33.560	73.490	6.465	-196.267	-163.008
600	35.080	79.740	9.895	-195.274	-156.449
700	36.590	85.270	13.480	-194.154	-150.068

*Data except enthalpy of formation at 298 K estimated.

$\text{HfBr}_4(\text{g})$
Hafnium tetrabromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	24.750	100.100	0	-157.000	-162.048
300	24.760	100.260	.046	-157.031	-162.079
400	25.210	107.450	2.548	-171.638	-160.764
500	25.430	113.100	5.081	-171.511	-158.057
600	25.550	117.750	7.630	-171.399	-155.380
700	25.620	121.690	10.190	-171.304	-152.712
800	25.670	125.120	12.755	-171.227	-150.065
900	25.710	128.150	15.324	-171.171	-147.431
1000	25.730	130.860	17.896	-171.133	-144.799

*Enthalpy of formation at 298 K estimated.

$\text{HgBr}(\text{g})$
Mercury monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.894	64.875	0	24.900	16.389
400	8.978	67.502	.910	21.000	14.272
600	9.072	71.161	2.716	20.619	10.991
800	9.140	73.781	4.538	6.358	11.632
1000	9.201	75.827	6.372	6.299	12.957
1200	9.259	77.510	8.218	6.249	14.293
1400	9.315	78.941	10.075	6.207	15.639
1600	9.371	80.189	11.944	6.174	16.987
1800	9.426	81.296	13.824	6.150	18.341
2000	9.481	82.291	15.714	6.133	19.698

$\text{Hg}_2\text{Br}_2(\text{c})$
Dimeric mercury bromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	25.000	52.283	0	-49.450	-43.375
300	25.025	52.438	.046	-49.461	-43.336
400	26.200	59.805	2.610	-56.461	-39.837
500	27.020	65.744	5.273	-55.984	-35.735
600	27.630	70.726	8.007	-55.436	-31.736

*Data except enthalpy of formation at 298 K estimated.
666 K, vapor pressure of decomposition products = 1 atm.

$\text{HgBr}_2(\text{c}, \text{l}, \text{g})$
Mercury dibromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	18.000	40.706	0	-41.900	-37.782
400	18.714	46.095	1.870	-48.978	-34.904
514	19.512	50.883	4.050	-48.547	-30.946
514	24.400	59.210	8.330	-44.267	-30.946
592	24.400	62.655	10.233	-43.563	-28.974
592	14.770	86.545	24.376	-29.420	-28.974
600	14.774	86.741	24.498	-29.421	-28.963
800	14.830	91.000	27.459	-43.437	-24.996
1000	14.857	94.313	30.428	-43.261	-20.408
1200	14.871	97.023	33.401	-43.087	-15.853
1400	14.880	99.316	36.376	-42.916	-11.326
1600	14.886	101.303	39.353	-42.750	-6.825
1800	14.890	103.057	42.330	-42.587	-2.346
2000	14.893	104.626	45.309	-42.428	2.118

*Entropy at 298 K estimated.

514 K, melting point; $\Delta H^\circ = 4.280$ 592 K, boiling point; $\Delta H^\circ = 14.143$

$\text{HgBr}_2(\text{g})$
Mercury dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.407	76.511	0	-21.824	-28.381
400	14.618	80.779	1.480	-29.292	-29.091
600	14.774	86.741	4.422	-29.421	-28.963
800	14.830	91.000	7.383	-43.437	-24.996
1000	14.857	94.313	10.352	-43.261	-20.408
1200	14.871	97.023	13.325	-43.087	-15.853
1400	14.880	99.316	16.300	-42.916	-11.326
1600	14.886	101.303	19.277	-42.750	-6.825
1800	14.890	103.057	22.254	-42.587	-2.346
2000	14.893	104.626	25.233	-42.428	2.118

$\text{HoBr}_3(\text{c}, \text{l})$
Holmium tribromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.600	46.400	0	-201.000	-193.219
400	24.528	53.487	2.459	-211.624	-188.356
600	25.194	63.578	7.440	-210.643	-176.931
800	25.714	70.894	12.529	-209.598	-165.846
1000	26.451	76.706	17.741	-208.539	-155.032
1192	27.446	81.432	22.910	-207.516	-144.850
1192	34.400	91.474	34.880	-195.546	-144.850
1200	34.400	91.704	35.155	-195.448	-144.510

*Entropy and heat capacity at 298 K estimated.

1192 K, melting point; $\Delta H^\circ = 11.970$

$\text{HoBr}_3(\text{g})$
Holmium tribromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.089	96.555	0	-131.100	-138.272
400	19.422	102.218	1.964	-142.219	-138.444
600	19.669	110.149	5.877	-142.307	-136.536
800	19.770	115.822	9.822	-142.406	-134.596
1000	19.855	120.243	13.784	-142.596	-132.626
1200	19.950	123.872	17.765	-142.938	-130.602
1400	20.078	126.957	21.769	-143.494	-128.501
1600	20.202	129.646	25.797	-144.330	-126.314
1800	20.319	132.033	29.849	-149.133	-123.842
2000	20.420	134.179	33.923	-149.898	-121.003

$\text{IBr}(\text{g})$
Iodine monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.731	61.864	0	9.770	0.886
400	8.853	64.449	.896	3.931	-1.289
600	8.961	68.062	2.679	-1.379	-2.229
800	9.019	70.649	4.478	-1.374	-2.512
1000	9.061	72.666	6.286	-1.370	-2.797
1200	9.098	74.321	8.102	-1.364	-3.083
1400	9.136	75.726	9.925	-1.357	-3.369
1600	9.186	76.949	11.757	-1.347	-3.657
1800	9.261	78.035	13.601	-1.330	-3.948
2000	9.374	79.017	15.464	-1.300	-4.241

$\text{IrBr}_3(\text{c})$
Iridium tribromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	25.200	30.500	0	-42.500	-32.795
300	25.210	30.660	.047	-42.514	-32.735
400	25.700	37.970	2.590	-52.938	-27.305
500	26.190	43.760	5.190	-52.278	-20.968
600	26.670	48.580	7.830	-51.600	-14.775
700	27.160	52.730	10.520	-50.892	-8.696
800	27.650	56.390	13.260	-50.152	-2.719

KBr(c,l)
Potassium bromide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	12.440	22.921	0	-94.120	-90.922
400	12.799	26.627	1.285	-98.299	-88.978
600	13.546	31.956	3.919	-98.020	-84.369
800	14.312	35.958	6.705	-97.556	-79.884
1000	15.084	39.234	9.644	-96.949	-75.535
1007	15.111	39.339	9.750	-96.925	-75.385
1007	16.540	45.397	15.850	-90.825	-75.385
1200	16.540	48.298	19.042	-108.588	-69.682
1400	16.540	50.847	22.350	-107.178	-63.308

1007 K, melting point; ΔH° = 6.10

KBr(g)
Potassium bromide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.824	59.852	0	-43.040	-50.853
400	8.919	62.460	.904	-47.601	-52.612
600	9.011	66.095	2.698	-48.161	-54.993
800	9.068	68.696	4.506	-48.674	-57.194
1000	9.114	70.724	6.324	-49.189	-59.265
1200	9.157	72.390	8.152	-68.398	-58.403
1400	9.198	73.805	9.987	-68.461	-56.732
1600	9.238	75.035	11.831	-68.521	-55.051
1800	9.277	76.126	13.682	-68.576	-53.367
2000	9.315	77.105	15.541	-68.630	-51.673

(KBr)₂(g)
Dimeric potassium bromide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	19.546	89.902	0	-129.200	-135.941
400	19.689	95.669	1.999	-138.130	-136.453
600	19.790	103.676	5.949	-138.888	-135.445
800	19.826	109.375	9.911	-139.570	-134.195
1000	19.842	113.801	13.878	-140.268	-132.773
1200	19.851	117.419	17.848	-178.371	-125.548
1400	19.857	120.480	21.818	-178.198	-116.758
1600	19.860	123.131	25.790	-178.033	-107.991
1800	19.863	125.471	29.762	-177.874	-99.250
2000	19.864	127.563	33.735	-177.727	-90.519

*Data except enthalpy of formation at 298 K estimated.

LaBr₃(c,l)
Lanthanum tribromide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	23.800	42.500	0	-216.800	-209.147
400	24.800	49.635	2.475	-227.401	-204.333
600	26.200	59.965	7.581	-226.354	-193.023
800	27.500	67.693	12.960	-225.042	-182.106
1000	28.700	73.960	18.580	-223.634	-171.531
1061	29.000	75.667	20.340	-223.187	-168.363
1061	33.000	87.920	33.340	-210.187	-168.363
1200	33.000	91.983	37.927	-210.926	-162.928

*Data 298-1061 K estimated except enthalpy of formation at 298 K.

1061 K, melting point; ΔH° = 13.0

LaBr₃(g)
Lanthanum tribromide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	19.129	91.681	0	-144.300	-151.310
400	19.446	97.353	1.967	-155.410	-151.428
600	19.679	105.291	5.884	-155.551	-149.416
800	19.762	110.965	9.829	-155.674	-147.354
1000	19.802	115.379	13.786	-155.928	-145.244
1200	19.823	118.992	17.748	-158.605	-143.017
1400	19.836	122.049	21.714	-158.996	-140.394
1600	19.844	124.698	25.682	-159.394	-137.702
1800	19.850	127.036	29.652	-159.795	-134.977
2000	19.854	129.127	33.622	-160.204	-132.185

LiBr(c,l)
Lithium bromide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.910	17.690	0	-83.942	-81.720
400	12.482	21.279	1.245	-87.466	-80.229
600	13.388	26.505	3.829	-87.898	-76.437
800	14.711	30.524	6.630	-87.384	-72.686
823	14.900	30.943	6.970	-87.306	-72.265
823	15.600	36.071	11.190	-83.086	-72.265
1000	15.600	39.110	13.951	-82.343	-70.013
1200	15.600	41.954	17.071	-81.502	-67.626
1400	15.600	44.359	20.191	-80.658	-65.380

823 K, melting point; ΔH° = 4.220

LiBr(g)
Lithium bromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.115	53.593	0	-36.800	-45.282
400	8.446	56.028	.845	-40.724	-47.387
600	8.758	59.521	2.570	-42.015	-50.363
800	8.903	62.063	4.338	-42.534	-53.067
1000	8.990	64.059	6.127	-43.025	-55.644
1200	9.052	65.704	7.932	-43.499	-58.123
1400	9.101	67.103	9.747	-43.960	-60.523
1600	9.145	68.322	11.572	-44.408	-62.859
1800	9.184	69.401	13.405	-44.840	-65.135
2000	9.220	70.370	15.245	-45.259	-67.356

$(\text{LiBr})_2(\text{g})$
Dimeric lithium bromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.937	75.148	0	-119.700	-127.112
400	18.735	80.545	1.873	-127.366	-128.086
600	19.346	88.281	5.692	-129.579	-127.818
800	19.571	93.881	9.587	-130.256	-127.127
1000	19.678	98.261	13.513	-130.891	-126.272
1200	19.737	101.855	17.455	-131.506	-125.291
1400	19.772	104.900	21.406	-132.108	-124.206
1600	19.796	107.542	25.363	-132.696	-123.037
1800	19.811	109.875	29.324	-133.266	-121.787
2000	19.823	111.962	33.288	-133.820	-120.458

MgBr(g)
Magnesium monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.518	58.516	0	-8.400	-18.095
400	8.716	61.051	.879	-12.279	-20.620
600	8.885	64.622	2.642	-12.707	-24.701
800	8.962	67.190	4.427	-13.231	-28.625
1000	9.011	69.195	6.225	-13.755	-32.225
1200	9.049	70.841	8.031	-14.278	-35.408
1400	9.080	72.239	9.844	-14.794	-38.167
1600	9.109	73.453	11.663	-15.307	-40.412
1800	9.136	74.527	13.487	-15.817	-42.146
2000	9.162	75.491	15.317	-16.324	-43.311

$\text{MgBr}_2(\text{c,l})$
Magnesium dibromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.846	28.000	0	-125.300	-120.475
400	18.470	33.290	1.836	-132.360	-117.357
600	19.462	40.989	5.640	-131.631	-110.010
800	20.209	46.689	9.606	-130.869	-102.919
984	20.994	50.949	13.395	-132.277	-96.429
984	25.000	60.502	22.795	-122.877	-96.429
1000	25.000	60.905	23.195	-122.747	-96.000
1200	25.000	65.463	28.195	-121.182	-90.804
1400	25.000	69.317	33.195	-149.827	-85.046

984 K, melting point; $\Delta H^\circ = 9.40$

1431 K, boiling point to monomer; $\Delta H^\circ = 35.6$

$\text{MgBr}_2(\text{g})$
Magnesium dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.032	71.922	0	-72.400	-80.669
400	14.372	76.099	1.448	-79.848	-81.969
600	14.651	81.989	4.356	-80.015	-82.994
800	14.758	86.221	7.298	-80.277	-83.953
1000	14.809	89.520	10.255	-82.787	-84.655
1200	14.838	92.223	13.220	-83.257	-84.991
1400	14.855	94.512	16.189	-113.933	-84.425
1600	14.866	96.496	19.162	-113.771	-80.221
1800	14.874	98.247	22.136	-113.611	-76.036
2000	14.880	99.815	25.111	-113.456	-71.870

$(\text{MgBr}_2)_2(\text{g})$
Dimeric magnesium dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	30.834	110.237	0	-183.500	-190.017
400	31.253	119.365	3.165	-198.127	-189.235
600	31.551	132.105	9.451	-197.991	-184.825
800	31.657	141.199	15.773	-198.077	-180.435
1000	31.706	148.269	22.110	-202.674	-175.639
1200	31.733	154.052	28.454	-203.200	-170.195
1400	31.750	158.945	34.803	-264.141	-163.015
1600	31.760	163.185	41.154	-263.412	-148.620
1800	31.767	166.927	47.507	-262.687	-134.316
2000	31.773	170.274	53.861	-261.973	-120.089

*Data except enthalpy of formation at 298 K estimated.

MoBr(g)
Molybdenum monobromide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	8.652	64.380	0	109.300	97.571
400	8.794	66.945	.889	105.454	94.344
600	8.910	70.537	2.662	105.110	88.862
800	8.964	73.108	4.449	104.716	83.504
1000	8.998	75.112	6.246	104.285	78.250
1200	9.026	76.755	8.048	103.803	73.089
1400	9.052	78.149	9.856	103.259	68.011
1600	9.087	79.360	11.670	102.649	63.017
1800	9.141	80.433	13.492	101.966	58.103
2000	9.231	81.400	15.329	101.199	53.270

*Data estimated.

MoBr₂(c)
Molybdenum dibromide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	19.045	29.800	0	-48.500	-44.496
400	19.300	35.432	1.953	-55.420	-41.685
600	19.600	43.352	5.863	-54.512	-35.013
800	20.300	49.117	9.873	-53.576	-28.653
1000	20.800	53.701	13.983	-52.594	-22.537
1200	21.300	57.537	18.193	-51.571	-16.619
1400	21.800	60.858	22.503	-50.518	-10.876

*Data except enthalpy of formation at 298 K estimated.
1535 K, decomposition point.

MoBr₂(g)
Molybdenum dibromide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	16.561	76.666	0	40.000	30.025
400	16.828	81.596	1.703	32.830	28.100
600	16.780	88.429	5.072	33.197	25.650
800	16.437	93.211	8.396	33.447	23.095
1000	16.093	96.841	11.648	33.571	20.488
1200	15.823	99.750	14.838	33.574	17.871
1400	15.625	102.173	17.982	33.461	15.262
1600	15.484	104.250	21.092	33.239	12.676
1800	15.387	106.068	24.178	32.909	10.123
2000	15.326	107.685	27.249	32.463	7.615

*Data except enthalpy of formation at 298 K estimated.

MoBr₃(c)
Molybdenum tribromide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	25.184	41.700	0	-67.800	-61.921
300	25.190	41.856	.047	-67.814	-61.884
400	25.540	49.150	2.583	-78.228	-57.740
500	25.890	54.887	5.155	-77.586	-52.692
600	26.240	59.638	7.761	-76.937	-47.774
700	26.590	63.710	10.403	-76.271	-42.966
800	26.940	67.283	13.079	-75.587	-38.254
900	27.290	70.476	15.791	-74.882	-33.630
1000	27.640	73.370	18.537	-74.156	-29.087

*Data except enthalpy of formation at 298 K estimated.
1087 ± 20 K, decomposition point.

MoBr₃(g)
Molybdenum tribromide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	19.185	89.599	0	-2.000	-10.402
400	19.481	95.284	1.971	-13.039	-11.006
600	19.726	103.235	5.895	-13.003	-9.998
800	19.915	108.936	9.859	-13.006	-8.996
1000	20.130	113.402	13.863	-13.030	-7.993
1200	20.339	117.091	17.910	-13.073	-6.980
1400	20.517	120.240	21.996	-13.149	-5.959
1600	20.661	122.990	26.115	-13.271	-4.924
1800	20.780	125.430	30.259	-13.453	-3.871
2000	20.888	127.625	34.426	-13.716	-2.793

*Data estimated.

MoBr₄(c)
Molybdenum tetrabromide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	31.800	50.000	0	-72.700	-63.872
300	31.810	50.197	.059	-72.718	-63.817
400	32.300	59.417	3.265	-86.583	-57.963
500	32.700	66.666	6.514	-85.705	-50.910

*Data except enthalpy of formation at 298 K estimated.
413 ± 20 K, decomposition point.

$\text{MoBr}_4(\text{g})$
Molybdenum tetrabromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	24.590	100.091	0	-40.900	-47.007
400	25.116	107.401	2.535	-55.513	-46.067
600	25.506	117.673	7.604	-55.216	-41.439
800	25.647	125.033	12.722	-54.960	-36.885
1000	25.714	130.764	17.859	-54.750	-32.394
1200	25.750	135.456	23.005	-54.596	-27.937
1400	25.773	139.427	28.158	-54.511	-23.500
1600	25.788	142.870	33.314	-54.504	-19.072
1800	25.803	145.908	38.473	-54.582	-14.640
2000	25.822	148.627	43.635	-54.763	-10.193

*Data except enthalpy of formation at 298 K estimated.

$\text{NBr}(\text{g})$
Nitrogen monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.819	56.256	0	71.900	67.374
400	8.196	58.611	.817	68.225	66.583
600	8.581	62.018	2.500	68.314	65.744
800	8.755	64.514	4.236	68.422	64.872
1000	8.849	66.478	5.997	68.516	63.973
1200	8.907	68.097	7.773	68.596	63.057
1400	8.948	69.473	9.559	68.660	62.130
1600	8.979	70.670	11.352	68.712	61.193
1800	9.004	71.729	13.150	68.754	60.250
2000	9.026	72.679	14.953	68.789	59.303

$\text{NaBr}(\text{c,l})$
Sodium bromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.280	20.750	0	-86.296	-83.393
400	12.652	24.416	1.271	-90.518	-81.611
600	13.425	29.687	3.877	-90.259	-77.203
800	14.307	33.663	6.645	-89.786	-72.917
1000	16.495	37.041	9.681	-89.030	-68.778
1020	16.905	37.372	10.015	-88.925	-68.374
1020	16.260	43.519	16.285	-82.655	-68.374
1200	16.260	46.161	19.212	-105.039	-65.470
1400	16.260	48.668	22.464	-103.685	-58.980

1020 K, melting point; $\Delta H^\circ = 6.270$

1661 K, boiling point to equilibrium mixture; $\Delta H^\circ = 37$.

$\text{NaBr}(\text{g})$
Sodium bromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.681	57.628	0	-34.200	-42.292
400	8.833	60.203	.893	-38.800	-44.208
600	8.970	63.814	2.675	-39.366	-46.785
800	9.043	66.405	4.477	-39.859	-49.182
1000	9.098	68.429	6.291	-40.324	-51.460
1200	9.144	70.092	8.115	-64.040	-53.188
1400	9.187	71.505	9.948	-64.105	-51.372
1600	9.228	72.734	11.790	-64.166	-49.549
1800	9.268	73.823	13.639	-64.221	-47.719
2000	9.307	74.802	15.497	-64.270	-45.883

$(\text{NaBr})_2(\text{g})$
Dimeric sodium bromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.150	83.384	0	-116.300	-122.981
400	19.463	89.062	1.969	-125.318	-123.595
600	19.688	97.005	5.888	-126.093	-122.558
800	19.768	102.682	9.835	-126.736	-121.282
1000	19.806	107.097	13.793	-127.337	-119.848
1200	19.826	110.710	17.756	-174.453	-117.381
1400	19.838	113.767	21.723	-174.283	-107.877
1600	19.846	116.417	25.691	-174.120	-98.405
1800	19.852	118.755	29.661	-173.959	-88.952
2000	19.856	120.847	33.632	-173.802	-79.514

$\text{NbBr}_5(\text{c,l,g})$
Niobium pentabromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	35.350	61.850	0	-132.900	-121.631
400	35.350	72.238	3.600	-150.598	-114.113
527	35.350	81.985	8.090	-149.694	-102.661
527	51.100	92.877	13.830	-143.954	-102.661
600	49.330	99.405	17.500	-142.361	-97.046
635	48.340	102.144	19.190	-141.660	-94.454
635	31.377	130.666	37.290	-123.560	-94.454
800	31.533	137.954	42.497	-123.111	-86.923
1000	31.627	145.002	48.814	-122.608	-77.935
1200	31.678	150.773	55.145	-122.146	-69.026
1400	31.709	155.658	61.484	-121.736	-60.203
1600	31.729	159.894	67.828	-121.396	-51.431
1800	31.742	163.632	74.175	-121.129	-42.702
2000	31.752	166.977	80.524	-120.945	-34.004

*Data for (c,l) estimated except enthalpy of formation at 298 K and temperature of fusion.

527 K, melting point; $\Delta H^\circ = 5.740$

634.6 K, boiling point; $\Delta H^\circ = 18.100$

$\text{NbBr}_5(\text{g})$
Niobium pentabromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	30.068	107.348	0	-106.020	-108.316
400	30.793	116.299	3.104	-124.215	-105.353
600	31.335	128.908	9.327	-123.655	-96.041
800	31.533	137.954	15.617	-123.112	-86.923
1000	31.627	145.002	21.934	-122.608	-77.935
1200	31.678	150.773	28.265	-122.146	-69.026
1400	31.709	155.658	34.604	-121.736	-60.203
1600	31.729	159.894	40.948	-121.396	-51.431
1800	31.742	163.632	47.295	-121.129	-42.702
2000	31.752	166.977	53.644	-120.945	-34.004

$\text{NdBr}_3(\text{c,l})$
Neodymium tribromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.700	46.400	0	-208.700	-201.166
400	24.764	53.521	2.471	-219.325	-196.387
600	26.370	63.877	7.590	-218.312	-185.132
800	27.800	71.661	13.008	-217.206	-174.236
955	28.871	76.677	17.400	-216.331	-165.993
955	37.000	88.017	28.230	-205.501	-165.993
1000	37.000	89.720	29.895	-204.888	-164.145
1200	37.000	96.466	37.295	-203.033	-156.201

*Entropy and heat capacity at 298 K estimated.
955 K, melting point; $\Delta H^\circ = 10.830$

$\text{NdBr}_3(\text{g})$
Neodymium tribromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.132	96.024	0	-138.200	-145.462
400	19.527	101.705	1.970	-149.326	-145.661
600	20.120	109.737	5.936	-149.465	-143.802
800	20.638	115.599	10.014	-149.701	-141.880
1000	21.017	120.248	14.182	-150.101	-139.886
1200	21.248	124.102	18.411	-151.417	-137.748
1400	21.352	127.387	22.672	-153.695	-135.286
1600	21.366	130.240	26.945	-154.251	-132.627
1800	21.322	132.754	31.215	-154.817	-129.088
2000	21.245	134.997	35.472	-155.403	-127.084

$\text{NiBr}(\text{g})$
Nickel monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.645	62.709	0	44.000	32.855
400	8.936	65.291	1.896	40.095	29.838
600	9.356	69.001	2.729	39.550	24.815
800	9.567	71.726	4.624	39.017	19.994
1000	9.634	73.870	6.546	38.529	15.290
1200	9.644	75.627	8.474	37.980	10.701
1400	9.651	77.114	10.403	37.354	6.201
1600	9.686	78.405	12.336	36.642	1.799
1800	9.761	79.550	14.280	31.746	-2.338
2000	9.876	80.584	16.243	30.936	-6.081

$\text{NiBr}_2(\text{c})$
Nickel dibromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.020	29.260	0	-50.640	-46.389
400	18.620	34.650	1.868	-57.711	-43.472
600	19.190	42.310	5.652	-57.189	-36.475
800	19.870	47.920	9.553	-56.611	-29.646
1000	20.930	52.460	13.625	-55.848	-22.996
1200	22.420	56.400	17.955	-54.897	-16.499

$\text{NiBr}_2(\text{g})$
Nickel dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	15.012	76.710	0	2.800	-7.096
400	15.546	81.205	1.559	-4.580	-8.963
600	15.957	87.604	4.719	-4.682	-11.144
800	16.041	92.210	7.921	-4.803	-13.270
1000	16.048	95.791	11.130	-4.903	-15.382
1200	16.054	98.717	14.340	-5.072	-17.455
1400	16.066	101.193	17.552	-5.321	-19.502
1600	16.075	103.339	20.766	-5.661	-21.504
1800	16.075	105.232	23.981	-10.196	-23.287
2000	16.066	106.925	27.196	-10.667	-24.715

PBr(g)
Phosphorus monobromide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	8.460	59.537	0	38.800	29.400
400	8.677	62.057	.874	34.750	27.019
600	8.863	65.616	2.631	31.536	23.484
800	8.947	68.179	4.413	31.475	20.809
1000	8.999	70.181	6.208	31.403	18.151
1200	9.037	71.825	8.012	31.329	15.508
1400	9.069	73.221	9.822	31.252	12.876
1600	9.097	74.434	11.639	31.176	10.256
1800	9.124	75.507	13.461	31.102	7.645
2000	9.149	76.469	15.288	31.029	5.044

*Data estimated

PBr₃(g)
Phosphorus tribromide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	18.173	83.206	0	-34.900	-40.510
400	18.863	88.655	1.890	-46.210	-40.101
600	19.402	96.426	5.727	-49.113	-36.781
800	19.603	102.039	9.630	-48.842	-32.710
1000	19.699	106.425	13.561	-48.576	-28.710
1200	19.751	110.022	17.507	-48.314	-24.761
1400	19.783	113.069	21.461	-48.057	-20.855
1600	19.804	115.712	25.420	-47.808	-16.986
1800	19.818	118.045	29.382	-47.563	-13.148
2000	19.829	120.134	33.347	-47.324	-9.337

PbBr(g)
Lead monobromide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.824	65.095	0	16.950	7.583
400	8.905	67.701	.903	13.061	5.172
600	8.980	71.328	2.693	12.608	1.318
800	9.023	73.917	4.493	10.917	-1.979
1000	9.059	75.935	6.302	10.408	-5.146
1200	9.097	77.590	8.117	9.932	-8.208
1400	9.145	78.995	9.941	9.479	-11.203
1600	9.207	80.220	11.776	9.038	-14.149
1800	9.286	81.309	13.625	8.608	-16.996
2000	9.378	82.292	15.491	8.193	-19.820

PbBr₂(c,l)
Lead dibromide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	19.000	38.600	0	-66.600	-62.644
400	19.457	44.240	1.956	-73.574	-59.839
600	21.240	52.421	6.003	-72.655	-53.165
644	21.822	53.944	6.950	-73.560	-51.659
644	26.800	60.062	10.890	-69.628	-51.659
800	26.800	65.875	15.071	-67.972	-47.491
1000	26.800	71.855	20.431	-65.829	-42.622
1200	26.800	76.741	25.791	-63.663	-38.179

644 K, melting point; ΔH° = 3.940

1202 K, boiling point to PbBr₂(g); ΔH° = 28.3

PbBr₂(g)
Lead dibromide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	13.603	81.089	0	-24.950	-33.662
400	13.736	85.108	1.393	-32.487	-35.099
600	13.832	90.699	4.152	-32.856	-36.333
800	13.866	94.684	6.922	-34.471	-37.037
1000	13.882	97.780	9.697	-34.913	-37.631
1200	13.890	100.312	12.474	-35.330	-38.131
1400	13.896	102.453	15.253	-35.733	-38.574
1600	13.899	104.309	18.033	-36.138	-38.973
1800	13.901	105.946	20.813	-36.547	-39.278
2000	13.903	107.411	23.593	-36.961	-39.561

PbBr₄(g)
Lead tetrabromide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	25.007	101.837	0	-109.073	-113.125
400	25.363	109.243	2.568	-123.710	-111.498
600	25.621	119.586	7.671	-123.505	-105.444
800	25.713	126.971	12.806	-124.543	-99.054
1000	25.756	132.714	17.953	-124.412	-92.702
1200	25.780	137.412	23.107	-124.257	-86.368
1400	25.794	141.387	28.264	-124.093	-80.076
1600	25.803	144.832	33.424	-123.935	-73.820
1800	25.809	147.871	38.585	-123.784	-67.539
2000	25.814	150.591	43.748	-123.641	-61.299

*Data estimated.

$\text{PrBr}_3(\text{c,l})$
Praseodymium tribromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	24.300	46.000	0	-213.000	-205.177
400	25.500	53.313	2.537	-223.555	-200.310
600	27.200	63.982	7.812	-222.359	-188.942
800	28.700	72.012	13.402	-221.053	-177.995
966	29.800	77.527	18.260	-219.918	-169.166
966	35.000	89.225	29.560	-208.618	-169.166
1000	35.000	90.436	30.750	-208.212	-167.785
1200	35.000	96.817	37.750	-206.559	-159.836

*Data estimated except enthalpy of formation at 298° K and temperature and enthalpy of fusion. 966 K, melting point; $\Delta H^\circ = 11.300$

$\text{PrBr}_3(\text{g})$
Praseodymium tribromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.132	95.852	0	-142.100	-149.140
400	19.502	101.531	1.969	-153.223	-149.265
600	20.037	109.541	5.924	-153.347	-147.266
800	20.544	115.376	9.983	-153.572	-145.205
1000	20.968	120.007	14.135	-153.927	-143.071
1200	21.278	123.859	18.362	-155.047	-140.775
1400	21.471	127.155	22.639	-157.182	-138.085
1600	21.562	130.029	26.944	-157.658	-135.327
1800	21.575	132.570	31.258	-158.129	-132.509
2000	21.534	134.842	35.570	-158.610	-129.621

$\text{PuBr}_3(\text{c,l})$
Plutonium tribromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	25.780	46.100	0	-189.600	-183.074
400	26.290	53.747	2.652	-201.043	-178.634
600	27.290	64.596	8.010	-200.335	-167.606
800	28.300	72.584	13.568	-199.656	-156.828
954	29.070	77.632	17.984	-199.336	-148.651
954	33.000	91.678	31.384	-185.936	-148.651
1000	33.000	93.233	32.902	-185.503	-146.863
1200	33.000	99.249	39.502	-183.631	-139.310
1400	33.000	104.336	46.102	-181.767	-132.070

*Data estimated except enthalpy of formation at 298° K and temperature and enthalpy of fusion. 954 K, melting point; $\Delta H^\circ = 13.400$

$\text{SbBr}_3(\text{g})$
Antimony tribromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.110	89.490	0	-46.500	-53.668
300	19.120	89.610	.035	-46.526	-53.712
400	19.440	95.160	1.965	-57.570	-53.844
500	19.590	99.520	3.917	-57.569	-52.915
600	19.670	103.100	5.881	-57.576	-51.987
700	19.730	106.130	7.851	-57.605	-51.046
800	19.760	108.770	9.825	-57.660	-50.112
900	19.780	111.100	11.802	-57.751	-49.164
1000	19.800	113.180	13.782	-62.620	-47.697

$\text{SeBr}_2(\text{g})$
Selenium dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	13.240	75.760	0	-21.650	-24.715
400	13.530	79.710	1.367	-29.064	-24.246
600	13.740	85.240	4.098	-29.113	-21.824
800	13.810	89.200	6.854	-29.154	-19.381
1000	13.840	92.290	9.619	-29.190	-16.943
1200	13.860	94.810	12.390	-29.215	-14.481
1400	13.880	96.950	15.164	-29.232	-12.027
1600	13.880	98.810	17.940	-29.240	-9.581
1800	13.890	100.440	20.718	-29.240	-7.110
2000	13.900	101.900	23.497	-29.230	-4.648

*Data except enthalpy of formation at 298° K estimated.

$\text{Se}_2\text{Br}_2(\text{g})$
Diselenium dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.040	90.350	0	-26.300	-25.039
300	19.050	90.462	.033	-26.318	-25.031
400	19.440	96.020	1.964	-33.624	-23.105
500	19.640	100.380	3.919	-33.559	-20.482
600	19.770	103.970	5.890	-33.487	-17.873
700	19.860	107.030	7.872	-33.408	-15.278
800	19.940	109.680	9.862	-33.321	-12.684
900	20.010	112.040	11.860	-33.226	-10.119
1000	20.070	114.150	13.864	-33.121	-7.559

SiBr(g)
Silicon monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	9.257	59.107	0	56.200	45.342
400	9.327	61.842	.948	52.495	42.389
600	9.259	65.613	2.807	52.351	37.362
800	9.209	68.269	4.654	52.108	32.403
1000	9.189	70.321	6.493	51.799	27.519
1200	9.189	71.996	8.331	51.453	22.687
1400	9.198	73.413	10.169	51.079	17.926
1600	9.214	74.643	12.010	50.681	13.201
1800	9.234	75.729	13.855	38.258	9.378
2000	9.256	76.703	15.704	37.974	6.179

*Enthalpy of formation at 298 K estimated.

$\text{SiBr}_2(\text{g})$
Silicon dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	12.820	72.924	0	-12.500	-22.054
400	13.258	76.761	1.331	-19.960	-23.794
600	13.605	82.215	4.023	-20.156	-25.671
800	13.735	86.149	6.759	-20.404	-27.470
1000	13.797	89.221	9.513	-20.697	-29.196
1200	13.831	91.740	12.276	-21.020	-30.874
1400	13.852	93.874	15.045	-21.369	-32.485
1600	13.866	95.725	17.817	-21.745	-34.062
1800	13.875	97.358	20.591	-34.149	-34.741
2000	13.882	98.821	23.367	-34.419	-34.799

*Data except enthalpy of formation at 298 K estimated.

$\text{SiBr}_3(\text{g})$
Silicon tribromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	17.825	84.050	0	-48.206	-55.654
400	18.629	89.414	1.861	-59.274	-55.929
600	19.282	97.115	5.664	-59.243	-54.263
800	19.532	102.701	9.549	-59.237	-52.602
1000	19.652	107.074	13.469	-59.263	-50.934
1200	19.718	110.663	17.406	-59.315	-49.272
1400	19.759	113.706	21.354	-59.390	-47.588
1600	19.785	116.346	25.309	-59.492	-45.908
1800	19.803	118.678	29.268	-71.621	-43.369
2000	19.816	120.765	33.230	-71.618	-40.235

*Data estimated.

$\text{SiBr}_4(\text{l}, \text{g})$
Silicon tetrabromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	35.000	66.500	0	-109.300	-106.093
400	35.000	76.785	3.565	-122.801	-102.165
426	35.000	78.956	4.461	-122.492	-100.854
426	24.352	99.123	13.044	-113.909	-100.854
600	25.061	107.626	17.362	-113.662	-95.553
800	25.387	114.887	22.412	-113.384	-89.556
1000	25.544	120.571	27.506	-113.136	-83.623
1200	25.631	125.236	32.625	-112.908	-77.748
1400	25.684	129.192	37.757	-112.705	-71.901
1600	25.719	132.624	42.897	-112.530	-66.098
1800	25.743	135.654	48.044	-124.382	-59.467
2000	25.760	138.368	53.194	-124.104	-52.276

278.4 K, melting point; ΔH° = unknown

425.6 K, boiling point; ΔH° = 8.583

$\text{SiBr}_4(\text{g})$
Silicon tetrabromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	23.185	90.643	0	-99.300	-103.291
400	24.215	97.617	2.420	-113.946	-101.643
600	25.061	107.626	7.362	-113.662	-95.553
800	25.387	114.887	12.412	-113.384	-89.556
1000	25.544	120.571	17.506	-113.136	-83.623
1200	25.631	125.236	22.625	-112.908	-77.748
1400	25.684	129.192	27.757	-112.705	-71.901
1600	25.719	132.624	32.897	-112.530	-66.098
1800	25.743	135.654	38.044	-124.382	-59.467
2000	25.760	138.368	43.194	-124.104	-52.276

$\text{SnBr}_2(\text{c}, \text{l})$
Tin dibromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	18.875	36.568	0	-58.200	-54.608
300	18.890	36.685	.035	-58.210	-54.585
400	19.870	42.246	1.970	-65.184	-51.926
500	21.200	46.814	4.020	-64.727	-48.663
504	21.260	46.983	4.105	-64.707	-48.536
504	24.800	55.118	8.205	-60.607	-48.536
600	24.800	59.442	10.586	-61.423	-45.993
700	24.800	63.265	13.066	-60.520	-43.493
800	24.800	66.577	15.546	-59.615	-41.122
900	24.800	69.498	18.026	-58.714	-38.865
1000	24.800	72.111	20.506	-57.814	-36.709

*Data above 298 K except temperature and enthalpy of fusion estimated.

$\text{SnBr}_4(\text{g})$
Tin tetrabromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.710	98.620	0	-75.200	-79.263
300	24.730	98.770	.045	-75.233	-79.287
400	25.180	105.960	2.545	-89.884	-77.633
500	25.420	111.600	5.075	-89.829	-74.576
600	25.550	116.250	7.625	-91.429	-71.214
700	25.620	120.190	10.180	-91.344	-67.853
800	25.670	123.620	12.745	-91.249	-64.506
900	25.700	126.640	15.315	-91.157	-61.164
1000	25.730	129.350	17.885	-91.067	-57.839

$\text{SrBr}(\text{g})$
Strontium monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.809	63.011	0	-21.300	-30.937
400	8.895	65.613	.902	-25.206	-33.439
600	8.974	69.237	2.690	-25.744	-37.446
800	9.018	71.825	4.490	-26.478	-41.241
1000	9.053	73.841	6.297	-27.547	-44.792
1200	9.083	75.494	8.110	-30.301	-47.865
1400	9.111	76.897	9.930	-31.066	-50.732
1600	9.140	78.115	11.755	-31.830	-53.488
1800	9.170	79.193	13.586	-64.821	-53.286
2000	9.205	80.161	15.423	-64.899	-52.000

$\text{SrBr}_2(\text{c,l})$
Strontium dibromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	18.368	34.282	0	-171.600	-167.248
400	18.890	39.755	1.898	-178.648	-164.298
600	19.760	47.577	5.762	-177.995	-157.265
800	20.930	53.410	9.823	-177.361	-150.451
918	21.920	56.354	12.350	-177.134	-146.489
918	27.500	59.535	15.270	-174.214	-146.489
930	27.500	59.892	15.600	-174.100	-146.127
930	27.818	62.496	18.022	-171.678	-146.127
1000	27.818	64.515	19.969	-170.991	-144.229
1200	27.818	69.587	25.532	-170.897	-138.768
1400	27.818	73.875	31.096	-168.824	-133.576
1600	27.818	77.590	36.660	-166.757	-128.682
1800	27.818	80.866	42.223	-196.927	-121.183
2000	27.818	83.797	47.787	-194.191	-112.913

*Heat capacities 300-918 K estimated.

918 K, transition point; $\Delta H^\circ = 2.92$

930 K, melting point; $\Delta H^\circ = 2.422$

$\text{SrBr}_2(\text{g})$
Strontium dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	14.554	77.270	0	-97.300	-105.765
400	14.704	81.571	1.491	-104.755	-107.131
600	14.813	87.558	4.445	-105.012	-108.271
800	14.852	91.826	7.412	-105.472	-109.294
1000	14.871	95.142	10.385	-106.275	-110.140
1200	14.881	97.855	13.360	-108.769	-110.562
1400	14.887	100.149	16.337	-109.283	-110.819
1600	14.891	102.137	19.314	-109.803	-111.003
1800	14.894	103.891	22.293	-142.557	-108.258
2000	14.895	105.461	25.272	-142.406	-104.456

*Data except enthalpy of formation at 298 K estimated.

$\text{TaBr}_5(\text{g})$
Tantalum pentabromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	30.320	109.030	0	-115.600	-118.034
400	30.950	118.040	3.125	-133.790	-115.117
600	31.410	130.690	9.370	-133.225	-105.899
800	31.580	139.760	15.675	-132.667	-96.876
1000	31.650	146.810	21.990	-132.152	-87.996
1200	31.700	152.590	28.325	-131.656	-79.215

$\text{TbBr}_3(\text{g})$
Terbium tribromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.105	96.159	0	-129.200	-136.377
400	19.477	101.830	1.967	-140.343	-136.545
600	19.968	109.823	5.912	-140.429	-134.632
800	20.422	115.630	9.952	-140.572	-132.672
1000	20.808	120.231	14.076	-140.787	-130.685
1200	21.087	124.051	18.268	-141.092	-128.634
1400	21.255	127.315	22.504	-141.538	-126.515
1600	21.328	130.159	26.763	-143.191	-124.301
1800	21.333	132.672	31.031	-146.325	-121.662
2000	21.293	134.918	35.294	-147.023	-118.886

$\text{ThBr}_4(\text{c,l,g})$
Thorium tetrabromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	29.920	52.820	0	-230.783	-221.034
400	31.020	61.780	3.110	-244.900	-214.770
600	32.250	74.610	9.445	-243.499	-200.005
693	32.690	79.290	12.465	-242.815	-193.314
693	32.690	80.730	13.465	-241.815	-193.314
800	33.150	85.460	16.990	-241.003	-185.882
970	33.840	91.910	22.685	-239.680	-174.303
970	41.000	107.390	37.695	-224.670	-174.303
1000	41.000	108.640	38.925	-224.218	-172.756
1127	41.000	113.540	44.130	-222.329	-166.332
1127	25.776	136.705	70.240	-196.219	-166.332
1200	25.783	138.323	72.121	-196.260	-164.395
1400	25.797	142.298	77.279	-196.427	-159.069
1600	25.805	145.744	82.439	-196.679	-153.719
1800	25.811	148.783	87.601	-197.766	-148.248
2000	25.815	151.503	92.763	-198.093	-142.731

*Data above 298 K except temperature and enthalpy of fusion and temperature of boiling estimated.

693 K, transition point; $\Delta H^\circ = 1.000$

970 K, melting point; $\Delta H^\circ = 15.010$

1127 K, boiling point; $\Delta H^\circ = 26.110$

$\text{ThBr}_4(\text{g})$
Thorium tetrabromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	25.064	102.720	0	-181.783	-186.912
400	25.396	110.139	2.572	-196.438	-185.651
600	25.636	120.491	7.680	-196.264	-180.299
800	25.722	127.879	12.817	-196.176	-174.990
1000	25.762	133.624	17.966	-196.177	-169.699
1200	25.783	138.323	23.121	-196.260	-164.395
1400	25.797	142.298	28.279	-196.427	-159.069
1600	25.805	145.744	33.439	-196.679	-153.719
1800	25.811	148.783	38.601	-197.766	-148.248
2000	25.815	151.503	43.763	-198.093	-142.731

*Data except enthalpy of formation at 298 K estimated.

$\text{TiBr}(\text{g})$
Titanium monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	9.087	62.175	0	50.800	39.868
400	9.601	64.920	.953	46.988	36.912
600	10.194	68.943	2.941	46.785	31.916
800	10.411	71.911	5.005	46.553	26.998
1000	10.475	74.242	7.095	46.247	22.146
1200	10.500	76.154	9.193	44.884	17.396
1400	10.524	77.775	11.295	44.619	12.833
1600	10.557	79.182	13.403	44.277	8.316
1800	10.596	80.428	15.518	43.839	3.844
2000	10.640	81.546	17.642	39.863	-0.474

*Data estimated.

$\text{TiBr}_2(\text{c,g})$
titanium dibromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	18.807	25.900	0	-96.900	-91.593
400	19.086	31.466	1.930	-103.872	-88.328
600	19.634	39.308	5.802	-103.077	-80.729
800	20.182	45.032	9.783	-102.286	-73.395
1000	20.730	49.594	13.874	-101.490	-66.262
1200	21.278	53.422	18.075	-101.652	-59.257
1209	21.302	53.576	18.262	-101.607	-58.945
1209	14.934	94.352	67.552	-52.317	-58.945
1400	15.030	96.549	70.414	-52.586	-59.972
1600	15.171	98.565	73.433	-52.926	-61.006
1800	15.343	100.362	76.484	-53.338	-61.994
2000	15.532	101.988	79.572	-57.263	-62.833

*Data except enthalpy of formation at 298 K estimated.

1208.8 K, sublimation point; $\Delta H^\circ = 49.490$

$\text{TiBr}_2(\text{g})$
Titanium dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	14.346	73.752	0	-42.800	-51.760
400	14.581	78.005	1.475	-50.227	-53.298
600	14.756	83.958	4.412	-50.367	-54.809
800	14.822	88.213	7.370	-50.599	-56.253
1000	14.867	91.525	10.339	-50.925	-57.628
1200	14.930	94.241	13.318	-52.309	-58.897
1400	15.030	96.549	16.314	-52.586	-59.972
1600	15.171	98.565	19.333	-52.926	-61.006
1800	15.343	100.362	22.384	-53.338	-61.994
2000	15.532	101.988	25.472	-57.263	-62.833

*Data except enthalpy of formation at 298 K estimated.

$\text{TiBr}_3(\text{c})$
Titanium tribromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.310	42.200	0	-131.100	-125.230
300	24.319	42.350	.045	-131.116	-125.192
400	25.367	49.467	2.521	-141.619	-121.035
500	27.224	55.314	5.145	-140.961	-115.965
600	29.734	60.490	7.988	-140.114	-111.040
700	32.843	65.299	11.112	-139.018	-106.271
800	36.529	69.919	14.575	-137.611	-101.686

$\text{TiBr}_3(\text{g})$
Titanium tribromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	18.961	85.777	0	-89.600	-96.722
400	19.862	91.493	1.983	-100.656	-96.883
600	20.462	99.689	6.030	-100.572	-95.017
800	20.579	105.597	10.138	-100.548	-93.166
1000	20.585	110.191	14.255	-100.625	-91.313
1200	20.571	113.942	18.371	-101.774	-89.399
1400	20.553	117.112	22.483	-101.841	-87.333
1600	20.535	119.855	26.592	-102.000	-85.250
1800	20.518	122.273	30.697	-102.268	-83.144
2000	20.501	124.434	34.799	-106.092	-80.903

*Data except enthalpy of formation at 298 K estimated.

$\text{TiBr}_4(\text{c,l,g})$
Titanium tetrabromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	31.431	58.200	0	-147.400	-140.877
311	31.936	59.578	.420	-147.537	-140.582
311	36.110	69.596	3.540	-144.417	-140.582
400	36.110	78.637	6.739	-157.838	-136.683
504	36.110	86.982	10.495	-156.586	-131.336
504	25.156	108.208	21.193	-145.888	-131.336
600	25.350	112.613	23.618	-145.806	-128.571
800	25.557	119.938	28.711	-145.691	-122.840
1000	25.655	125.653	33.833	-145.663	-117.132
1200	25.709	130.335	38.970	-146.694	-111.385
1400	25.742	134.301	44.116	-146.632	-105.506
1600	25.763	137.740	49.266	-146.658	-99.631
1800	25.778	140.775	54.421	-146.787	-93.746
2000	25.788	143.492	59.577	-150.470	-87.746

311.4 K, melting point; $\Delta H^\circ = 3.120$

504 K, boiling point; $\Delta H^\circ = 10.698$

$\text{TiBr}_4(\text{g})$
Titanium tetrabromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.070	95.246	0	-131.300	-135.822
400	24.793	102.434	2.493	-145.984	-134.348
600	25.350	112.613	7.518	-145.806	-128.571
800	25.557	119.938	12.611	-145.691	-122.840
1000	25.655	125.653	17.733	-145.663	-117.132
1200	25.709	130.335	22.870	-146.694	-111.385
1400	25.742	134.301	28.016	-146.632	-105.506
1600	25.763	137.740	33.166	-146.658	-99.631
1800	25.778	140.775	38.321	-146.787	-93.746
2000	25.788	143.492	43.477	-150.470	-87.746

$\text{TlBr}(\text{c,l})$
Thallium bromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.550	29.300	0	-41.400	-40.139
400	12.790	32.960	1.270	-44.921	-38.977
600	14.210	38.410	3.970	-45.617	-36.027
733	15.160	41.350	5.920	-45.207	-33.942
733	18.620	46.700	9.840	-41.287	-33.942
800	18.020	48.300	11.070	-40.831	-33.296
1000	16.210	52.130	14.490	-39.730	-31.549
1200	14.400	54.920	17.555	-38.988	-29.983

733.2 K, melting point; $\Delta H^\circ = 3.920$

1100 $\pm$ 10 K, boiling point to mixture of monomer and dimer; ΔH° (sublimation to monomer, 298 K) = 32.5

$\text{TlBr}_3(\text{g})$
Thallium tribromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.002	95.862	0	-130.400	-137.437
400	19.418	101.524	1.963	-141.509	-137.565
600	19.666	109.454	5.876	-141.554	-135.583
800	19.755	115.125	9.819	-141.651	-133.580
1000	19.797	119.538	13.775	-141.859	-131.534
1200	19.820	123.150	17.737	-142.146	-129.448
1400	19.833	126.206	21.702	-142.512	-127.294
1600	19.842	128.855	25.670	-142.956	-125.099
1800	19.849	131.193	29.639	-143.472	-122.843
2000	19.853	133.284	33.609	-148.245	-120.120

$\text{UBr}_3(\text{c})$
Uranium tribromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	25.980	46.000	0	-167.100	-160.968
300	25.990	46.160	.048	-167.113	-160.928
400	26.620	53.720	2.679	-177.532	-156.698
500	27.250	59.730	5.372	-176.898	-151.565
600	27.880	64.760	8.129	-176.270	-146.559
700	28.510	69.100	10.948	-175.658	-141.653
800	29.140	72.950	13.831	-175.071	-136.836
900	29.770	76.420	16.776	-174.523	-132.093
1000	30.400	79.590	19.785	-174.599	-127.368

*Data except enthalpy of formation at 298 K estimated.

$\text{UBr}_4(\text{c,l})$
Uranium tetrabromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	30.620	57.000	0	-191.800	-183.524
300	30.630	57.190	.057	-191.821	-183.471
400	31.340	66.100	3.155	-205.893	-177.772
500	32.050	73.170	6.325	-205.223	-170.819
600	32.760	79.070	9.565	-204.556	-163.997
700	33.470	84.180	12.877	-203.898	-157.293
792	34.120	88.350	15.986	-203.309	-151.204
792	41.000	103.000	27.586	-191.709	-151.204
800	41.000	103.410	27.914	-191.604	-150.795
900	41.000	108.240	32.014	-190.351	-145.772
1000	41.000	112.560	36.114	-189.786	-140.844

*Entropy at 298 K and all heat capacities estimated.
792 K, melting point; $\Delta H^\circ = 11.600$
1040 K, boiling point; ΔH° (sublimation, 298 K) = 50.

$\text{WBr}(\text{g})$
Tungsten monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	8.612	65.130	0	140.100	128.430
400	8.767	67.685	.886	136.247	125.228
600	8.895	71.268	2.654	135.906	119.786
800	8.961	73.837	4.440	135.540	114.468
1000	9.025	75.843	6.239	135.153	109.251
1200	9.102	77.495	8.051	134.747	104.110
1400	9.189	78.905	9.880	134.323	99.053
1600	9.279	80.137	11.727	133.881	94.043
1800	9.369	81.236	13.592	133.422	89.085
2000	9.458	82.227	15.474	132.946	84.183

*Data estimated.

$\text{WBr}_5(\text{c,l,g})$
Tungsten pentabromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	37.156	65.000	0	-74.500	-64.438
400	39.600	76.260	3.909	-91.881	-57.372
559	43.400	90.120	10.510	-89.762	-44.016
559	43.500	97.455	14.610	-85.662	-44.016
600	43.500	100.534	16.394	-85.045	-40.983
634	43.500	102.898	17.851	-84.543	-38.537
634	31.466	133.657	37.337	-65.057	-38.537
800	31.591	141.019	42.588	-64.578	-31.626
1000	31.672	148.077	48.915	-64.035	-23.447
1200	31.735	153.857	55.255	-63.523	-15.375
1400	31.805	158.754	61.609	-63.044	-7.372
1600	31.889	163.007	67.978	-62.599	.546
1800	31.987	166.768	74.366	-62.176	8.410
2000	32.093	170.144	80.774	-61.778	16.229

*Data except enthalpy of formation at 298 K and temperature of fusion estimated.

559 K, melting point; $\Delta H^\circ = 4.10$

633.5 K, boiling point; $\Delta H^\circ = 19.486$

$\text{WBr}_5(\text{g})$
Tungsten pentabromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	30.404	110.252	0	-47.600	-51.030
400	31.000	119.282	3.131	-65.758	-48.458
600	31.434	131.951	9.383	-65.156	-39.944
800	31.591	141.019	15.688	-64.578	-31.626
1000	31.672	148.077	22.015	-64.035	-23.447
1200	31.735	153.857	28.355	-63.523	-15.375
1400	31.805	158.754	34.709	-63.044	-7.372
1600	31.889	163.007	41.078	-62.599	.546
1800	31.987	166.768	47.466	-62.176	8.410
2000	32.093	170.144	53.874	-61.778	16.229

*Data except enthalpy of formation at 298 K estimated.

$\text{WBr}_6(\text{c})$
Tungsten hexabromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	43.352	75.000	0	-82.000	-69.496
300	43.400	75.268	.080	-82.030	-69.416
400	46.000	88.110	4.550	-102.877	-60.869
500	48.600	90.654	9.280	-101.399	-50.535
600	51.200	107.744	14.270	-99.691	-40.520

*Data except enthalpy of formation at 298 K estimated.

$\text{WBr}_6(\text{g})$
Tungsten hexabromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	36.178	115.340	0	-58.100	-57.624
400	36.858	126.081	3.724	-79.803	-52.983
600	37.351	141.138	11.155	-78.906	-39.772
800	37.527	151.911	18.645	-78.038	-26.856
1000	37.609	160.295	26.159	-77.207	-14.156
1200	37.654	167.156	33.686	-76.410	-1.616
1400	37.681	172.962	41.220	-75.657	10.807
1600	37.698	177.995	48.758	-74.951	23.107
1800	37.711	182.436	56.299	-74.286	35.318
2000	37.719	186.410	63.842	-73.666	47.460

*Data estimated.

$\text{ZnBr}_2(\text{c,l})$
Zinc dibromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	15.700	33.100	0	-78.550	-74.606
300	15.710	33.200	.030	-78.564	-74.580
400	16.760	37.860	1.650	-85.804	-71.763
500	17.800	41.710	3.380	-85.596	-68.274
600	18.840	45.050	5.210	-85.320	-64.837
675	19.610	47.320	6.655	-85.065	-62.295
675	27.200	52.860	10.395	-81.325	-62.295
700	27.200	53.840	11.075	-82.798	-61.570
800	27.200	57.480	13.795	-81.723	-58.616
900	27.200	60.680	16.515	-80.652	-55.790
1000	27.200	63.550	19.235	-79.582	-53.089

*Heat capacity at 298 K estimated.

675 K, melting point; $\Delta H^\circ = 3.740$

$\text{ZrBr}(\text{g})$
Zirconium Monobromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	8.620	63.443	0	72.000	61.286
400	8.776	66.000	.887	68.099	58.416
600	8.973	69.596	2.662	67.630	53.674
800	9.215	72.209	4.480	67.106	49.099
1000	9.492	74.295	6.350	66.547	44.661
1200	9.751	76.049	8.275	65.103	40.391
1400	9.968	77.569	10.248	64.781	36.298
1600	10.136	78.911	12.259	64.430	32.253
1800	10.260	80.113	14.299	64.041	28.251
2000	10.348	81.199	16.360	63.607	24.296

*Data estimated.

$\text{ZrBr}_2(\text{c,l,g})$
Zirconium dibromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	20.727	27.700	0	-96.700	-91.334
400	21.006	33.830	2.125	-103.501	-88.076
600	21.554	42.451	6.381	-102.374	-80.608
800	22.102	48.727	10.747	-101.244	-73.522
900	22.376	51.345	12.970	-100.674	-70.091
900	21.750	68.012	27.970	-85.674	-70.091
1000	21.750	70.304	30.145	-85.174	-68.388
1200	21.750	74.269	34.495	-85.096	-65.067
1400	21.750	77.622	38.845	-83.946	-61.820
1555	21.750	79.907	42.218	-83.104	-59.415
1555	15.144	100.148	73.695	-51.627	-59.415
1600	15.178	100.580	74.376	-51.686	-59.640
1800	15.349	102.377	77.428	-51.973	-60.618
2000	15.536	104.004	80.516	-52.293	-61.563

*Data estimated.

900 K, melting point; $\Delta H^\circ = 15.0$ 1555.1 K, boiling point; $\Delta H^\circ = 31.477$

$\text{ZrBr}_2(\text{g})$
Zirconium dibromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	14.504	75.684	0	-41.700	-50.640
400	14.676	79.974	1.487	-49.139	-52.172
600	14.801	85.953	4.437	-49.318	-53.653
800	14.847	90.218	7.403	-49.588	-55.059
1000	14.883	93.535	10.376	-49.943	-56.388
1200	14.941	96.253	13.357	-51.234	-57.586
1400	15.039	98.563	16.355	-51.436	-58.628
1600	15.178	100.580	19.376	-51.686	-59.640
1800	15.349	102.377	22.428	-51.973	-60.618
2000	15.536	104.004	25.516	-52.293	-61.563

*Data estimated.

$\text{ZrBr}_3(\text{c})$
Zirconium tribromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.777	41.122	0	-152.000	-145.212
300	23.796	41.269	.044	-152.016	-145.169
400	24.500	48.226	2.464	-162.600	-140.694
500	24.800	53.733	4.932	-162.121	-135.273
600	25.000	58.274	7.423	-161.654	-129.947
700	25.100	62.136	9.929	-161.201	-124.698

*Data estimated.

$\text{ZrBr}_3(\text{g})$
Zirconium tribromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	18.988	88.787	0	-103.000	-110.423
400	19.365	94.427	1.956	-114.107	-110.682
600	19.642	102.342	5.862	-114.215	-108.949
800	19.742	108.009	9.802	-114.406	-107.167
1000	19.789	112.420	13.755	-114.680	-105.329
1200	19.814	116.030	17.716	-115.894	-103.373
1400	19.830	119.086	21.680	-116.035	-101.276
1600	19.840	121.734	25.647	-116.248	-99.154
1800	19.847	124.071	29.616	-116.528	-97.003
2000	19.852	126.163	33.586	-116.879	-94.816

*Data estimated.

$\text{ZrBr}_4(\text{g})$
Zirconium tetrabromide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	24.538	99.037	0	-154.100	-159.156
400	25.083	106.335	2.531	-168.770	-157.868
600	25.489	116.598	7.596	-168.604	-152.456
800	25.638	123.954	12.710	-168.514	-147.089
1000	25.707	129.683	17.846	-168.505	-141.736
1200	25.746	134.374	22.991	-169.437	-136.324
1400	25.769	138.344	28.143	-169.296	-130.816
1600	25.784	141.786	33.298	-169.229	-125.325
1800	25.794	144.824	38.456	-169.231	-119.841
2000	25.801	147.542	43.616	-169.305	-114.349

*Data except enthalpy of formation at 298 K estimated.

$\text{ZrBr}_4(\text{c}, \text{g})$
Zirconium tetrabromide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	29.829	53.702	0	-181.800	-173.340
400	30.900	62.630	3.097	-195.904	-167.520
600	31.870	75.362	9.383	-194.517	-153.627
629	31.960	76.842	10.293	-194.316	-151.688
629	25.515	117.781	36.023	-168.586	-151.688
800	25.638	123.954	40.410	-168.514	-147.089
1000	25.707	129.683	45.546	-168.505	-141.736
1200	25.746	134.374	50.691	-169.437	-136.324
1400	25.769	138.344	55.843	-169.296	-130.816
1600	25.784	141.786	60.998	-169.229	-125.325
1800	25.794	144.824	66.156	-169.231	-119.841
2000	25.801	147.542	71.316	-169.305	-114.349

*Data except enthalpy of formation at 298 K estimated.
628.5 K, sublimation point; $\Delta H^\circ = 25.73$

Carbides

Units: T is in K; Cp° and S° are in cal/mol·K; H° - H°₂₉₈, ΔHf° and ΔGf° are in kcal/mol.

Sources of data from general references are listed below, with the reference(s) given immediately after each formula:

AlC(g) (7), BC(g) (7), B₄C(c,l) (30), BaC₂(c) (1, 26), Be₂C(c,l) (26, 28), CaC₂(c) (26), CeC₂(c) (1), Ce₂C₃(c) (2), Li₂C₂(c) (7), MgC₂(c) (7, 26), Mg₂C₃(c) (7, 26), Mn₃C(c) (31), MoC(c) (2), NbC_{0.98}(c) (6), Nb₂C(c) (28, 32), Ni₃C(c) (1), SiC(α) (30), SiC(β) (30), SiC(g) (7), SiC₂(g) (7), Si₂C(g) (7), SrC₂(c) (1), TaC(c) (6), Ta₂C(c) (28, 32), ThC_{1.94}(c) (33), TiC(c) (32), UC_{1.94}(c) (33), VC_{0.88}(c) (32), W₂C(c) (28).

Additional sources:

Al₄C₃(c):

Binford, J. S., Jr., J. M. Strohmenger, and T. H. Herbert. A Modified Drop Calorimeter. The Heat Content of Aluminum Carbide and Cobalt(II) Fluoride Above 25°. J. Phys. Chem., v. 71, 1967, pp. 2404-2408.

Furukawa, G. T., T. B. Douglas, W. G. Saba, and A. C. Victor. Heat Capacity and Enthalpy Measurements on Aluminum Carbide (Al₄C₃) From 15 to 1173° K. Thermodynamic Properties From 0 to 2000° K. J. Res. NBS, v. 69A, 1965, pp. 423-435.

B₄C(c,l):

Kelley, K. K. The Specific Heats at Low Temperatures of Crystalline Boric Oxide, Boron Carbide, and Silicon Carbide. J. Am. Chem. Soc., v. 63, 1941, p. 1137.

King, E. G. High-Temperature Heat Content of Boron Carbide. Ind. and Eng. Chem., v. 41, 1949, p. 1298.

Sheindlin, A. E., I. S. Belevich, and I. G. Kozhevnikov. Enthalpy and Heat Capacity of Boron Carbide in the Temperature Range 273-2600° K. High Temp. (Engl. Transl.), v. 10, 1972, pp. 369-371.

CaC₂(c):

Kelley, K. K. The Specific Heat of Calcium Carbide at Low Temperatures. Ind. and Eng. Chem., v. 33, 1941, pp. 1314-1315.

Moore, G. E. High-Temperature Heat Content of Calcium Carbide. Ind. and Eng. Chem., v. 35, 1943, pp. 1292-1293.

CeC₂(c) and Ce₂C₃(c):

Baker, F. B., E. J. Huber, Jr., C. E. Holley, Jr., and N. H. Krikorian. Enthalpies of Formation of Cerium Dioxide, Cerium Sesquicarbide, and Cerium Dicarbide. J. Chem. Thermodyn., v. 3, 1971, pp. 77-83.

Cr₃C₂(c):

Kelley, K. K., F. S. Boericke, G. E. Moore, E. H. Huffman, and W. M. Bangert. Thermodynamic Properties of Carbides of Chromium. BuMines TP 662, 1944, 43 pp.

Mah, A. D. Heats of Formation of Chromium Carbides. BuMines RI 7217, 1969, 9 pp.

Oriani, R. A., and W. K. Murphy. The Heat Capacity of Chromium Carbide (Cr_3C_2). J. Am. Chem. Soc., v. 76, 1954, pp. 343-345.

$\text{Cr}_7\text{C}_3(\text{c})$ and $\text{Cr}_{23}\text{C}_6(\text{c})$:

Kelley, K. K., F. S. Boericke, G. E. Moore, E. H. Huffman, and W. M. Bangert. Thermodynamic Properties of Carbides of Chromium. BuMines IP 662, 1944, 43 pp.

Mah, A. D. Heats of Formation of Chromium Carbides. BuMines RI 7217, 1969, 9 pp.

$\text{Fe}_3\text{C}(\text{c})$:

Chipman, J. Thermodynamics and Phase Diagram of the Fe-C System. Metall. Trans., v. 3, 1972, pp. 55-64.

$\text{HfC}(\text{c})$:

Spencer, P. J. Thermochemical Properties. Ch. in Hafnium: Physico-Chemical Properties of Its Compounds and Alloys, ed. by K. L. Komarek. At. Energy Rev., Spec. Issue No. 8, 1981, pp. 9-56.

Turchanin, A. G., and A. E. Polyakov. Thermodynamic Properties of Hafnium Carbide in the Temperature Range 0-3000° K. Inorg. Mater. (Engl. Transl.), v. 18, 1982, pp. 335-338.

$\text{Mn}_3\text{C}(\text{c})$:

Kelley, K. K., and G. E. Moore. Specific Heats at Low Temperatures of Manganese Carbide and Manganese Dioxide. J. Am. Chem. Soc., v. 65, 1943, pp. 782-785.

Southard, J. C., and G. E. Moore. High-Temperature Heat Content of Manganese Tetroxide, Manganese Silicate, and Manganese Carbide. J. Am. Chem. Soc., v. 64, 1942, pp. 1769-1770.

$\text{Mn}_7\text{C}_3(\text{c})$:

Bolgar, A. S., V. F. Litvinenko, T. A. Baran, and L. I. Domasevich. Entalpiya i Teploemkost Karbidov Margantsa (Enthalpy and Heat Capacity of Manganese Carbides). Vses. Konf. Kalorim., [Rasshir. Tezisy Dokl.], 7th, v. 2, 1977, p. 350.

Gokcen, N. A., and S. Fujishiro. Thermodynamic Properties of Mn_7C_3 . Trans. Metall. Soc. AIME, v. 227, 1963, pp. 542-544.

McCabe, C. L., and R. G. Hudson. Free Energy of Formation of Mn_7C_3 From Vapor Pressure Measurements. J. Met., v. 9, 1957, pp. 17-19.

$\text{Mn}_{15}\text{C}_4(\text{c})$:

Bolgar, A. S., V. F. Litvinenko, T. A. Baran, and L. I. Domasevich. Entalpiya i Teploemkost Karbidov Margantsa (Enthalpy and Heat Capacity of Manganese Carbides). Vses. Konf. Kalorim., [Rasshir. Tezisy Dokl.], 7th, v. 2, 1977, p. 350.

$\text{Mn}_{23}\text{C}_6(\text{c})$:

Bolgar, A. S., V. F. Litvinenko, T. A. Baran, and L. I. Domasevich. Entalpiya i Teploemkost Karbidov Margantsa (Enthalpy and Heat Capacity of Manganese Carbides). Vses. Konf. Kalorim., [Rasshir. Tezisy Dokl.], 7th, v. 2, 1977, p. 350.

Dawson, W. M., and F. R. Sale. Enthalpy of Formation of Manganese Carbide, Mn_{23}C_6 . Metall. Trans., v. 11A, 1980, pp. 1849-1852.

Moattar, F., and J. S. Anderson. Thermodynamics of the Manganese Carbides Mn_7C_3 , Mn_3C_2 , and Mn_{23}C_6 . Trans. Faraday Soc., v. 67, 1971, pp. 2303-2307.

$\text{Mo}_2\text{C}(\text{c})$:

Ditmars, D., and S. Ishihara. Preliminary Report on the Measurement of the Relative Enthalpy of Mo_2C From 273.15 to 1475 K. Ch. in Interim Report of the Chemical Species Important in Aerospace Industries. NBS Rep. 10904, 1972, pp. 64-75.

Johnson, G. K., W. N. Hubbard, and E. K. Storms. The Enthalpies of Formation of $\text{Mo}_2\text{C}(\text{c})$ by Fluorine Bomb Calorimetry. J. Chem. Thermodyn., v. 9, 1977, pp. 1021-1026.

Pankratz, L. B., W. W. Weller, and E. G. King. Thermodynamic Data for Molybdenum Carbide and Tantalum Carbide. BuMines RI 6861, 1966, 10 pp.

 $\text{Na}_2\text{C}_2(\text{c})$:

Johnson, G. K., E. H. Van Deventer, J. P. Ackerman, Jr., and W. N. Hubbard. Enthalpy of Formation of Disodium Acetylide and of Monosodium Acetylide at 298.15 K, Heat Capacity of Disodium Acetylide From 5 to 350 K, and Some Derived Thermodynamic Properties. J. Chem. Thermodyn., v. 5, 1973, pp. 57-71.

 $\text{PuC}_{0.82}(\text{c})$:

Johnson, G. K., E. H. Van Deventer, O. L. Kruger, and W. N. Hubbard. The Enthalpy of Formation of Plutonium Monocarbide. J. Chem. Thermodyn., v. 2, 1970, pp. 617-622.

Oetting, F. L. The Chemical Thermodynamics of Nuclear Materials. IV. The High-Temperature Enthalpies of Plutonium Carbide and Plutonium Sesquicarbide. J. Nucl. Mater., v. 88, 1980, pp. 265-272.

 $\text{PuC}_{0.88}(\text{c})$:

Tetenbaum, I., A. Sheth, and W. Olson. A Review of the Thermodynamics of the U-C, Pu-C, and U-Pu-C Systems. Argonne Natl. Lab., ANL-AFP-8, 1975, 27 pp.

 $\text{PuC}_2(\text{c})$:

Campbell, G. M., R. A. Kent, and J. A. Leary. Thermodynamic Properties of the Plutonium-Carbon System. Paper in Plutonium 1970 and Other Actinides (Proc. 4th Int. Conf.). Metall. Soc. AIME, 1971, pp. 781-791.

Oetting, F. L. The Chemical Thermodynamic Properties of Plutonium Compounds. Chem. Rev., v. 67, 1967, pp. 261-297.

 $\text{Pu}_2\text{C}_3(\text{c})$:

Johnson, G. K., E. H. Van Deventer, and W. N. Hubbard. The Enthalpy of Formation of Plutonium Sesquicarbide. J. Chem. Thermodyn., v. 6, 1974, pp. 219-225.

Oetting, F. L. The Chemical Thermodynamics of Nuclear Materials. IV. The High-Temperature Enthalpies of Plutonium Carbide and Plutonium Sesquicarbide. J. Nucl. Mater., v. 88, 1980, pp. 265-272.

 $\text{SiC}(\text{hexagonal})$:

Chekhovsky, V. Ya. Enthalpy and Thermodynamic Properties of SiC at Temperatures Up to 2900 K. J. Chem. Thermodyn., v. 3, 1971, pp. 289-296.

Humphrey, G. L., S. S. Todd, J. P. Coughlin, and E. G. King. Some Thermodynamic Properties of Silicon Carbide. BuMines RI 4888, 1952, 23 pp.

SiC(cubic):

Humphrey, G. L., S. S. Todd, J. P. Coughlin, and E. G. King. Some Thermodynamic Properties of Silicon Carbide. BuMines RI 4888, 1952, 23 pp.

SmC₂(c):

Haschke, J. M., and T. A. Deline. Vaporization and Thermodynamic Properties of Samarium Dicarbide and Sub-stoichiometric Disamarium Tricarbide. J. Chem. Thermodyn., v. 14, 1984, pp. 1019-1028.

ThC_{1.94}(c):

Besmann, T. M., and T. B. Lindemer. High-Temperature Equilibrium Between Thorium Dioxide, Thorium Dicarbide and Carbon. J. Inorg. and Nucl. Chem., v. 43, 1981, pp. 981-985.

TiC(c):

Kelley, K. K. Specific Heats at Low Temperatures of Titanium and Titanium Carbide. Ind. and Eng. Chem., v. 36, 1944, p. 866.

Levinson, L. S. High-Temperature Heat Contents of TiC and ZrC. J. Chem. Phys., v. 42, 1965, pp. 2891-2892.

Naylor, B. F. High-Temperature Heat Contents of Titanium Carbide and Titanium Nitride. J. Am. Chem. Soc., v. 68, 1946, p. 370.

Turchanin, A. G., and V. V. Fesenko. Enthalpy and Heat Capacity of Titanium Carbide in the Region of Homogeneity in the Range 1300-2500° K. Russ. J. Phys. Chem. (Engl. Transl.), v. 42, 1968, pp. 539-540.

UC(c):

Tetenbaum, T., A. Sheth, and W. Olson. A Review of the Thermodynamics of the U-C, Pu-C, and U-Pu-C Systems. Argonne Natl. Lab., ANL-AFP-8, 1975, 27 pp.

UC_{1.94}(c):

Farr, J. D., W. G. Witterman, P. L. Stone, and E. F. Westrum, Jr. Uranium Dicarbide and Diuranium Tricarbide. Preparation and Chemical Thermodynamic Properties From 5 to 350° K. Paper in Advances in Thermophysical Properties at Extreme Temperatures and Pressures, ed. by S. Gratch (3d Symp. on Thermophys. Prop.). ASME, 1965, pp. 162-166.

MacLeod, A. C. High-Temperature Thermodynamic Properties of Uranium Dicarbide. J. Inorg. and Nucl. Chem., v. 31, 1969, pp. 715-725.

Oetting, F. L., J. D. Navratil, and E. K. Storms. The Chemical Thermodynamic Properties of Nuclear Materials (II) High Temperature Enthalpy of the Uranium Carbides. J. Nucl. Mater., v. 45, 1973, pp. 271-283.

U₂C₃(c):

Holley, C. E., Jr. Thermodynamic Properties of Actinide Carbides. J. Nucl. Mater., v. 51, 1974, pp. 36-46.

AlC(g)
Aluminum monocarbide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	7.710	53.380	0	164.800	151.314
400	8.106	55.705	.807	164.750	146.713
600	8.540	59.085	2.477	164.451	137.750
800	8.747	61.574	4.208	163.898	128.926
1000	8.864	63.539	5.970	160.556	120.451
1200	8.940	65.163	7.751	159.757	112.505
1400	8.996	66.545	9.545	158.924	104.695
1600	9.040	67.749	11.348	158.067	97.006
1800	9.077	68.816	13.160	157.192	89.426
2000	9.109	69.774	14.979	156.303	81.945
2200	9.139	70.644	16.804	155.402	74.550
2400	9.167	71.440	18.634	154.489	67.242

*Data estimated.

Al₄C₃(c)
Tetraluminum tricarbonide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	27.909	21.264	0	-49.900	-46.932
400	33.404	30.343	3.160	-49.920	-45.910
600	38.048	44.898	10.370	-49.892	-43.914
800	40.639	56.219	18.254	-50.261	-41.879
1000	42.700	65.514	26.592	-61.345	-38.968
1200	44.567	73.466	35.321	-61.874	-34.436
1400	46.319	80.469	44.411	-62.183	-29.837
1600	47.959	86.763	53.841	-62.251	-25.209
1800	49.459	92.500	63.586	-62.085	-20.588
2000	50.781	97.781	73.613	-61.700	-15.992

BC(g)
Boron monocarbide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	7.099	49.822	0	198.000	183.975
400	7.359	51.942	.736	198.166	179.154
600	7.895	55.031	2.263	198.117	169.643
800	8.267	57.358	3.882	197.789	160.198
1000	8.504	59.230	5.561	197.317	150.852
1200	8.659	60.795	7.278	196.749	141.607
1400	8.766	62.138	9.021	196.101	132.470
1600	8.845	63.314	10.783	195.380	123.422
1800	8.906	64.360	12.558	194.588	114.484
2000	8.955	65.300	14.344	193.730	105.620
2200	8.996	66.156	16.139	192.807	96.852
2400	9.031	66.940	17.942	179.841	88.432

*Data except enthalpy of formation at 298 K estimated.

B₄C(c,l)
Tetraboron carbide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	12.620	6.480	0	-17.000	-16.841
400	18.284	11.069	1.605	-16.931	-16.797
600	23.325	19.582	5.838	-16.920	-16.745
800	25.869	26.672	10.779	-17.118	-16.648
1000	27.494	32.631	16.126	-17.393	-16.499
1200	28.655	37.752	21.746	-17.727	-16.310
1400	29.560	42.239	27.571	-18.139	-16.028
1600	30.343	46.238	33.562	-18.654	-15.723
1800	31.114	49.856	39.707	-19.270	-15.270
2000	31.967	53.177	46.013	-19.970	-14.834
2200	32.993	56.270	52.505	-20.726	-14.280
2400	34.278	59.194	59.228	-69.404	-12.622
2600	35.909	62.000	66.240	-69.631	-7.884
2740	37.300	63.918	71.362	-69.585	-4.591
2740	32.500	73.042	96.362	-44.585	-4.591
2800	32.500	73.746	98.312	-44.812	-3.744
3000	32.500	75.988	104.812	-45.578	-.752

2740 K, melting point; ΔH° = 25.000 kcal/mol.

BaC₂(c)
Barium dicarbide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	15.270	21.000	0	-18.000	-18.995
400	16.516	25.686	1.628	-17.606	-19.401
600	17.498	32.601	5.045	-17.600	-20.341
800	17.959	37.704	8.595	-17.737	-21.250
1000	18.269	41.747	12.219	-18.052	-22.097
1200	18.520	45.100	15.899	-20.359	-22.494
1400	18.742	47.972	19.625	-20.792	-22.818

*Data except enthalpy of formation and entropy at 298 K estimated.

$\text{Be}_2\text{C}(\text{c}, \text{l})$
Diberyllium carbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	10.340	4.000	0	-28.000	-27.430
400	10.860	7.111	1.080	-28.054	-27.233
600	11.882	11.708	3.354	-28.566	-26.726
800	12.903	15.266	5.832	-29.317	-26.011
1000	13.924	18.255	8.515	-30.138	-25.088
1200	14.945	20.884	11.402	-31.003	-24.008
1400*	15.966	23.264	14.493	-31.889	-22.757
1600	16.988	25.463	17.789	-39.777	-21.206
1800	18.009	27.523	21.288	-40.263	-18.888
2000	19.030	29.473	24.992	-40.565	-16.461
2200	20.051	31.335	28.900	-40.681	-14.050
2400	21.072	33.123	33.012	-40.609	-11.642
2400	21.072	40.623	51.012	-22.609	-11.642
2600	21.072	42.310	55.226	-22.451	-10.754

*Data above 1200 K estimated.

2400 K, melting point; $\Delta \text{H}^\circ = 16.000$ kcal/mol.

$\text{CaC}_2(\text{c})$
Calcium dicarbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	14.990	16.720	0	-14.300	-15.503
400	16.273	21.324	1.599	-13.824	-15.987
600	17.522	28.197	4.998	-13.140	-17.231
720*	17.790	31.420	7.120	-12.930	-18.075
720	17.033	33.253	8.440	-11.830	-18.075
800	17.157	35.055	9.807	-11.055	-18.809
1000	17.469	38.917	13.270	-10.090	-20.719
1200	17.781	42.129	16.795	-13.542	-21.984

*720 K, is also transition point of Ca.

720 K, transition point; $\Delta \text{H}^\circ = 1.320$ kcal/mol.

$\text{CeC}_2(\text{c})$
Cerium dicarbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	14.581	21.500	0	-23.200	-23.664
400	15.905	25.994	1.561	-22.807	-23.882
600	17.109	32.701	4.878	-22.298	-24.544
800	17.816	37.726	8.374	-22.135	-25.325
1000	18.380	41.763	11.995	-22.942	-26.125
1200	18.887	45.160	15.722	-24.444	-26.585
1400	19.368	48.108	19.548	-24.638	-26.926

*Data except enthalpy of formation at 298 K estimated.

$\text{Ce}_2\text{C}_3(\text{c})$
Dicerium tricarbonide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	24.700	41.500	0	-42.200	-43.090
400	27.390	49.186	2.671	-41.617	-43.480
600	29.627	60.783	8.406	-40.804	-44.609
800	30.780	69.476	14.455	-40.538	-45.929
1000	31.620	76.438	20.698	-42.157	-47.280
1200	32.337	82.267	27.095	-45.156	-47.950
1400	32.995	87.302	33.629	-45.553	-48.382

*Data except enthalpy of formation at 298 K estimated.

$\text{Cr}_3\text{C}_2(\text{c})$
Trichromium dicarbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	23.530	20.420	0	-22.500	-22.716
400	27.328	27.940	2.615	-22.154	-22.844
600	30.886	39.777	8.478	-21.519	-23.324
800	33.104	48.981	14.887	-21.073	-23.995
1000	34.935	56.569	21.695	-20.699	-24.778
1200	36.614	63.088	28.851	-20.497	-25.599
1400	38.220	68.853	36.336	-20.570	-26.491
1600	39.788	74.060	44.137	-20.867	-27.283
1800	41.334	78.835	52.250	-21.416	-28.056
2000	42.866	83.270	60.670	-22.159	-28.759

$\text{Cr}_7\text{C}_3(\text{c})$
Heptachromium tricarbonide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	50.052	48.000	0	-43.300	-44.592
400	56.284	63.675	5.448	-42.733	-45.123
600	62.766	87.855	17.418	-41.805	-46.517
800	67.038	106.523	30.417	-41.248	-48.173
1000	70.595	121.872	44.188	-40.833	-49.970
1200	73.893	135.037	58.639	-40.838	-51.768
1400	77.159	146.672	73.743	-41.521	-53.646
1600	80.553	157.194	89.511	-42.745	-55.215
1800	84.209	166.890	105.981	-44.538	-56.681
2000	88.251	175.967	123.220	-46.696	-57.920

$\text{Cr}_{23}\text{C}_6(\text{c})$
Chromium carbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	149.200	145.800	0	-94.700	-96.971
400	167.644	192.513	16.234	-93.547	-97.933
600	187.400	264.675	51.962	-91.423	-100.550
800	199.065	320.279	90.674	-90.186	-103.782
1000	208.904	365.760	131.475	-89.435	-107.325
1200	219.099	404.739	174.264	-90.048	-110.749
1400	229.757	439.312	219.147	-92.759	-114.347
1600	240.278	470.682	266.157	-97.175	-116.874
1800	250.623	499.578	315.242	-103.588	-118.996
2000	262.554	526.572	366.505	-111.468	-120.312

$\text{Li}_2\text{C}_2(\text{c})$
Dilithium acetylide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	17.100	14.000	0	-14.200	-13.409
400	20.890	19.630	1.961	-13.999	-13.165
600	23.830	28.756	6.482	-15.128	-12.354
800	25.180	35.815	11.396	-14.764	-11.485
1000	26.070	41.535	16.525	-14.385	-10.712
1200	26.770	46.352	21.811	-13.975	-10.015
1400	27.390	50.525	27.228	-13.518	-9.389
1600	27.960	54.221	32.764	-12.994	-8.832
1800	28.510	57.546	38.411	-12.135	-1.419
2000	29.040	60.577	44.167	-10.751	7.479

$\text{Fe}_3\text{C}(\text{c})$
Triiron carbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	25.400	25.000	0	5.985	4.772
400	27.930	32.800	2.710	6.536	4.274
478	30.710	38.170	5.052	7.055	3.772
478	26.350	38.170	5.052	7.055	3.772
600	27.200	44.230	8.309	7.184	2.919
800	28.600	52.250	13.889	6.901	1.518
1000	30.000	58.780	19.749	5.473	.298
1200*	31.400	64.380	25.889	2.892	-.488
1400	32.800	69.320	32.309	3.220	-1.068

*Data above 1000 K extrapolated.
478 K, Curie temperature; $\Delta\text{H}^\circ = 0$ kcal/mol.

$\text{MgC}_2(\text{c})$
Magnesium dicarbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	13.440	13.000	0	20.000	19.271
400	15.390	17.259	1.481	20.364	18.967
600	16.940	23.844	4.739	20.929	18.135
800	17.690	28.829	8.208	21.216	17.151
1000	18.200	32.833	11.799	19.151	16.298
1200	18.610	36.189	15.482	19.080	15.728
1400	18.990	39.087	19.243	-11.211	15.994
1600	19.340	41.646	23.076	-10.656	19.843
1800	19.680	43.943	26.978	-10.085	23.622
2000	20.010	46.033	30.946	-9.491	27.337

$\text{HfC}(\text{c})$
Hafnium carbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.960	9.474	0	-54.000	-53.312
400	10.250	12.309	.980	-53.904	-53.098
600	11.290	16.709	3.140	-53.741	-52.754
800	11.860	20.050	5.460	-53.681	-52.442
1000	12.250	22.739	7.870	-53.714	-52.138
1200	12.560	25.000	10.360	-53.808	-51.800
1400	12.840	26.984	12.900	-53.972	-51.490
1600	13.120	28.705	15.490	-54.192	-51.112
1800	13.380	30.258	18.140	-54.452	-50.690
2000	13.660	31.692	20.850	-54.746	-50.280
2200	13.940	33.031	23.610	-56.420	-49.734
2400	14.220	34.250	26.420	-56.513	-49.114
2600	14.520	35.421	29.310	-62.198	-48.233
2800	14.820	36.496	32.220	-62.141	-47.153
3000	15.130	37.548	35.220	-62.007	-46.137

$\text{Mg}_2\text{C}_3(\text{c})$
Dimagnesium tricarbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	22.410	24.000	0	17.000	15.729
400	25.660	31.105	2.470	17.484	15.222
600	28.250	42.084	7.903	18.225	13.916
800	29.490	50.395	13.687	18.528	12.418
1000	30.340	57.071	19.673	14.196	11.240
1200	31.030	62.665	25.812	13.889	10.666
1400	31.650	67.495	32.081	-46.837	11.789
1600	32.240	71.760	38.471	-45.861	20.101
1800	32.800	75.590	44.975	-44.850	28.284
2000	33.350	79.074	51.590	-43.793	36.357

$\text{Mn}_3\text{C}(\text{c})$
Trimanganese carbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	22.330	23.600	0	1.100	1.315
400	24.964	30.597	2.431	1.291	1.357
600	27.278	41.208	7.681	1.527	1.333
800	28.939	49.285	13.304	1.467	1.254
1000	30.673	55.925	19.262	-0.355	1.255
1200	32.663	61.689	25.591	-0.551	1.602
1310	33.890	64.606	29.250	-0.555	1.795
1310	38.000	67.182	32.625	2.820	1.795
1400	38.000	69.707	36.045	1.570	1.780
1600	38.000	74.782	43.645	-8.520	2.533
1800	38.000	79.257	51.245	-8.689	3.949

1310 K, transition point; $\Delta\text{H}^\circ = 3.375$ kcal/mol.

$\text{Mn}_7\text{C}_3(\text{c})$
Heptamanganese tricarbonide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	56.350	57.100	0	-26.100	-25.931
400	59.410	74.100	5.910	-25.582	-25.954
600	64.400	99.160	18.300	-25.354	-26.223
800	69.040	118.330	31.650	-25.853	-26.487
1000	73.570	134.220	45.910	-30.409	-26.484
1200	78.070	148.030	61.080	-31.172	-25.605
1400	82.540	160.400	77.140	-35.295	-24.500

*Entropy and heat capacity at 298 K estimated.

$\text{Mn}_{15}\text{C}_4(\text{c})$
Manganese carbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	107.070	32.500	0	-42.000	-15.841
400	112.880	64.810	11.210	-41.742	-6.973
600	122.370	112.410	34.770	-42.558	10.564
800	131.180	148.830	60.130	-44.730	28.491
1000	139.790	179.030	87.230	-55.536	47.264
1200	148.330	205.270	116.050	-58.279	68.119
1400	156.830	228.770	146.560	-68.325	89.662

*Data at 298 K estimated.

$\text{Mn}_{23}\text{C}_6(\text{c})$
Manganese carbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	WHf°	WGF°
298	163.420	186.740	0	-58.680	-59.443
400	172.280	236.050	17.140	-58.300	-59.769
600	186.770	308.710	53.080	-59.644	-60.278
800	200.220	364.300	91.780	-63.042	-60.151
1000	213.370	410.390	133.140	-79.672	-58.702
1200	226.400	450.440	177.120	-83.947	-54.057
1400	239.370	486.320	223.700	-99.405	-48.344

$\text{MoC}(\gamma)$
Molybdenum carbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	7.380	8.760	0	-6.800	-6.960
400	8.330	11.070	.800	-6.846	-7.012
600	9.750	14.730	2.620	-6.952	-7.066
800	10.710	17.670	4.670	-7.071	-7.084
1000	11.350	20.140	6.880	-7.184	-7.083
1200	11.820	22.250	9.200	-7.308	-7.045
1400	12.250	24.100	11.600	-7.463	-6.991

$\text{Mo}_2\text{C}(\text{c})$
Dimolybdenum carbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	14.390	15.730	0	-12.700	-12.896
400	15.966	20.196	1.552	-12.592	-12.979
600	17.758	27.048	4.944	-12.358	-13.223
800	18.746	32.304	8.603	-12.154	-13.542
1000	19.409	36.561	12.421	-11.988	-13.912
1200	20.091	40.157	16.368	-11.867	-14.305
1400	21.103	43.324	20.479	-11.757	-14.721

$\text{Na}_2\text{C}_2(\text{c})$
Disodium acetylide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	21.745	26.587	0	4.800	5.025
300*	21.780	26.720	0.040	4.808	5.027
400	23.660	33.250	2.310	3.902	5.137
500	25.400	38.720	4.770	4.246	5.414
546	26.170	40.990	5.950	4.425	5.507
546	26.170	42.840	6.960	5.435	5.507
600	27.070	45.350	8.400	5.680	5.506
700	28.720	49.640	11.190	6.210	5.439
800	30.350	53.580	14.140	6.852	5.286
900	31.970	57.250	17.260	7.618	5.046
1000	33.590	60.710	20.540	8.504	4.708

*Data above 298 K estimated except temperature of transition.

546 K, transition point; $\Delta\text{H}^\circ = 1.010$

$\text{NbC}_{0.98}(\text{c})$
Niobium carbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.660	8.357	0	-33.200	-32.697
400	10.010	11.105	.956	-33.098	-32.540
600	11.320	15.444	3.105	-32.867	-32.309
800	11.980	18.798	5.440	-32.674	-32.158
1000	12.410	21.520	7.881	-32.524	-32.046
1200	12.740	23.812	10.397	-32.405	-31.944
1400	13.027	25.798	12.974	-32.316	-31.874
1600	13.290	27.555	15.606	-32.265	-31.807
1800	13.540	29.135	18.289	-32.255	-31.750
2000	13.780	30.574	21.021	-32.289	-31.697
2200	14.020	31.898	23.801	-32.375	-31.637
2400	14.260	33.129	26.629	-32.518	-31.565

$\text{Nb}_2\text{C}(\text{c})$
Diniobium carbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	14.468	15.300	0	-45.400	-44.365
400	15.799	19.760	1.549	-45.321	-44.024
600	17.111	26.443	4.854	-45.186	-43.403
800	17.960	31.486	8.364	-45.113	-42.831
1000	18.675	35.572	12.029	-45.074	-42.261
1200	19.338	39.036	15.831	-45.048	-41.668
1400	19.975	42.065	19.762	-45.028	-41.105
1600	20.600	44.774	23.820	-45.036	-40.530
1800	21.217	47.236	28.002	-45.077	-39.961
2000	21.829	49.503	32.307	-45.162	-39.398

$\text{Ni}_3\text{C}(\text{c})$
Trinickel carbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	25.491	25.400	0	9.000	8.222
300	25.500	25.558	0.047	9.007	8.217
400	26.000	32.962	2.622	9.382	7.890
500	26.500	38.818	5.247	9.560	7.490
600	27.000	43.693	7.922	9.512	7.071
700	27.500	47.893	10.647	9.419	6.691
800	28.000	51.598	13.422	9.524	6.285

*Data except enthalpy of formation at 298 K estimated.

$\text{PC}(\text{g})$
Phosphorus carbide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	7.149	51.661	0	107.500	95.434
400	7.446	53.802	.743	107.208	91.373
600	7.989	56.930	2.289	103.975	83.783
800	8.335	59.280	3.925	103.778	77.080
1000	8.545	61.164	5.614	103.506	70.435
1200	8.679	62.735	7.338	103.192	63.850
1400	8.770	64.080	9.083	102.847	57.319
1600	8.835	65.256	10.844	102.482	50.840
1800	8.884	66.299	12.616	102.099	44.409
2000	8.923	67.237	14.397	101.703	38.021

$\text{PuC}_{0.82}(\text{s})$
Plutonium carbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	11.009	16.632	0	-11.000	-11.622
400	11.613	19.968	1.158	-11.727	-11.842
600	12.178	24.783	3.536	-11.913	-11.893
800	13.162	28.405	6.059	-12.312	-11.860
1000	14.887	31.513	8.851	-12.818	-11.708
1200	17.434	34.439	12.069	-12.490	-11.508
1400	20.829	37.371	15.891	-11.608	-11.406

$\text{PuC}_{0.88}(\text{c})$
Plutonium carbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	11.400	17.380	0	-11.400	-12.221
400	11.860	20.820	1.192	-12.108	-12.513
600	12.020	25.650	3.578	-12.328	-12.703
800	12.740	29.180	6.039	-12.841	-12.782
1000	14.510	32.190	8.746	-13.492	-12.708
1200	17.380	35.090	11.915	-13.277	-12.586
1400	21.420	38.050	15.775	-12.413	-12.518
1600	26.600	41.230	20.557	-10.656	-12.632
1800	32.980	44.720	26.496	-7.766	-13.040

$\text{PuC}_2(\text{c})$
Plutonium dicarbide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	13.150	24.100	0	-6.800	-9.166
400	14.880	28.216	1.431	-7.547	-9.977
600	16.920	34.684	4.635	-7.726	-11.187
800	18.280	39.751	8.164	-8.160	-12.311
1000	19.320	43.949	11.931	-8.864	-13.293
1200	20.080	47.541	15.873	-9.066	-14.159
1400	20.700	50.684	19.953	-9.224	-14.995
1600	21.180	53.482	24.144	-9.337	-15.809
1800	21.520	55.996	28.414	-9.425	-16.614
2000	21.780	58.278	32.746	-9.493	-17.409
2200	21.980	60.363	37.122	-9.553	-18.199
2400	22.160	62.284	41.537	-9.608	-18.982

*Data except enthalpy of formation and entropy at 298 K estimated.

$\text{Pu}_2\text{C}_3(\text{c})$
Diplutonium tricarbonide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	27.247	35.851	0	-40.500	-41.959
400	29.101	44.164	2.886	-41.722	-42.509
600	30.460	56.249	8.856	-41.824	-42.959
800	31.992	65.202	15.088	-42.635	-43.289
1000	34.530	72.593	21.720	-43.951	-43.349
1200	38.282	79.201	28.981	-43.916	-43.220
1400	43.318	85.463	37.119	-43.145	-43.153

$\text{SiC}(\alpha)$
Silicon carbide (hexagonal)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	6.380	3.940	0	-15.000	-14.424
400	8.258	6.117	.759	-15.005	-14.227
600	10.063	9.851	2.613	-14.963	-13.845
800	11.046	12.893	4.732	-14.923	-13.478
1000	11.638	15.427	7.006	-14.891	-13.113
1200	11.990	17.583	9.372	-14.868	-12.768
1400	12.186	19.447	11.791	-14.865	-12.415
1600	12.288	21.082	14.240	-14.889	-12.076
1800	12.342	22.533	16.703	-26.952	-10.887
2000	12.383	23.835	19.176	-26.889	-9.109

$\text{SiC}(\beta)$
Silicon carbide (cubic)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	6.420	3.970	0	-15.600	-15.033
400	8.322	6.155	.762	-15.602	-14.839
600	10.055	9.905	2.623	-15.553	-14.468
800	10.960	12.932	4.732	-15.523	-14.109
1000	11.529	15.444	6.985	-15.512	-13.751
1200	11.903	17.581	9.331	-15.509	-13.407
1400	12.143	19.435	11.737	-15.519	-13.052
1600	12.288	21.067	14.182	-15.547	-12.710
1800	12.371	22.520	16.649	-27.606	-11.510
2000	12.416	23.826	19.128	-27.537	-9.739

$\text{SiC}(\text{g})$
Silicon carbide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	9.182	50.892	0	172.000	158.577
400	10.574	53.813	1.016	172.252	153.952
600	10.610	58.180	3.170	172.594	144.714
800	9.972	61.140	5.225	172.570	135.417
1000	9.620	63.323	7.179	172.282	126.164
1200	9.483	65.062	9.007	171.847	116.972
1400	9.455	66.521	10.980	171.324	107.870
1600	9.477	67.784	12.872	170.743	98.833
1800	9.520	68.903	14.772	158.117	90.716
2000	9.567	69.909	16.681	157.616	83.248

*Data except enthalpy of formation at 298 K estimated.

$\text{SiC}_2(\text{g})$
Silicon dicarbide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	10.901	56.553	0	147.000	132.299
400	11.671	59.869	1.151	147.139	127.250
600	12.729	64.817	3.599	147.081	117.304
800	13.403	68.579	6.218	146.738	107.425
1000	13.831	71.619	8.944	146.228	97.659
1200	14.109	74.167	11.740	145.619	87.994
1400	14.298	76.357	14.582	144.936	78.446
1600	14.438	78.276	17.456	144.195	68.985
1800	14.557	79.983	20.356	131.400	60.467
2000	14.677	81.523	23.279	130.723	52.617

*Data except enthalpy of formation at 298 K estimated.

$\text{Si}_2\text{C}(\text{g})$
Disilicon carbide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	11.334	57.881	0	128.000	113.835
400	12.082	61.322	1.195	127.915	109.003
600	13.057	66.422	3.717	127.507	99.626
800	13.652	70.267	6.392	126.907	90.421
1000	14.019	73.356	9.162	126.187	81.396
1200	14.254	75.934	11.991	125.392	72.495
1400	14.416	78.144	14.859	124.537	63.753
1600	14.543	80.077	17.755	123.629	55.106
1800	14.666	81.797	20.676	98.667	48.269
2000	14.806	83.349	23.623	97.984	42.696

*Data except enthalpy of formation at 298 K estimated.

$\text{SmC}_2(\text{c})$
Samarium dicarbide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	16.680	21.010	0	-23.000	-23.488
400	17.990	26.120	1.770	-22.485	-23.743
600	19.200	33.670	5.510	-21.916	-24.509
800	19.920	39.300	9.420	-21.807	-25.401
1000	20.510	43.810	13.470	-21.878	-26.288
1200	21.040	47.590	17.620	-22.829	-27.142
1400	21.540	50.870	21.880	-25.134	-27.760
1440	21.640	51.480	22.740	-25.206	-27.838
1440	21.640	52.400	24.070	-23.876	-27.838
1600	22.030	54.710	27.570	-24.128	-28.272
1800	22.510	57.330	32.020	-24.416	-28.779
2000	22.990	59.730	36.570	-24.646	-29.246

*Data except enthalpy of formation at 298 K estimated.
1440 K, transition point; $\Delta H^\circ = 1.330$ kcal/mol.

$\text{SrC}_2(\text{c})$
Strontium dicarbide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	15.068	17.000	0	-18.000	-18.524
300	15.099	17.093	.028	-17.992	-18.527
400	16.293	21.620	1.604	-17.563	-18.771
500	16.990	25.335	3.271	-17.229	-19.113
600	17.492	28.479	4.996	-17.000	-19.513
700	17.902	31.207	6.766	-16.869	-19.945
800	18.263	33.622	8.575	-16.826	-20.388
900	18.595	35.792	10.418	-17.034	-20.818
1000	18.910	37.768	12.293	-17.073	-21.236

*Data except enthalpy of formation at 298 K estimated.

$\text{TaC}(\text{c})$
Tantalum carbide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.793	10.127	0	-34.440	-34.093
400	9.958	12.886	.959	-34.356	-33.986
600	11.101	17.168	3.079	-34.185	-33.838
800	11.729	20.454	5.366	-34.059	-33.744
1000	12.205	23.124	7.761	-33.960	-33.678
1200	12.614	25.385	10.243	-33.866	-33.628
1400	13.012	27.360	12.806	-33.766	-33.598
1600	13.393	29.122	15.447	-33.656	-33.579
1800	13.764	30.721	18.162	-33.535	-33.578
2000	14.132	32.190	20.952	-33.402	-33.590
2200	14.496	33.554	23.815	-33.262	-33.616
2400	14.858	34.831	26.750	-33.122	-33.655

$\text{Ta}_2\text{C}(\text{c})$
Ditantalum carbide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	14.567	20.700	0	-51.000	-50.847
400	15.931	25.193	1.561	-50.941	-50.803
600	17.309	31.942	4.899	-50.807	-50.761
800	18.224	37.052	8.456	-50.689	-50.765
1000	19.005	41.204	12.180	-50.563	-50.800
1200	19.734	44.734	16.054	-50.403	-50.860
1400	20.437	47.829	20.072	-50.202	-50.952
1600	21.128	50.603	24.229	-49.965	-51.074
1800	21.811	53.131	28.523	-49.690	-51.229
2000	22.489	55.464	32.953	-49.384	-51.418

*Data except enthalpy of formation and entropy at
298 K estimated.

$\text{ThC}_{1.94}(\text{c})$
Thorium carbide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.550	16.800	0	-35.300	-35.711
400	14.670	20.960	1.443	-35.015	-35.898
600	15.890	27.150	4.511	-34.687	-36.415
800	16.750	31.060	7.779	-34.605	-37.019
1000	17.520	35.680	11.209	-34.656	-37.619
1200	18.260	38.930	14.788	-34.765	-38.187
1400	18.950	41.800	18.509	-34.899	-38.751
1600	19.650	44.380	22.371	-35.030	-39.295
1700	20.000	45.600	24.354	-35.907	-39.556
1700	20.000	45.890	24.854	-35.407	-39.556
1763	20.000	46.610	26.114	-35.412	-39.692
1763	20.000	48.030	28.614	-32.912	-39.692
1800	20.000	48.460	29.353	-32.923	-39.864
2000	20.000	50.560	33.353	-33.069	-40.614
2200	20.000	52.470	37.353	-36.877	-41.066
2400	20.000	54.190	41.353	-37.454	-41.373

1700 K, transition point; $\Delta H^\circ = 0.500$ kcal/mol.

1763 K, transition point; $\Delta H^\circ = 2.500$ kcal/mol.

$\text{TiC}(\text{s})$
Titanium carbide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.070	5.790	0	-44.100	-43.235
400	9.663	8.406	.911	-44.064	-42.941
600	11.192	12.659	3.018	-43.958	-42.407
800	11.855	15.981	5.332	-43.929	-41.891
1000	12.188	18.666	7.739	-44.012	-41.373
1200	12.434	20.910	10.201	-45.170	-40.795
1400	12.718	22.847	12.715	-45.227	-40.062
1600	13.084	24.568	15.294	-45.332	-39.316
1800	13.534	26.135	17.955	-45.482	-38.557
2000	14.046	27.587	20.712	-49.102	-37.682
2200	14.598	28.951	23.576	-49.656	-36.513
2400	15.190	30.246	26.554	-50.113	-35.295
2600	15.865	31.488	29.657	-50.459	-34.048
2800	16.733	32.694	32.912	-50.667	-32.778

3290 K, melting point of TiC.

$\text{UC}(\text{c})$
Uranium monocarbide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.980	14.150	0	-23.400	-23.632
400	13.190	17.860	1.290	-23.056	-23.763
600	14.100	23.410	4.034	-22.539	-24.240
800	14.570	27.540	6.904	-22.373	-24.847
1000	14.950	30.830	9.857	-23.198	-25.405
1200	15.360	33.590	12.887	-24.251	-25.684
1400	15.820	35.990	16.004	-24.073	-25.934
1600	16.340	38.140	19.218	-26.492	-25.894
1800	16.930	40.090	22.543	-26.662	-25.794
2000	17.590	41.910	25.994	-26.727	-25.699
2200	18.340	43.620	29.586	-26.669	-25.595
2400	19.160	45.250	33.334	-26.472	-25.505
2600	20.060	46.820	37.254	-26.117	-25.441
2800	21.030	48.340	41.362	-25.588	-25.403
3000	22.090	49.830	45.672	-24.870	-25.425

$\text{UC}_{1.94}(\text{c})$
Uranium dicarbide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.520	16.980	0	-20.800	-21.491
400	16.334	21.540	1.585	-20.394	-21.790
600	17.963	28.511	5.034	-19.824	-22.627
800	18.944	33.821	8.730	-19.663	-23.597
1000	19.736	38.135	12.600	-20.505	-24.523
1200	20.454	41.797	16.620	-21.566	-25.162
1400	21.138	45.002	20.779	-21.389	-25.776
1600	21.803	47.868	25.074	-23.800	-26.088
1800	22.457	50.474	29.500	-23.968	-26.364

$\text{U}_2\text{C}_3(\text{c})$
Diuranium tricarbonide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	25.660	32.930	0	-43.400	-44.835
400	28.670	40.960	2.790	-42.750	-45.427
600	30.770	53.050	8.770	-41.918	-46.974
800	32.090	62.080	15.050	-41.929	-48.685
1000	33.750	69.410	21.630	-43.899	-50.218
1200	36.030	75.760	28.600	-46.157	-51.143
1400	39.000	81.530	36.090	-45.654	-52.011
1600	42.730	86.970	44.250	-49.902	-52.321
1800	47.220	92.250	53.230	-49.081	-52.659
2000	52.490	97.490	63.190	-47.343	-53.137

VC₅(c)
Vanadium carbide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	6.680	6.110	0	-14.000	-13.555
400	7.660	8.220	.730	-14.018	-13.404
600	8.840	11.570	2.400	-13.981	-13.091
800	9.620	14.230	4.240	-13.924	-12.817
1000	10.210	16.440	6.230	-13.835	-12.544
1200	10.700	18.340	8.320	-13.753	-12.288
1400	11.140	20.030	10.510	-13.683	-12.054
1600	11.540	21.540	12.770	-13.659	-11.827
1800	11.920	22.920	15.120	-13.663	-11.591

VC₆(c)
Vanadium carbide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.640	6.000	0	-24.300	-23.667
400	9.340	8.512	.880	-24.262	-23.449
600	10.940	12.641	2.920	-24.119	-23.079
800	11.880	15.924	5.210	-23.947	-22.756
1000	12.580	18.652	7.660	-23.776	-22.476
1200	13.150	20.998	10.230	-23.617	-22.236
1400	13.640	23.063	12.910	-23.479	-22.018
1600	14.040	24.911	15.680	-23.379	-21.815
1800	14.380	26.585	18.520	-23.337	-21.625
2000	14.650	28.114	21.430	-23.364	-21.427
2200	14.850	29.520	24.380	-28.975	-21.206
2400	15.000	30.819	27.360	-29.281	-20.491

WC(c)
Tungsten carbide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.460	7.672	0	-9.600	-9.153
400	9.847	10.380	.942	-9.508	-9.011
600	10.945	14.616	3.039	-9.329	-8.808
800	11.477	17.843	5.285	-9.224	-8.651
1000	11.860	20.447	7.620	-9.169	-8.511
1200	12.195	22.639	10.026	-9.140	-8.379
1400	12.518	24.543	12.497	-9.126	-8.238
1600	12.843	26.236	15.033	-9.113	-8.115
1800	13.177	27.768	17.635	-9.093	-7.995
2000	13.525	29.174	20.305	-9.058	-7.876
2200	13.888	30.480	23.046	-9.002	-7.770
2400	14.267	31.705	25.861	-8.920	-7.653
2600	14.663	32.862	28.754	-8.808	-7.542

W₂C(c)
Ditungsten carbide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	18.320	13.400	0	-6.300	-5.235
400	20.325	19.101	1.981	-5.771	-4.946
600	22.053	27.718	6.243	-4.651	-4.785
800	22.996	34.201	10.754	-3.539	-4.997
1000	23.712	39.411	15.427	-2.432	-5.478
1200	24.338	43.791	20.233	-1.318	-6.188
1400	24.922	47.587	25.160	-.196	-7.056
1600	25.484	50.952	30.201	.941	-8.118
1800	26.033	53.985	35.352	2.097	-9.328
2000	26.573	56.756	40.613	3.278	-10.664

*Data except enthalpy of formation and entropy at 298 K estimated.

ZrC₉₆(c)
Zirconium carbide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	9.015	7.930	0	-48.300	-47.493
400	10.583	10.835	1.011	-48.178	-47.234
600	11.536	15.352	3.245	-47.969	-46.813
800	11.810	18.715	5.584	-47.926	-46.440
1000	11.964	21.367	7.962	-48.031	-46.059
1200	12.135	23.563	10.371	-49.109	-45.593
1400	12.371	25.450	12.820	-49.113	-45.008
1600	12.690	27.122	15.325	-49.159	-44.418
1800	13.103	28.639	17.903	-49.221	-43.822
2000	13.615	30.046	20.573	-49.275	-43.221
2200	14.228	31.371	23.355	-54.274	-42.440
2400	14.944	32.639	26.271	-54.134	-41.366
2600	15.764	33.867	29.340	-53.854	-40.314
2800	16.689	35.068	32.584	-53.413	-39.286
3000	17.719	36.254	36.023	-52.790	-38.297

Carbonates

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

Source of data:

Chang, Y. A., and N. Ahmad. Thermodynamic Data on Metal Carbonates and Related Oxides. Metall. Soc. AIME, 1982, 235 pp.

$\text{Ag}_2\text{CO}_3(\text{c})$
Silver carbonate

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	26.830	40.000	0	-120.876	-104.416
300	26.840	40.166	.049	-120.876	-104.314
400	29.314	48.230	2.860	-120.598	-98.831
500	31.501	55.000	5.900	-120.218	-93.429

$\text{BaCO}_3(\text{c})$
Barium carbonate

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	20.400	26.800	0	-289.384	-270.601
400	23.520	33.280	2.254	-289.201	-264.213
600	27.090	43.540	7.338	-289.062	-251.764
800	30.000	51.740	13.052	-288.517	-239.417
1000	32.780	58.730	19.332	-287.643	-227.231
1079	33.860	61.400	22.086	-288.955	-222.346
1079	37.000	65.290	26.283	-284.758	-222.346
1200	37.000	69.190	30.760	-283.671	-215.378
1241	37.000	70.510	32.251	-283.329	-213.170
1241	38.000	71.110	32.999	-282.581	-213.170
1400	38.000	75.590	39.042	-281.019	-204.232
1600	38.000	80.660	46.640	-279.123	-193.386

1079 K, transition point; $\Delta\text{H}^\circ = 4.197$ kcal/mol.

1241 K, transition point; $\Delta\text{H}^\circ = 0.748$ kcal/mol.

$\text{CaCO}_3(\text{c})$
Calcium carbonate, calcite

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	19.950	21.920	0	-288.610	-269.857
400	23.180	28.290	2.216	-288.353	-263.482
600	26.260	38.340	7.196	-287.623	-251.198
800	28.170	46.170	12.648	-287.116	-239.141
1000	29.750	52.630	18.444	-286.534	-227.224
1200	31.200	58.190	24.539	-287.844	-215.262

$\text{CaCO}_3(\text{c})$
Calcium carbonate, aragonite

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	19.670	21.030	0	-288.660	-269.641
300	20.130	21.150	.037	-288.658	-269.521
400	22.150	27.190	2.139	-288.480	-263.169
500	23.860	32.320	4.444	-288.232	-256.868
600	25.280	36.800	6.902	-287.967	-250.618
700	26.570	40.790	9.495	-287.698	-244.417

$\text{CdCO}_3(\text{c})$
Cadmium Carbonate

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	19.690	22.100	0	-181.410	-161.983
300*	19.990	22.220	.040	-181.405	-161.857
400	22.900	28.340	2.170	-181.219	-155.371
500	26.050	33.780	4.620	-180.846	-148.942
600	29.200	38.810	7.380	-181.768	-142.595
700	32.350	43.550	10.460	-180.990	-136.126

*Data above 298 K estimated.

$\text{Cs}_2\text{CO}_3(\text{c})$
Cesium carbonate

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	29.600	48.870	0	-271.250	-251.349
300*	29.650	49.050	.055	-271.247	-251.223
400	32.580	58.010	3.175	-271.960	-244.262
500	34.830	65.530	6.549	-271.497	-237.389
600	36.800	72.060	10.132	-270.908	-230.620
700	38.650	77.870	13.906	-270.204	-223.957
800	40.440	83.150	17.861	-269.385	-217.409
900	42.180	88.010	21.992	-268.440	-210.963
1000	43.910	92.550	26.296	-269.526	-203.038

*Data above 298 K estimated.

$\text{FeCO}_3(\text{c})$
Iron carbonate

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	20.440	22.970	0	-177.320	-159.899
300*	20.490	23.100	.038	-177.317	-159.792
400	23.170	29.370	2.221	-177.069	-153.988
500	25.850	34.840	4.671	-176.714	-148.263
600	28.530	39.800	7.390	-176.242	-142.620
700	31.210	44.400	10.377	-175.641	-137.063
800	33.890	48.750	13.631	-174.908	-131.609

*Data above 298 K estimated.

$K_2CO_3(c,l)$
Potassium carbonate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	27.351	37.170	0	-274.900	-254.440
400	30.625	45.675	2.956	-275.931	-247.248
600	36.010	59.152	9.640	-275.107	-233.049
800	40.641	70.152	17.309	-273.542	-219.250
1000	45.160	79.707	25.890	-271.282	-205.925
1174	48.936	87.252	34.082	-306.219	-190.032
1174	50.000	92.874	40.682	-299.619	-190.032
1200*	50.000	93.972	41.982	-299.051	-187.615
1400	50.000	101.679	51.982	-294.725	-169.384
1600	50.000	108.356	61.982	-290.478	-151.770
1800	50.000	114.245	71.982	-286.294	-134.684
2000	50.000	119.513	81.982	-282.173	-118.059

*Data above melting point estimated.

1174 K, melting point; ΔH° = 6.600 kcal/mol.

$Li_2CO_3(c,l)$
Lithium carbonate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	23.000	21.551	0	-290.640	-270.593
400	26.810	28.860	2.543	-290.694	-263.731
600	35.700	41.295	8.736	-291.686	-249.832
623	36.600	42.656	9.566	-291.539	-248.232
623	38.700	42.871	9.700	-291.405	-248.232
683	38.700	46.430	12.020	-290.881	-244.104
683	32.920	47.213	12.555	-290.346	-244.104
800	38.000	52.811	16.711	-289.742	-236.218
993	46.367	61.902	24.856	-287.599	-223.511
993	44.320	72.676	35.556	-276.899	-223.511
1000	44.320	72.980	35.859	-276.811	-223.143
1200*	44.320	81.061	44.723	-274.292	-212.648
1400	44.320	87.893	53.587	-271.859	-202.568
1600	44.320	93.811	62.451	-269.485	-192.830
1800	44.320	99.031	71.315	-336.895	-176.457
2000	44.320	103.701	80.179	-333.903	-158.792

*Data above 1100 K estimated.

623 K, transition point; ΔH° = 0.134 kcal/mol.

683 K, transition point; ΔH° = 0.535 kcal/mol.

993.15 K, melting point; ΔH° = 10.700 kcal/mol.

$MgCO_3(c)$
Magnesium carbonate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.190	15.560	0	-266.035	-246.020
300	18.250	15.670	.034	-266.035	-245.894
400	21.650	21.430	2.046	-265.943	-239.187
500	23.880	26.520	4.327	-265.714	-232.530
600	25.660	31.030	6.806	-265.410	-225.913
700	27.240	35.110	9.453	-265.048	-219.359
800	28.700	38.840	12.250	-264.630	-212.862
900	29.910	42.300	15.189	-264.150	-206.415
1000	31.440	45.540	18.266	-265.737	-199.857

$MnCO_3(c)$
Manganese carbonate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.050	23.900	0	-212.417	-194.937
300	18.140	24.010	.033	-212.420	-194.828
400	22.970	30.000	2.127	-212.287	-188.975
500	25.150	35.390	4.544	-211.981	-183.182
600	26.300	40.080	7.122	-211.655	-177.449
700	26.960	44.190	9.788	-211.362	-171.777

$Na_2CO_3(c,l)$
Sodium carbonate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	26.840	32.260	0	-269.880	-249.840
400	30.650	40.695	2.933	-270.991	-242.913
600	38.500	54.633	9.870	-269.902	-229.042
723	45.985	62.336	14.941	-268.535	-220.803
723	34.297	62.564	15.106	-268.370	-220.803
800	36.650	66.151	17.837	-267.983	-215.766
1000	42.830	74.991	25.782	-266.254	-202.891
1123	46.611	80.181	31.291	-264.661	-195.168
1123	45.300	86.494	38.381	-257.571	-195.168
1200*	45.300	89.492	41.862	-303.040	-190.030
1400	45.300	96.475	50.922	-299.656	-171.461
1600	45.300	102.524	59.982	-296.346	-153.376
1800	45.300	107.860	69.042	-293.098	-135.701
2000	45.300	112.632	78.102	-289.906	-118.382

*Data above melting point estimated.

723.15 K, transition point; ΔH° = 0.165 kcal/mol.

1123.15 K, melting point; ΔH° = 7.090 kcal/mol.

$\text{NaHCO}_3(\text{c})$
Sodium hydrogencarbonate

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	20.983	24.400	0	-226.805	-203.436
300	21.047	24.530	.039	-226.808	-203.290
400	24.486	31.056	2.316	-227.531	-195.382
500	27.925	36.889	4.936	-227.415	-187.353

$\text{PbCO}_3(\text{c})$
Lead carbonate

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	20.917	31.300	0	-167.950	-150.338
300	20.970	31.430	.039	-167.947	-150.229
400	23.830	37.854	2.279	-167.658	-144.361
500	26.690	43.479	4.805	-167.211	-138.586
600	29.550	48.598	7.617	-166.601	-132.917
700	32.410	53.368	10.715	-166.967	-127.171
800	35.270	57.882	14.099	-165.964	-121.550

$\text{Rb}_2\text{CO}_3(\text{c})$
Rubidium carbonate

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	28.110	43.340	0	-273.500	-253.154
300*	28.220	43.510	.052	-273.500	-253.027
400	32.260	52.250	3.097	-274.408	-245.923
500	34.720	59.720	6.453	-274.001	-238.846
600	36.580	66.230	10.022	-273.415	-231.871
700	38.140	71.980	13.759	-272.699	-224.996
800	39.540	77.170	17.644	-271.868	-218.240
900	40.860	81.900	21.665	-270.936	-211.576
1000	42.120	86.270	25.815	-304.277	-204.141
1100	43.340	90.350	30.088	-302.780	-194.196

*Data above 298 K estimated.

$\text{SrCO}_3(\text{c})$
Strontium carbonate

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.460	23.200	0	-291.284	-272.149
400	23.440	29.620	2.235	-291.053	-265.640
600	25.290	39.530	7.133	-290.518	-253.059
800	27.180	47.040	12.367	-290.171	-240.626
1000	29.810	53.380	18.055	-289.915	-228.250
1197	32.950	59.110	24.312	-290.835	-215.926
1197	34.600	62.870	28.810	-286.337	-215.926
1200	34.600	62.960	28.914	-286.313	-215.755
1400	34.600	68.300	35.843	-284.753	-204.120

1197 K, transition point; $\Delta H^\circ = 4.498$ kcal/mol.

$\text{Tl}_2\text{CO}_3(\text{c})$
Thallium carbonate

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	27.200	37.100	0	-167.268	-146.857
300	27.390	37.270	.050	-167.266	-146.731
400	35.180	46.280	3.200	-166.707	-139.955

*Data except enthalpy of formation and entropy at 298 K estimated.

473 K, transition point; $\Delta H^\circ = \text{unknown}$.

$\text{ZnCO}_3(\text{c})$
Zinc carbonate

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	19.050	19.700	0	-194.810	-175.392
300	19.200	19.820	.035	-194.809	-175.272
400	22.500	25.790	2.120	-194.652	-168.774
500	25.800	31.170	4.535	-194.290	-162.345

*Data except enthalpy of formation and entropy at 298 K estimated.

Chlorides

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

Source of data: reference 25.

AgCl(c,l)
Silver chloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.640	23.000	0	-30.370	-26.251
400	13.250	26.800	1.320	-30.096	-24.885
600	14.740	32.420	4.100	-29.434	-22.414
730	20.160	35.600	6.215	-28.740	-20.954
730	14.630	39.630	9.160	-25.795	-20.954
800	14.460	40.960	10.180	-25.556	-20.497
1000	14.030	44.140	13.025	-24.989	-19.307
1200	13.630	46.660	15.790	-24.585	-18.208
1400	13.230	48.740	18.480	-27.083	-16.806

730 K, melting point; $\Delta H^\circ = 2.945$

$\text{AlCl}_3(\text{c,l})$
Aluminum trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	21.780	26.120	0	-168.650	-150.585
300	21.820	26.255	.040	-168.643	-150.473
400	23.920	32.820	2.327	-168.199	-144.480
466	25.300	36.560	3.944	-167.827	-140.611
466	30.000	54.704	12.394	-159.377	-140.611
500	30.000	56.836	13.423	-159.007	-139.242
600	30.000	62.306	16.423	-157.961	-135.387

453.8 K, vapor pressure (monomer and dimer) = 1 atm.

465.7 K, melting point; $\Delta H^\circ = 8.450$

467 K, triple point; vapor pressure = 2.3 atm.

AlCl(g)
Aluminum monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.284	54.457	0	-12.300	-18.572
400	8.560	56.934	.859	-12.472	-20.689
600	8.804	60.459	2.599	-12.869	-24.714
800	8.913	63.008	4.372	-13.378	-28.590
1000	8.977	65.004	6.162	-16.590	-32.136
1200	9.022	66.645	7.962	-17.207	-35.188
1400	9.059	68.039	9.770	-17.820	-38.137
1600	9.090	69.250	11.585	-18.430	-40.997
1800	9.119	70.323	13.406	-19.037	-43.782
2000	9.146	71.285	15.232	-19.642	-46.499

$\text{AlCl}_3(\text{g})$
Aluminum trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.179	75.140	0	-139.720	-136.270
400	18.168	80.341	1.805	-139.792	-135.081
600	19.035	87.901	5.540	-139.915	-132.697
800	19.383	93.432	9.386	-140.115	-130.267
1000	19.554	97.777	13.282	-143.006	-127.587
1200	19.649	101.351	17.203	-143.298	-124.475
1400	19.707	104.385	21.139	-143.589	-121.315
1600	19.745	107.019	25.085	-143.882	-118.113
1800	19.772	109.346	29.036	-144.179	-114.874
2000	19.790	111.431	32.993	-144.480	-111.600

$\text{AlCl}_2(\text{g})$
Aluminum dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	12.341	69.146	0	-67.000	-69.707
400	12.932	72.864	1.290	-67.164	-70.608
600	13.436	78.221	3.936	-67.515	-72.254
800	13.635	82.117	6.646	-67.970	-73.769
1000	13.731	85.171	9.383	-71.127	-74.971
1200	13.785	87.680	12.135	-71.690	-75.687
1400	13.818	89.808	14.896	-72.253	-76.309
1600	13.839	91.654	17.662	-72.819	-76.849
1800	13.854	93.285	20.431	-73.388	-77.319
2000	13.865	94.746	23.203	-73.961	-77.725

$(\text{AlCl}_3)_2(\text{g})$
Dimeric aluminum trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	37.968	113.514	0	-309.690	-291.828
400	40.172	125.015	3.992	-309.451	-285.763
600	42.011	141.717	12.242	-308.917	-274.032
800	42.729	153.915	20.726	-308.527	-262.472
1000	43.076	163.491	29.310	-313.515	-250.614
1200	43.269	171.363	37.946	-313.306	-238.053
1400	43.387	178.043	46.613	-313.093	-225.527
1600	43.464	183.842	55.298	-312.886	-213.035
1800	43.517	188.964	63.997	-312.683	-200.563
2000	43.555	193.551	72.704	-312.493	-188.111

*Data except enthalpy of formation at 298 K estimated.

$\text{AsCl}_3(\text{g})$
Arsenic trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.020	78.130	0	-62.500	-59.417
300	18.040	78.240	.033	-62.500	-59.398
400	18.770	83.540	1.878	-62.501	-58.364
500	19.140	87.770	3.776	-62.495	-57.326
600	19.360	91.280	5.702	-62.500	-56.292
700	19.490	94.280	7.645	-62.514	-55.261
800	19.580	96.890	9.598	-62.542	-54.226
900	19.640	99.200	11.559	-70.649	-52.950
1000	19.680	101.270	13.526	-70.715	-50.976

$(\text{BCl}_2)_2(\text{g})$
Dimeric boron dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	22.667	85.767	0	-117.200	-110.154
400	25.048	92.780	2.437	-117.097	-107.765
600	27.649	103.493	7.739	-117.003	-103.123
800	28.870	111.628	13.400	-116.998	-98.496
1000	29.511	118.143	19.242	-117.038	-93.865
1200	29.840	123.554	25.178	-117.142	-89.232
1400	30.099	128.174	31.173	-117.323	-84.560
1600	30.263	132.205	37.212	-117.594	-79.877
1800	30.370	135.775	43.275	-117.967	-75.114
2000	30.460	138.979	49.359	-118.445	-70.347

$\text{BCl}(\text{g})$
Boron monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.567	50.942	0	35.730	28.906
400	7.967	53.224	.792	35.778	26.565
600	8.442	56.556	2.439	35.681	21.972
800	8.678	59.020	4.153	35.450	17.437
1000	8.810	60.972	5.903	35.151	12.968
1200	8.894	62.586	7.674	34.800	8.558
1400	8.954	63.962	9.459	34.400	4.219
1600	9.000	65.161	11.255	33.948	-.070
1800	9.038	66.223	13.059	33.444	-4.279
2000	9.070	67.177	14.869	32.887	-8.454

$\text{BCl}_3(\text{g})$
Boron trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.912	69.328	0	-96.500	-92.917
400	16.353	73.926	1.597	-96.493	-91.696
600	17.935	80.897	5.047	-96.507	-89.294
800	18.684	86.172	8.717	-96.548	-86.883
1000	19.079	90.388	12.497	-96.601	-84.462
1200	19.308	93.888	16.338	-96.678	-82.031
1400	19.452	96.876	20.215	-96.792	-79.578
1600	19.547	99.480	24.115	-96.954	-77.116
1800	19.614	101.787	28.032	-97.165	-74.612
2000	19.662	103.856	31.960	-97.432	-72.102

$\text{BCl}_2(\text{g})$
Boron dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.323	65.144	0	-19.000	-22.114
400	12.170	68.599	1.200	-18.967	-23.185
600	13.011	73.718	3.730	-19.041	-25.284
800	13.375	77.518	6.374	-19.225	-27.337
1000	13.558	80.524	9.069	-19.471	-29.337
1200	13.663	83.006	11.792	-19.768	-31.288
1400	13.729	85.117	14.531	-20.117	-33.178
1600	13.778	86.954	17.282	-20.521	-35.025
1800	13.821	88.579	20.042	-20.979	-36.797
2000	13.864	90.038	22.811	-21.491	-38.539

$\text{BaCl}(\text{g})$
Barium monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.708	61.790	0	-34.000	-40.031
400	8.837	64.370	.894	-34.266	-42.057
600	8.948	67.977	2.674	-35.370	-45.742
800	9.005	70.559	4.470	-36.378	-49.058
1000	9.045	72.573	6.275	-37.416	-52.107
1200	9.081	74.225	8.088	-40.364	-54.574
1400	9.119	75.628	9.908	-41.388	-56.862
1600	9.169	76.849	11.736	-42.407	-59.003
1800	9.238	77.933	13.577	-43.416	-61.017
2000	9.332	78.911	15.433	-44.414	-62.919

$\text{BaCl}_2(\text{c,l})$
Barium dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.960	29.560	0	-205.200	-193.677
400	18.526	34.926	1.861	-204.922	-189.790
600	19.193	42.565	5.633	-204.895	-182.256
800	20.107	48.201	9.556	-204.657	-174.751
1000	21.500	52.828	13.709	-204.239	-167.317
1198	23.404	56.872	18.145	-205.425	-159.701
1198	29.600	60.248	22.190	-201.380	-159.701
1200	29.600	60.297	22.249	-201.359	-159.630
1235	29.600	61.148	23.285	-200.980	-158.419
1235	25.980	64.241	27.105	-197.160	-158.419
1400	25.980	67.499	31.392	-195.963	-153.319
1600*	25.980	70.968	36.588	-194.521	-147.324
1800	25.980	74.028	41.784	-193.085	-141.511
2000	25.980	76.765	46.980	-191.656	-135.856

*Data above 1400 K extrapolated.

1198 K, transition point; $\Delta H^\circ = 4.045$

1235 K, melting point; $\Delta H^\circ = 3.820$

$\text{BaCl}_2(\text{g})$
Barium dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.422	77.826	0	-119.200	-122.068
400	13.630	81.803	1.379	-119.404	-123.022
600	13.783	87.364	4.123	-120.405	-124.645
800	13.838	91.338	6.886	-121.327	-125.931
1000	13.864	94.429	9.656	-122.292	-126.971
1200	13.878	96.958	12.431	-125.177	-127.441
1400	13.886	99.098	15.207	-126.148	-127.743
1600	13.892	100.953	17.985	-127.124	-127.903
1800	13.896	102.589	20.764	-128.105	-127.941
2000	13.898	104.053	23.543	-129.093	-127.869

$\text{BeCl}_2(\text{g})$
Beryllium monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.563	51.984	0	14.500	7.622
400	7.963	54.265	.792	14.426	5.281
600	8.437	57.595	2.437	14.165	.761
800	8.672	60.058	4.151	13.824	-3.660
1000	8.804	62.009	5.900	13.425	-7.984
1200	8.888	63.622	7.669	12.951	-12.230
1400	8.947	64.997	9.453	12.398	-16.376
1600	8.992	66.194	11.247	8.264	-20.351
1800	9.029	67.256	13.049	7.748	-23.915
2000	9.060	68.208	14.858	7.236	-27.387

$\text{BeCl}_2(\beta, \alpha, \text{l})$
Beryllium dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.931	18.120	0	-118.500	-107.337
300	14.967	18.212	.028	-118.494	-107.269
400	16.462	22.741	1.606	-118.182	-103.572
500	17.408	26.524	3.302	-117.840	-99.962
600	18.035	29.757	5.077	-117.479	-96.415
676*	18.348	31.927	6.460	-117.197	-93.769
676	19.557	34.131	7.950	-115.707	-93.769
688	19.650	34.476	8.185	-115.648	-93.380
688	29.100	37.456	10.235	-113.598	-93.380
700	29.100	37.959	10.584	-113.425	-93.029

* $\alpha\text{-BeCl}_2$ metastable below 676 K

676 K, transition point; $\Delta H^\circ = 1.490$

688 K, melting point; $\Delta H^\circ = 2.050$

$\text{BeCl}_2(\alpha, \text{l})$
Beryllium dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	15.500	19.760	0	-117.200	-106.526
300	15.532	19.856	.029	-117.193	-106.461
400	16.911	24.526	1.655	-116.833	-102.937
500	17.954	28.415	3.400	-116.442	-99.510
600	18.862	31.770	5.242	-116.014	-96.158
688*	19.608	34.401	6.935	-115.598	-93.278
688	29.100	37.381	8.985	-113.548	-93.278
700	29.100	37.885	9.334	-113.375	-92.927

* $\alpha\text{-BeCl}_2$ metastable below 676 K

688 K, melting point; $\Delta H^\circ = 2.050$

$\text{BeCl}_2(\text{g})$
Beryllium dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.338	60.260	0	-86.100	-87.501
400	13.025	63.988	1.294	-86.094	-87.983
600	13.822	69.439	3.988	-86.168	-88.914
800	14.225	73.477	6.797	-86.296	-89.815
1000	14.446	76.677	9.666	-86.466	-90.675
1200	14.576	79.324	12.569	-86.705	-91.503
1400	14.658	81.577	15.493	-87.021	-92.270
1600	14.714	83.538	18.431	-90.918	-92.900
1800	14.752	85.274	21.378	-91.199	-93.148
2000	14.781	86.829	24.331	-91.481	-93.331

$(\text{BeCl}_2)_2(\text{g})$
Dimeric beryllium dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	27.574	91.150	0	-202.000	-196.046
400	29.054	99.481	2.891	-201.685	-194.065
600	30.406	111.561	8.859	-201.253	-190.354
800	30.973	120.396	15.004	-200.982	-186.774
1000	31.256	127.342	21.230	-200.834	-183.240
1200	31.416	133.056	27.498	-200.850	-179.735
1400	31.514	137.906	33.792	-201.036	-176.186
1600	31.579	142.119	40.102	-208.396	-172.430
1800	31.624	145.841	46.422	-208.532	-167.958
2000	31.656	149.175	52.751	-208.673	-163.407

*Data except enthalpy of formation at 298 K estimated.

$\text{BiCl}_3(\text{c,l})$
Bismuth trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	24.000	42.300	0	-90.600	-75.336
300	24.025	42.449	.044	-90.590	-75.241
400	25.427	49.553	2.517	-89.982	-70.217
500	26.826	55.377	5.130	-89.307	-65.349
507	26.920	55.735	5.310	-89.260	-65.028
507	34.300	66.905	10.970	-83.600	-65.028
600	34.300	72.702	14.170	-84.979	-61.454
700	34.300	77.989	17.600	-83.559	-57.644

*Heat capacity at 298 K estimated.

506.7 K, melting point; $\Delta H^\circ = 5.660$

$\text{BiCl}_3(\text{g})$
Bismuth trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.020	85.400	0.000	-63.400	-60.986
300	19.030	85.520	0.035	-63.399	-60.972
400	19.390	91.050	1.960	-63.340	-60.173
500	19.550	95.390	3.910	-63.327	-59.375
600	19.640	98.970	5.865	-66.084	-58.320
700	19.700	102.000	7.835	-66.124	-57.017
800	19.730	104.630	9.805	-66.160	-55.711

$\text{BrCl}(\text{g})$
Bromine monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.363	57.337	0	3.500	-0.228
400	8.611	59.833	.866	-.194	-.743
600	8.826	63.373	2.613	-.193	-1.018
800	8.921	65.926	4.389	-.193	-1.292
1000	8.977	67.923	6.179	-.194	-1.567
1200	9.016	69.563	7.978	-.196	-1.842
1400	9.048	70.956	9.785	-.198	-2.116
1600	9.076	72.166	11.597	-.201	-2.390
1800	9.102	73.236	13.415	-.204	-2.663
2000	9.126	74.197	15.238	-.207	-2.936

$\text{CCl}(\text{g})$
Carbon monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.709	53.634	0	120.000	112.362
400	8.029	55.945	.802	120.132	109.732
600	8.459	59.291	2.455	120.229	104.503
800	8.684	61.758	4.172	120.181	99.265
1000	8.814	63.711	5.923	120.046	94.049
1200	8.897	65.326	7.694	119.857	88.867
1400	8.957	66.702	9.480	119.631	83.720
1600	9.003	67.901	11.276	119.378	78.608
1800	9.041	68.964	13.080	119.103	73.526
2000	9.074	69.918	14.892	118.812	68.479

$\text{CCl}_2(\text{g})$
Carbon dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.054	63.392	0	57.000	54.397
400	11.984	66.781	1.177	57.084	53.495
600	12.949	71.848	3.683	57.174	51.677
800	13.546	75.657	6.334	57.178	49.842
1000	14.132	78.742	9.101	57.167	48.008
1200	14.713	81.371	11.986	57.193	46.175
1400	15.206	83.677	14.930	57.272	44.333
1600	15.557	85.732	18.059	57.395	42.478
1800	15.762	87.578	21.193	57.540	40.604
2000	15.843	89.244	24.355	57.685	38.715

$\text{CCl}_3(\text{g})$
Carbon trichloride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	15.212	70.918	0	19.000	22.097
400	16.658	75.606	1.628	19.113	23.138
600	18.156	82.686	5.131	19.339	25.103
800	18.834	88.014	8.838	19.517	26.994
1000	19.184	92.258	12.643	19.652	28.846
1200	19.385	95.775	16.502	19.753	30.675
1400	19.509	98.773	20.392	19.825	32.489
1600	19.592	101.384	24.303	19.873	34.296
1800	19.650	103.695	28.227	19.898	36.097
2000	19.691	105.768	32.162	19.902	37.899

*Data except enthalpy of formation at 298 K estimated.

$\text{CCl}_4(\text{l}, \text{g})$
Carbon tetrachloride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	31.490	51.720	0	-32.370	-15.604
350	31.818	56.793	1.640	-31.701	-12.746
350	21.080	77.322	8.825	-24.516	-12.746
400	21.918	80.180	9.910	-24.398	-11.057
600	23.823	89.486	14.513	-23.933	-4.485
800	24.638	96.466	19.370	-23.487	1.928
1000	25.047	102.012	24.342	-23.077	8.232
1200	25.279	106.601	29.377	-22.698	14.459
1400	25.423	110.510	34.448	-22.348	20.622
1600	25.517	113.911	39.543	-22.023	26.740
1800	25.582	116.920	44.653	-21.722	32.818
2000	25.629	119.618	49.775	-21.444	38.866

*Heat capacities extrapolated from 298 to 350 K.
350 K, boiling point; $\Delta \text{H}^\circ = 7.195$

$\text{CCl}_4(\text{g})$
Carbon tetrachloride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	19.933	74.019	0	-24.600	-14.483
400	21.918	80.180	2.140	-24.398	-11.057
600	23.823	89.486	6.743	-23.933	-4.485
800	24.638	96.466	11.600	-23.487	1.928
1000	25.047	102.012	16.572	-23.077	8.232
1200	25.279	106.601	21.607	-22.698	14.459
1400	25.423	110.510	26.678	-22.348	20.622
1600	25.517	113.911	31.773	-22.023	26.740
1800	25.582	116.920	36.883	-21.722	32.818
2000	25.629	119.618	42.005	-21.444	38.866

$\text{C}_2\text{Cl}_2(\text{g})$
Dichloroacetylene (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	15.672	64.989	0	50.100	47.430
400	16.782	69.762	1.657	50.416	46.468
600	18.048	76.831	5.153	50.802	44.400
800	18.827	82.138	8.846	50.965	42.235
1000	19.352	86.399	12.667	51.014	40.043
1200	19.713	89.962	16.576	51.002	37.850
1400	19.966	93.020	20.545	50.947	35.662
1600	20.148	95.699	24.557	50.861	33.485
1800	20.282	98.080	28.601	50.747	31.320
2000	20.382	100.223	32.668	50.607	29.169

$\text{C}_2\text{Cl}_4(\text{g})$
Tetrachloroethylene

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	22.836	82.052	0	-2.970	5.161
400	25.194	89.115	2.454	-2.702	7.898
600	27.905	99.906	7.795	-2.193	13.088
800	29.304	108.146	13.530	-1.752	18.110
1000	30.089	114.777	19.476	-1.362	23.027
1200	30.562	120.308	25.545	-1.011	27.873
1400	30.866	125.044	31.690	-.696	32.660
1600	31.072	129.180	37.885	-.413	37.408
1800	31.217	132.848	44.115	-.161	42.121
2000	31.323	136.143	50.369	.059	46.809

394.2 K, boiling point; $\Delta \text{H}^\circ = 8.3$

$\text{C}_2\text{Cl}_6(\text{g})$
Hexachloroethane (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	33.206	95.069	0	-32.080	-11.941
400	36.677	105.355	3.573	-31.538	-5.144
600	40.142	120.981	11.305	-30.360	7.804
800	41.714	132.769	19.507	-29.216	20.346
1000	42.551	142.176	27.941	-28.122	32.606
1200	43.024	149.979	36.502	-27.076	44.654
1400	43.296	156.633	45.136	-26.078	56.529
1600	43.435	162.424	53.811	-25.129	68.268
1800	43.478	167.543	62.502	-24.236	79.887
2000	43.500	172.125	71.200	-23.399	91.415

457.6 K, sublimation point; $\Delta \text{H}^\circ = 12.2$

CaCl(g)
Calcium monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.524	57.707	0	-23.400	-29.698
400	8.719	60.243	.879	-23.570	-31.823
600	8.885	63.815	2.642	-23.995	-35.863
800	8.961	66.382	4.428	-24.790	-39.708
1000	9.009	68.387	6.225	-25.642	-43.351
1200	9.045	70.033	8.030	-28.549	-46.639
1400	9.076	71.430	9.843	-29.039	-49.613
1600	9.105	72.643	11.661	-29.528	-52.526
1800	9.133	73.717	13.485	-66.554	-54.434
2000	9.162	74.681	15.314	-66.638	-53.084

$\text{CaCl}_2(\text{c,l})$
Calcium dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.360	25.000	0	-190.200	-178.802
400	18.063	30.211	1.808	-189.864	-174.958
600	18.684	37.668	5.490	-189.231	-167.646
800	19.390	43.120	9.209	-188.894	-160.510
1000	20.637	47.580	13.284	-188.441	-153.473
1045	20.960	48.496	14.220	-188.358	-151.902
1045	25.516	54.936	20.950	-181.628	-151.902
1200	24.961	58.427	24.862	-182.473	-147.410
1400	24.244	62.221	29.783	-180.758	-141.702
1600	23.528	65.412	34.560	-179.195	-136.240
1800	22.811	68.141	39.194	-214.321	-130.018

1045 K, melting point; $\Delta H^\circ = 6.730$

$\text{CaCl}_2(\text{g})$
Calcium dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.179	69.347	0	-112.700	-114.524
400	14.476	73.561	1.461	-112.711	-115.145
600	14.705	79.482	4.383	-112.838	-116.341
800	14.790	83.726	7.334	-113.349	-117.443
1000	14.830	87.031	10.297	-113.928	-118.411
1200	14.853	89.737	13.265	-116.570	-119.079
1400	14.866	92.028	16.237	-116.804	-119.478
1600	14.875	94.013	19.211	-117.044	-119.850
1800	14.881	95.766	22.187	-153.828	-119.250
2000	14.885	97.334	25.163	-153.678	-115.416

$\text{CdCl}_2(\text{c,l})$
Cadmium dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.840	27.550	0	-93.570	-82.205
300	17.855	27.660	.033	-93.563	-82.133
400	18.575	32.897	1.855	-93.206	-78.379
500	19.198	37.110	3.744	-92.834	-74.715
600	19.776	40.662	5.693	-93.927	-71.108
700	20.333	43.752	7.699	-93.509	-67.340
800	20.878	46.503	9.759	-93.045	-63.633
841	21.100	47.552	10.620	-92.839	-62.130
841	26.600	56.589	18.220	-85.239	-62.130
900	26.600	58.392	19.789	-84.615	-60.526
1000	26.600	61.195	22.449	-83.559	-57.906

841 K, melting point; $\Delta H^\circ = 7.600$

$\text{CeCl}_3(\text{c,l})$
Cerium trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	21.000	36.000	0	-251.800	-233.573
400	24.827	42.802	2.367	-251.372	-227.402
600	27.125	53.402	7.610	-250.133	-215.676
800	28.327	61.369	13.155	-248.801	-204.390
1000	29.947	67.851	18.971	-248.101	-193.455
1080	30.806	70.188	21.400	-248.772	-189.091
1080	38.200	81.947	34.100	-236.072	-189.091
1200	38.200	85.971	38.684	-234.188	-183.976

1080 K, melting point; $\Delta H^\circ = 12.700$

$\text{CeCl}_3(\text{g})$
Cerium trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.737	88.576	0	-172.800	-170.248
400	19.257	94.162	1.937	-172.803	-169.376
600	19.904	102.099	5.857	-172.886	-167.647
800	20.413	107.898	9.891	-173.064	-165.877
1000	20.739	112.492	14.009	-174.063	-164.057
1200	20.886	116.288	18.174	-175.698	-161.867
1400	20.911	119.511	22.355	-176.028	-159.535
1600	20.868	122.301	26.534	-176.372	-157.160
1800	20.794	124.754	30.701	-176.737	-154.736
2000	20.710	126.941	34.851	-177.130	-152.270

CoCl(g)
Cobalt monochloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.398	58.692	0	46.100	38.686
400	8.627	61.195	.868	45.920	36.175
600	8.819	64.736	2.616	45.460	31.403
800	8.900	67.286	4.389	44.764	26.818
1000	8.945	69.277	6.174	44.002	22.404
1200	8.976	70.911	7.966	42.988	18.180
1400	9.002	72.296	9.764	41.557	14.142
1600	9.028	73.500	11.567	40.533	10.292
1800	9.060	74.565	13.375	35.840	6.629
2000	9.100	75.522	15.191	34.440	3.458

CoCl₂(c,l)
Cobalt dichloride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.760	26.115	0	-74.700	-64.457
400	19.506	31.743	1.952	-74.218	-61.037
600	20.251	39.809	5.936	-73.303	-54.641
800	20.731	45.704	10.036	-72.555	-48.536
994*	21.121	50.247	14.100	-71.822	-42.803
994	24.000	60.810	24.600	-61.322	-42.803
1000	24.000	60.954	24.744	-61.285	-42.691
1200	24.000	65.330	29.544	-60.190	-39.075

*Enthalpy of fusion and heat capacity of liquid estimated.

994 K, melting point; ΔH° = 10.500

1365 K, boiling point; ΔH° = 34.8

CoCl₂(g)
Cobalt dichloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	14.250	71.316	0	-22.400	-25.634
400	14.497	75.542	1.465	-22.405	-26.744
600	14.787	81.478	4.395	-22.544	-28.883
800	15.031	85.766	7.378	-22.913	-30.943
1000	15.233	89.143	10.405	-23.324	-32.919
1200	15.374	91.934	13.467	-23.967	-34.777
1400	15.455	94.311	16.551	-25.015	-36.513
1600	15.494	96.377	19.646	-25.654	-38.115
1800	15.505	98.203	22.746	-29.965	-39.579
2000	15.502	99.837	25.847	-30.994	-40.592

(CoCl₂)₂(g)
Dimeric cobalt dichloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	30.457	107.620	0	-83.800	-79.829
400	31.014	116.659	3.134	-83.606	-78.514
600	31.515	129.341	9.393	-83.485	-75.994
800	31.831	138.453	15.729	-83.853	-73.451
1000	32.066	145.582	22.120	-84.338	-70.824
1200	32.224	151.444	28.550	-85.318	-68.028
1400	32.317	156.419	35.005	-87.127	-65.039
1600	32.362	160.738	41.474	-88.126	-61.822
1800	32.378	164.551	47.948	-96.474	-58.363
2000	32.378	167.962	54.424	-98.258	-54.030

CoCl₃(g)
Cobalt trichloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	18.221	79.850	0	-39.100	-36.934
400	19.375	85.389	1.923	-39.069	-36.202
600	20.041	93.411	5.884	-39.038	-34.773
800	20.127	99.193	9.904	-39.252	-33.325
1000	20.127	103.684	13.929	-39.557	-31.824
1200	20.132	107.354	17.955	-40.135	-30.223
1400	20.152	110.459	21.983	-41.142	-28.510
1600	20.181	113.151	26.016	-41.750	-26.666
1800	20.215	115.530	30.056	-46.031	-24.687
2000	20.249	117.662	34.102	-47.028	-22.263

*Data except enthalpy of formation at 298 K estimated.

CrCl₂(c,l)
Chromium dichloride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	17.010	27.560	0	-94.500	-85.144
400	17.940	32.698	1.783	-94.153	-82.002
600	19.060	40.203	5.492	-93.446	-76.076
800	19.810	45.792	9.382	-92.719	-70.394
1000	20.450	50.282	13.408	-91.959	-64.903
1088	20.730	52.108	15.220	-91.626	-62.534
1088	24.000	59.095	22.920	-83.926	-62.534
1200	24.000	61.447	25.608	-83.166	-60.367

*Data above 298 K except temperature and enthalpy of fusion estimated.

1088 K, melting point; ΔH° = 7.700

$\text{CrCl}_3(\text{c})$
Chromium trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	21.940	29.380	0	-133.000	-116.242
400*	23.400	36.050	2.315	-132.544	-110.589
600	25.010	45.879	7.174	-131.548	-99.819
800	25.980	53.216	12.280	-130.486	-89.402
1000	26.710	59.094	17.551	-129.374	-79.261
1200	27.340	64.020	22.956	-128.274	-69.337

*Data above 298 K estimated.

1280 K, sublimation point; $\Delta H^\circ(\text{at } 298 \text{ K}) = 56.5$

$\text{CrCl}_4(\text{g})$
Chromium tetrachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	22.973	87.068	0	-102.000	-94.498
400	24.093	94.006	2.407	-101.874	-91.956
600	25.006	103.981	7.333	-101.672	-87.041
800	25.358	111.229	12.374	-101.558	-82.184
1000	25.527	116.908	17.465	-101.517	-77.349
1200	25.620	121.571	22.580	-101.606	-72.505

* CrCl_4 stable only in presence of $\text{Cl}_2(\text{g})$.

$\text{CsCl}(\text{c,l})$
Cesium chloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.540	24.180	0	-105.890	-99.082
400	12.993	27.933	1.302	-106.286	-96.607
600	13.562	33.320	3.963	-105.978	-91.830
743	13.786	36.245	5.920	-105.707	-88.488
743	15.830	37.725	7.020	-104.607	-88.488
800	15.830	38.895	7.922	-104.381	-87.260
918	15.830	41.073	9.790	-103.910	-84.767
918	17.740	46.367	14.650	-99.050	-84.767
1000	17.740	47.885	16.105	-114.650	-82.712
1200	17.740	51.119	19.653	-112.993	-76.478
1400	17.740	53.854	23.201	-111.343	-70.523

743 K, transition point; $\Delta H^\circ = 1.100$

918 K, melting point; $\Delta H^\circ = 4.860$

$\text{CsCl}(\text{g})$
Cesium chloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.832	61.175	0	-57.400	-61.622
400	8.922	63.785	.905	-58.194	-62.855
600	9.011	67.421	2.699	-58.751	-65.064
800	9.067	70.021	4.507	-59.306	-67.086
1000	9.112	72.049	6.325	-59.939	-68.166
1200	9.154	73.715	8.152	-76.004	-66.604
1400	9.194	75.129	9.986	-76.068	-65.033
1600	9.233	76.359	11.829	-76.128	-63.452
1800	9.271	77.449	13.680	-76.189	-61.864
2000	9.309	78.427	15.538	-76.257	-60.267

$(\text{CsCl})_2(\text{g})$
Dimeric cesium chloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.507	91.614	0	-157.700	-156.980
400	19.667	97.372	1.996	-159.101	-156.345
600	19.780	105.372	5.943	-159.858	-154.802
800	19.820	111.069	9.904	-160.621	-153.004
1000	19.839	115.494	13.870	-193.559	-149.407
1200	19.849	119.112	17.838	-193.374	-140.593
1400	19.855	122.172	21.809	-193.199	-131.809
1600	19.859	124.823	25.780	-193.034	-123.050
1800	19.861	127.162	29.752	-192.886	-114.311
2000	19.863	129.255	33.725	-192.764	-105.586

$\text{CuCl}(\text{c,l})$
Copper monochloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.556	20.971	0	-37.200	-33.146
400	13.151	24.748	1.311	-36.917	-31.803
600	15.602	30.388	4.106	-36.221	-29.385
685	27.078	32.978	5.778	-35.464	-28.457
685	19.000	34.679	6.943	-34.299	-28.457
696	19.000	34.982	7.152	-34.209	-28.364
696	14.829	37.414	8.845	-32.516	-28.364
800	14.100	39.426	10.347	-32.152	-27.771
1000	13.454	42.490	13.090	-31.640	-26.740
1200	13.291	44.924	15.760	-31.275	-25.795
1400	13.356	46.976	18.422	-34.163	-24.808
1600	13.542	48.770	21.110	-33.942	-23.485

685 K, transition point; $\Delta H^\circ = 1.165$

696 K, melting point; $\Delta H^\circ = 1.693$

CuCl(g)
Copper monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.427	56.664	0	21.800	15.212
400	8.656	59.176	.871	21.643	12.986
600	8.853	62.729	2.625	21.299	8.729
800	8.942	65.290	4.406	20.907	4.597
1000	8.996	67.291	6.200	20.471	.569
1200	9.036	68.935	8.003	19.968	-3.365
1400	9.069	70.331	9.814	16.229	-7.113
1600	9.099	71.544	11.631	15.579	-10.403
1800	9.126	72.617	13.453	14.931	-13.612
2000	9.152	73.580	15.281	14.286	-16.749

$(\text{CuCl})_3(\text{g})$
Trimeric copper monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	29.773	102.631	0	-58.900	-58.579
400	30.621	111.515	3.081	-58.902	-58.470
600	31.256	124.076	9.281	-58.999	-58.239
800	31.488	133.104	15.559	-59.237	-57.955
1000	31.598	140.144	21.869	-59.620	-57.594
1200	31.657	145.910	28.195	-60.210	-57.134
1400	31.694	150.793	34.530	-70.525	-56.272
1600	31.717	155.027	40.871	-71.585	-54.162
1800	31.733	158.764	47.216	-72.650	-51.924
2000	31.745	162.108	53.564	-73.723	-49.560

$\text{CuCl}_2(\text{c})$
Copper dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.178	25.830	0	-52.100	-41.550
300	17.206	25.936	.032	-52.094	-41.484
400	18.246	31.047	1.811	-51.739	-38.000
500	18.798	35.183	3.665	-51.350	-34.611
600	19.158	38.644	5.564	-50.946	-31.300
675	19.366	40.913	7.009	-50.637	-28.863
675	19.700	41.163	7.178	-50.468	-28.863
700	19.700	41.880	7.670	-50.357	-28.065
800	19.700	44.510	9.640	-49.924	-24.911
900	19.700	46.831	11.610	-49.507	-21.809

675 K, transition point; $\Delta H^\circ = 0.169$

$\text{DyCl}_3(\text{c,l})$
Dysprosium trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.200	36.800	0	-236.600	-218.402
400	24.131	43.762	2.415	-236.137	-212.258
600	25.146	53.755	7.351	-235.131	-200.532
800	25.952	61.100	12.461	-234.049	-189.159
924	26.455	64.876	15.710	-233.350	-182.248
924	34.600	71.483	21.815	-227.245	-182.248
1000	34.600	74.218	24.445	-226.203	-178.594
1200	34.600	80.526	31.365	-223.583	-169.321

*Entropy and heat capacity at 298 K estimated.

924 K, melting point; $\Delta H^\circ = 6.105$

$\text{DyCl}_3(\text{g})$
Dysprosium trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.677	89.956	0	-161.900	-159.551
400	19.174	95.523	1.931	-161.921	-158.747
600	19.577	103.386	5.812	-161.969	-157.149
800	19.813	109.051	9.752	-162.057	-155.529
1000	20.033	113.496	13.736	-162.212	-153.881
1200	20.234	117.167	17.764	-162.484	-152.192
1400	20.396	120.299	21.827	-162.967	-150.447
1600	20.510	123.030	25.919	-163.729	-148.611
1800	20.581	125.450	30.028	-168.231	-146.385
2000	20.617	127.621	34.149	-169.236	-143.916

$\text{ErCl}_3(\text{c,l})$
Erbium trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.400	36.500	0	-237.700	-219.535
400	24.200	43.496	2.427	-237.229	-213.400
600	25.300	53.512	7.374	-236.240	-201.699
800	26.200	60.914	12.525	-235.157	-190.350
1000	27.200	66.867	17.864	-233.986	-179.275
1049	27.400	68.171	19.200	-233.687	-176.602
1049	33.700	75.607	27.000	-225.887	-176.602
1200	33.700	80.139	32.089	-224.039	-169.637

*Data estimated 298-1000 K except enthalpy of formation at 298 K.

1049 K, melting point; $\Delta H^\circ = 7.800$

$\text{ErCl}_3(\text{g})$
Erbium trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.671	89.894	0	-161.100	-158.855
400	19.170	95.460	1.930	-161.126	-158.083
600	19.548	103.319	5.809	-161.204	-156.548
800	19.687	108.964	9.735	-161.347	-154.980
1000	19.753	113.365	13.680	-161.570	-153.358
1200	19.789	116.970	17.634	-161.894	-151.689
1400	19.811	120.023	21.594	-162.339	-149.950
1600	19.825	122.669	25.558	-162.925	-148.142
1800	19.835	125.005	29.524	-168.424	-146.245
2000	19.842	127.095	33.492	-169.048	-143.736

$\text{EuCl}_3(\text{c,l})$
Europium trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	25.570	34.430	0	-223.700	-204.587
400	26.600	42.102	2.662	-222.982	-198.165
600	28.100	53.179	8.135	-221.480	-186.075
800	29.500	61.450	13.892	-219.878	-174.512
897	30.100	64.857	16.780	-219.075	-169.057
897	34.000	78.458	28.980	-206.875	-169.057
1000	34.000	82.154	32.482	-205.656	-164.784
1200	34.000	88.353	39.282	-205.604	-156.598

*Data above 298 K except temperature and enthalpy of fusion estimated.

897 K, melting point; $\Delta H^\circ = 12.200$

$\text{EuCl}_3(\text{g})$
Europium trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	21.030	86.894	0	-157.300	-153.829
400	21.523	93.151	2.170	-157.075	-152.676
600	21.959	101.974	6.525	-156.691	-150.562
800	22.161	108.322	10.939	-156.431	-148.563
1000	22.244	113.278	15.381	-156.357	-146.609
1200	22.220	117.333	19.829	-158.657	-144.427
1400	22.112	120.751	24.264	-158.753	-142.047
1600	21.951	123.694	28.671	-158.889	-139.651
1800	21.768	126.269	33.043	-159.069	-137.239
2000	21.581	128.552	37.378	-193.070	-130.995

$\text{FeCl}(\text{g})$
Iron monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	9.136	61.537	0	60.000	51.541
400	9.366	64.257	.943	59.883	48.667
600	9.516	68.093	2.836	59.496	43.134
800	9.515	70.831	4.740	58.858	37.768
1000	9.514	72.954	6.643	57.771	32.606
1200	9.532	74.690	8.547	56.224	27.722
1400	9.559	76.161	10.456	55.569	23.023
1600	9.584	77.439	12.371	54.835	18.425
1800	9.605	78.569	14.290	53.717	13.942
2000	9.619	79.582	16.212	49.231	9.925

$\text{FeCl}_2(\text{c,l})$
Iron dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.290	28.190	0	-81.650	-72.222
400	19.039	33.681	1.905	-81.227	-69.068
600	19.846	41.567	5.800	-80.473	-63.156
800	20.448	47.361	9.831	-79.866	-57.481
950	20.878	50.911	12.930	-79.588	-53.312
950	24.400	61.721	23.200	-69.318	-53.312
1000	24.400	62.972	24.420	-69.159	-52.473
1200	24.400	67.421	29.300	-68.629	-49.183

950 K, melting point; $\Delta H^\circ = 10.270$

1297 K, boiling point to mixture of monomer and dimer;
 $\Delta H^\circ = 26.3/\text{mol FeCl}_2$.

$\text{FeCl}_2(\text{g})$
Iron dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.759	71.503	0	-33.700	-37.186
400	14.210	75.617	1.427	-33.755	-38.370
600	14.579	81.462	4.312	-34.011	-40.631
800	14.750	85.681	7.246	-34.501	-42.772
1000	14.901	88.988	10.211	-35.418	-44.748
1200	15.073	91.720	13.208	-36.771	-46.484
1400	15.261	94.057	16.241	-37.205	-48.068
1600	15.445	96.107	19.312	-37.690	-49.586
1800	15.612	97.936	22.418	-38.531	-51.021
2000	15.752	99.589	25.555	-42.715	-52.021

(FeCl₂)₂(g)
Dimeric iron dichloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	30.084	110.990	0	-103.100	-100.527
400	30.795	119.944	3.105	-102.959	-99.673
600	31.337	132.553	9.328	-103.018	-98.035
800	31.567	141.602	15.620	-103.574	-96.308
1000	31.745	148.665	21.952	-105.006	-94.355
1200	31.932	154.470	28.319	-107.339	-92.001
1400	32.128	159.407	34.725	-107.867	-89.402
1600	32.318	163.709	41.170	-108.534	-86.718
1800	32.489	167.526	47.651	-109.947	-83.905
2000	32.631	170.956	54.163	-118.077	-80.245

FeCl₃(c,l)
Iron trichloride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	23.170	35.330	0	-95.420	-80.177
400	25.175	42.421	2.463	-94.862	-75.053
577	28.571	52.231	7.220	-93.631	-66.514
577	32.000	70.082	17.520	-83.331	-66.514
600	32.000	71.333	18.256	-83.071	-65.849

577 K, melting point; ΔH° = 10.300
605 K, boiling point to mixture of monomer and dimer;
ΔH° = 10/mol FeCl₃.

FeCl₃(g)
Iron trichloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.572	82.243	0	-60.700	-59.444
400	19.117	87.787	1.923	-60.681	-59.020
600	19.526	95.632	5.795	-60.812	-58.169
800	19.675	101.272	9.717	-61.196	-57.240
1000	19.746	105.671	13.660	-62.027	-56.170
1200	19.784	109.275	17.613	-63.322	-54.875
1400	19.807	112.326	21.573	-63.732	-53.434
1600	19.823	114.972	25.536	-64.232	-51.929
1800	19.833	117.308	29.501	-65.124	-50.338
2000	19.841	119.398	33.469	-69.391	-48.300

(FeCl₃)₂(g)
Dimeric iron trichloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	41.508	128.350	0	-156.500	-143.214
400	42.446	140.698	4.282	-156.027	-138.753
600	43.139	158.066	12.853	-155.460	-130.257
800	43.390	170.516	21.510	-155.415	-121.882
1000	43.508	180.212	30.201	-156.272	-113.430
1200	43.572	188.151	38.909	-158.061	-104.689
1400	43.611	194.871	47.628	-158.082	-95.792
1600	43.637	200.696	56.353	-158.283	-86.880
1800	43.654	205.836	65.082	-159.268	-77.892
2000	43.666	210.437	73.814	-167.005	-68.107

GaCl(g)
Gallium monochloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.539	57.395	0	-16.860	-23.119
400	8.729	59.935	.880	-18.410	-24.797
600	8.892	63.510	2.645	-18.789	-27.905
800	8.969	66.079	4.432	-19.155	-30.888
1000	9.019	68.087	6.231	-19.518	-33.780
1200	9.060	69.734	8.039	-19.878	-36.599
1400	9.096	71.134	9.855	-20.235	-39.358
1600	9.131	72.351	11.677	-20.590	-42.066
1800	9.165	73.428	13.507	-20.940	-44.728
2000	9.200	74.396	15.343	-21.288	-47.354

GaCl₂(g)
Gallium dichloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	12.699	71.920	0	-57.660	-60.305
400	13.170	75.727	1.321	-59.191	-60.750
600	13.564	81.157	4.002	-59.515	-61.456
800	13.711	85.082	6.731	-59.821	-62.058
1000	13.782	88.150	9.482	-60.124	-62.581
1200	13.822	90.667	12.242	-60.431	-63.046
1400	13.851	92.800	15.010	-60.739	-63.456
1600	13.880	94.651	17.783	-61.050	-63.823
1800	13.913	96.288	20.562	-61.361	-64.151
2000	13.955	97.756	23.349	-61.671	-64.443

$\text{GaCl}_3(\text{g})$
Gallium trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.909	77.686	0	-103.150	-99.570
400	18.688	83.071	1.869	-104.555	-97.907
600	19.313	90.790	5.680	-104.611	-94.567
800	19.551	96.383	9.570	-104.638	-91.216
1000	19.664	100.759	13.492	-104.662	-87.859
1200	19.727	104.350	17.432	-104.687	-84.496
1400	19.765	107.394	21.381	-104.717	-81.128
1600	19.790	110.035	25.337	-104.752	-77.756
1800	19.807	112.367	29.297	-104.792	-74.378
2000	19.819	114.455	33.260	-104.840	-70.996

$(\text{GaCl}_3)_2(\text{g})$
Dimeric gallium trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	39.430	119.628	0	-228.860	-211.043
400	41.165	131.489	4.115	-231.294	-204.136
600	42.525	148.488	12.509	-230.632	-190.691
800	43.034	160.802	21.072	-229.903	-177.489
1000	43.277	170.434	29.706	-229.161	-164.471
1200	43.410	178.337	38.376	-228.422	-151.604
1400	43.491	185.035	47.066	-227.690	-138.859
1600	43.544	190.846	55.770	-226.968	-126.219
1800	43.581	195.977	64.483	-226.255	-113.665
2000	43.607	200.571	73.202	-225.557	-101.191

$\text{GaCl}_3(\text{c,l})$
Gadolinium trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	23.370	36.190	0	-241.000	-223.115
400	24.332	43.205	2.434	-240.587	-217.070
600	25.588	53.314	7.428	-239.535	-205.523
800	27.002	60.860	12.681	-238.361	-194.359
875	27.637	63.308	14.730	-237.871	-190.255
875	33.300	74.428	24.460	-228.141	-190.255
1000	33.300	78.874	28.622	-226.610	-184.957
1200	33.300	84.946	35.282	-224.244	-176.846

875 K, melting point; $\Delta H^\circ = 9.730$

$\text{GdCl}_3(\text{g})$
Gadolinium trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.691	88.760	0	-166.500	-164.289
400	19.182	94.331	1.932	-166.589	-163.522
600	19.554	102.193	5.812	-166.650	-161.967
800	19.691	107.840	9.739	-166.803	-160.385
1000	19.755	112.241	13.684	-167.048	-158.761
1200	19.791	115.847	17.639	-167.387	-157.071
1400	19.812	118.899	21.599	-167.841	-155.307
1600	19.826	121.546	25.563	-171.626	-153.430
1800	19.836	123.881	29.530	-172.165	-151.113
2000	19.843	125.972	33.497	-172.715	-148.757

$\text{GeCl}(\text{g})$
Germanium monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.839	58.736	0	17.454	10.101
400	9.362	61.413	.929	17.376	7.599
600	9.731	65.301	2.849	17.245	2.746
800	9.714	68.103	4.797	17.090	-2.070
1000	9.620	70.260	6.731	16.864	-6.838
1200	9.536	72.006	8.646	16.545	-11.545
1400	9.475	73.472	10.546	7.391	-14.810
1600	9.436	74.734	12.437	7.055	-17.960
1800	9.415	75.844	14.322	6.710	-21.061
2000	9.408	76.836	16.204	6.359	-24.119

$\text{GeCl}_2(\text{g})$
Germanium dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.855	70.678	0	-40.870	-43.839
400	13.284	74.523	1.334	-40.966	-44.841
600	13.619	79.985	4.030	-41.182	-46.727
800	13.744	83.923	6.768	-41.429	-48.545
1000	13.803	86.996	9.523	-41.726	-50.294
1200	13.835	89.516	12.288	-42.093	-51.969
1400	13.855	91.650	15.057	-51.281	-52.194
1600	13.868	93.501	17.829	-51.643	-52.302
1800	13.877	95.135	20.604	-52.008	-52.357
2000	13.883	96.598	23.380	-52.379	-52.367

$\text{GeCl}_3(\text{g})$
Germanium trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.226	80.089	0	-76.684	-74.515
400	18.903	85.552	1.895	-76.642	-73.783
600	19.423	93.335	5.738	-76.572	-72.363
800	19.616	98.953	9.644	-76.533	-70.973
1000	19.707	103.341	13.577	-76.543	-69.587
1200	19.757	106.939	17.524	-76.627	-68.185
1400	19.787	109.987	21.479	-85.532	-65.379
1600	19.807	112.630	25.438	-85.614	-62.496
1800	19.821	114.964	29.401	-85.701	-59.596
2000	19.830	117.053	33.366	-85.797	-56.680

$\text{DCl}(\text{g})$
Deuterium chloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	6.972	46.040	0	-22.310	-22.932
400	7.028	48.095	.712	-22.376	-23.135
600	7.316	50.993	2.144	-22.507	-23.484
800	7.682	53.148	3.644	-22.607	-23.793
1000	7.999	54.898	5.213	-22.673	-24.083
1200	8.244	56.379	6.838	-22.715	-24.361
1400	8.429	57.664	8.507	-22.745	-24.632
1600	8.570	58.799	10.207	-22.770	-24.899
1800	8.680	59.815	11.932	-22.791	-25.164
2000	8.768	60.734	13.678	-22.811	-25.425

$\text{GeCl}_4(\text{g})$
Germanium tetrachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	22.925	83.241	0	-119.500	-110.326
400	24.080	90.160	2.401	-119.374	-107.214
600	25.006	100.132	7.326	-119.083	-101.189
800	25.358	107.381	12.367	-118.791	-95.275
1000	25.526	113.059	17.457	-118.537	-89.430
1200	25.619	117.722	22.572	-118.351	-83.623
1400	25.675	121.676	27.702	-126.984	-76.458
1600	25.712	125.107	32.841	-126.793	-69.255
1800	25.737	128.137	37.986	-126.608	-62.069
2000	25.756	130.850	43.136	-126.432	-54.896

356 K, boiling point; $\Delta H^\circ = 8.1$

$\text{HfCl}_4(\text{c,g})$
Hafnium tetrachloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	28.800	45.570	0	-236.700	-215.406
300	28.829	45.748	.053	-236.688	-215.273
400	29.935	54.216	2.999	-236.027	-208.237
500	30.505	60.962	6.024	-235.350	-201.362
589	30.835	65.987	8.753	-234.754	-195.367
589	25.200	105.763	32.181	-211.326	-195.367
600	25.230	106.230	32.458	-211.315	-195.069
700	25.380	110.130	34.990	-211.218	-192.366
800	25.490	113.530	37.534	-211.144	-189.683
900	25.560	116.530	40.086	-211.087	-186.999
1000	25.610	119.230	42.645	-211.050	-184.334

589 K, sublimation point; $\Delta H^\circ = 23.428$

$\text{HCl}(\text{g})$
Hydrogen chloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	6.964	44.643	0	-22.063	-22.777
400	6.973	46.691	.710	-22.129	-23.011
600	7.069	49.532	2.112	-22.288	-23.418
800	7.289	51.593	3.546	-22.440	-23.772
1000	7.559	53.248	5.030	-22.562	-24.091
1200	7.819	54.650	6.569	-22.653	-24.387
1400	8.043	55.873	8.155	-22.721	-24.672
1600	8.229	56.959	9.783	-22.771	-24.947
1800	8.382	57.938	11.445	-22.812	-25.216
2000	8.509	58.828	13.135	-22.846	-25.480
2200	8.614	59.644	14.847	-22.878	-25.744
2400	8.703	60.397	16.579	-22.908	-26.000
2600	8.778	61.097	18.327	-22.941	-26.259
2800	8.844	61.750	20.090	-22.977	-26.512
3000	8.902	62.362	21.864	-23.018	-26.763

$\text{HfCl}_4(\text{g})$
Hafnium tetrachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	23.650	89.030	0	-211.690	-203.354
300	23.670	89.180	.044	-211.687	-203.302
400	24.540	96.120	2.459	-211.557	-200.529
500	24.980	101.650	4.937	-211.427	-197.783
600	25.230	106.230	7.448	-211.315	-195.069
700	25.380	110.130	9.980	-211.218	-192.366
800	25.490	113.530	12.524	-211.144	-189.683
900	25.560	116.530	15.076	-211.087	-186.999
1000	25.610	119.230	17.635	-211.050	-184.334

HgCl(g)
Mercury monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.705	62.105	0	18.750	13.586
400	8.849	64.685	.895	18.550	11.854
600	8.981	68.302	2.680	18.173	8.588
800	9.054	70.896	4.484	3.906	9.244
1000	9.109	72.923	6.300	3.836	10.586
1200	9.157	74.588	8.127	3.770	11.942
1400	9.201	76.003	9.962	3.709	13.309
1600	9.243	77.234	11.807	3.653	14.684
1800	9.285	78.325	13.660	3.603	16.067
2000	9.325	79.305	15.521	3.556	17.457

$\text{HgCl}_2(\text{g})$
Mercury dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.889	70.433	0	-33.745	-33.448
400	14.299	74.579	1.438	-33.825	-33.333
600	14.621	80.450	4.336	-33.950	-33.060
800	14.742	84.675	7.274	-47.965	-28.951
1000	14.800	87.972	10.229	-47.788	-24.218
1200	14.831	90.673	13.192	-47.616	-19.520
1400	14.851	92.961	16.161	-47.446	-14.850
1600	14.863	94.945	19.132	-47.283	-10.206
1800	14.872	96.696	22.106	-47.122	-5.580
2000	14.878	98.263	25.081	-46.968	-0.970

$\text{Hg}_2\text{Cl}_2(\text{c})$
Dimeric mercury chloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	24.371	46.017	0	-63.319	-50.334
300	24.390	46.168	.045	-63.313	-50.253
400	25.340	53.318	2.533	-62.977	-45.947
500	26.130	59.060	5.107	-62.560	-41.737
600	26.800	63.884	7.755	-62.079	-37.616

*Data above 298 K estimated.

655 K, vapor pressure of decomposition products = 1 atm.

$\text{HoCl}_3(\text{c,l})$
Holmium trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.000	36.800	0	-240.300	-222.093
400	24.142	43.762	2.416	-239.822	-215.947
600	24.414	53.622	7.281	-238.885	-204.213
800	25.006	60.705	12.208	-237.967	-192.793
933	26.602	66.255	17.170	-236.987	-182.001
933	34.300	73.632	24.495	-229.662	-182.001
1000	34.300	73.873	24.735	-229.570	-181.666
1200	34.300	80.127	31.595	-227.020	-172.328

*Entropy and heat capacity at 298 K estimated.

933 K, melting point; $\Delta H^\circ = 7.325$

$\text{HgCl}_2(\text{c,l,g})$
Mercury dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	16.620	34.930	0	-53.600	-42.718
400	18.270	40.040	1.775	-53.343	-39.035
428	18.730	41.300	2.295	-53.243	-38.040
428	16.230	41.480	2.370	-53.168	-38.040
554	22.610	46.440	4.810	-52.627	-33.650
554	28.160	54.550	9.300	-48.137	-33.650
575	28.160	55.610	9.900	-47.861	-33.096
575	14.592	79.827	23.825	-33.936	-33.096
600	14.621	80.450	24.190	-33.951	-33.061
800	14.742	84.675	27.128	-47.966	-28.952
1000	14.800	87.972	30.083	-47.789	-24.219
1200	14.831	90.673	33.046	-47.617	-19.521
1400	14.851	92.961	36.015	-47.447	-14.851
1600	14.863	94.945	38.986	-47.284	-10.207
1800	14.872	96.696	41.960	-47.123	-5.581
2000	14.878	98.263	44.935	-46.969	-0.971

428 K, transition point; $\Delta H^\circ = 0.075$

553.7 K, melting point; $\Delta H^\circ = 4.490$

575 K, boiling point; $\Delta H^\circ = 13.925$

$\text{HoCl}_3(\text{g})$
Holmium trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.683	90.166	0	-163.100	-160.805
400	19.177	95.734	1.931	-163.107	-160.021
600	19.553	103.595	5.811	-163.156	-158.467
800	19.704	109.243	9.738	-163.236	-156.893
1000	19.812	113.652	13.690	-163.415	-155.290
1200	19.928	117.274	17.664	-163.751	-153.635
1400	20.056	120.355	21.662	-164.306	-151.906
1600	20.185	123.042	25.686	-165.141	-150.091
1800	20.305	125.426	29.736	-169.945	-147.984
2000	20.409	127.571	33.807	-170.715	-145.515

ICl(c,l)
Iodine chloride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	13.200	23.405	0	-8.510	-3.406
300	13.223	23.487	.024	-8.505	-3.375
301	13.229	23.509	.031	-8.504	-3.365
301	24.588	32.739	2.805	-5.730	-3.365
370	23.860	37.808	4.500	-4.797	-2.918

300.53 K, melting point; ΔH° = 2.774

370 K, ICl vaporizes with decomposition

ICl(g)
Iodine monochloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.497	59.145	0	4.110	-1.442
400	8.700	61.674	.877	1.966	-3.238
600	8.873	65.240	2.637	-3.342	-4.170
800	8.952	67.805	4.420	-3.341	-4.447
1000	9.000	69.808	6.216	-3.341	-4.723
1200	9.036	71.452	8.020	-3.344	-4.999
1400	9.066	72.847	9.830	-3.347	-5.274
1600	9.094	74.059	11.646	-3.352	-5.548
1800	9.119	75.132	13.467	-3.358	-5.824
2000	9.143	76.094	15.293	-3.365	-6.096

InCl(c,l)
Indium monochloride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	12.299	23.901	0	-44.460	-39.521
387	12.906	27.183	1.120	-44.294	-38.073
387	13.384	27.506	1.245	-44.169	-38.073
400	13.384	27.948	1.419	-44.139	-37.868
484	13.384	30.499	2.543	-44.745	-36.470
484	16.013	41.016	7.633	-39.655	-36.470
600	16.013	44.458	9.491	-39.114	-35.767
800	16.013	49.064	12.693	-38.193	-34.792
1000	16.013	52.638	15.896	-37.272	-34.049
1200	16.013	55.557	19.099	-36.358	-33.489

387 K, transition point; ΔH° = 0.125

484 K, melting point; ΔH° = 5.090

InCl(g)
Indium monochloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.637	59.312	0	-17.120	-22.739
400	8.793	61.875	.889	-17.330	-24.629
600	8.928	65.470	2.663	-18.603	-27.863
800	8.996	68.048	4.456	-19.090	-30.876
1000	9.044	70.061	6.260	-19.569	-33.767
1200	9.085	71.714	8.073	-20.044	-36.563
1400	9.124	73.117	9.894	-20.516	-39.277
1600	9.162	74.338	11.723	-20.984	-41.926
1800	9.201	75.419	13.559	-21.448	-44.516
2000	9.241	76.391	15.403	-21.908	-47.055

InCl₂(g)
Indium dichloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	12.937	74.544	0	-53.080	-55.296
400	13.332	78.408	1.340	-53.261	-56.029
600	13.640	83.883	4.043	-54.466	-57.010
800	13.756	87.826	6.784	-54.887	-57.797
1000	13.811	90.902	9.541	-55.305	-58.476
1200	13.843	93.423	12.307	-55.726	-59.070
1400	13.866	95.558	15.078	-56.151	-59.592
1600	13.891	97.412	17.854	-56.579	-60.056
1800	13.922	99.049	20.635	-57.008	-60.464
2000	13.962	100.518	23.423	-57.437	-60.825

InCl₃(g)
Indium trichloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.330	81.560	0	-89.400	-85.764
400	18.960	87.050	1.900	-89.443	-84.523
600	19.440	94.840	5.750	-90.363	-81.717
800	19.620	100.470	9.660	-90.497	-78.822
1000	19.710	104.860	13.590	-90.634	-75.894
1200	19.750	108.450	17.530	-90.779	-72.930
1400	19.780	111.500	21.490	-90.918	-69.940
1600	19.800	114.150	25.450	-91.069	-66.943
1800	19.810	116.480	29.410	-91.229	-63.915
2000	19.820	118.570	33.370	-91.400	-60.877

(InCl₃)₂(g)
Dimeric indium trichloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	40.384	126.406	0	-211.440	-193.222
400	41.765	138.493	4.193	-211.134	-187.051
600	42.816	155.666	12.670	-212.195	-174.495
800	43.204	168.045	21.278	-211.675	-162.010
1000	43.387	177.707	29.939	-211.148	-149.655
1200	43.488	185.627	38.627	-210.631	-137.406
1400	43.548	192.336	47.331	-210.125	-125.240
1600	43.588	198.154	56.045	-209.633	-113.148
1800	43.615	203.290	64.766	-209.152	-101.119
2000	43.635	207.886	73.491	-208.688	-89.136

KCl(c,l)
Potassium chloride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	12.277	19.729	0	-104.385	-97.714
400	12.685	23.399	1.273	-104.861	-95.343
600	13.467	28.689	3.888	-104.576	-90.637
800	14.335	32.676	6.664	-104.111	-86.057
1000	16.243	36.040	9.686	-103.414	-81.618
1045	17.093	36.773	10.435	-122.230	-80.617
1045	17.543	42.755	16.686	-115.979	-80.617
1200	17.543	45.181	19.405	-114.727	-75.461
1400	17.543	47.885	22.913	-113.115	-69.043

1045 K, melting point; ΔH° = 6.251

KCl(g)
Potassium chloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.723	57.116	0	-51.180	-55.656
400	8.857	59.701	.896	-52.034	-57.036
600	8.979	63.318	2.681	-52.579	-59.416
800	9.046	65.911	4.484	-53.085	-61.620
1000	9.097	67.935	6.298	-53.597	-63.695
1200	9.141	69.598	8.122	-72.805	-62.839
1400	9.182	71.010	9.955	-72.868	-61.171
1600	9.221	72.238	11.795	-72.930	-59.496
1800	9.259	73.327	13.643	-72.988	-57.815
2000	9.297	74.304	15.499	-73.046	-56.124

(KCl)₂(g)
Dimeric potassium chloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	19.327	84.309	0	-147.620	-147.651
400	19.564	90.027	1.982	-149.137	-147.392
600	19.733	97.998	5.915	-149.864	-146.357
800	19.793	103.684	9.869	-150.530	-145.088
1000	19.822	108.105	13.831	-151.218	-143.651
1200	19.837	111.720	17.797	-189.317	-136.414
1400	19.846	114.779	21.765	-189.141	-127.610
1600	19.852	117.429	25.735	-188.975	-118.831
1800	19.856	119.767	29.706	-188.816	-110.073
2000	19.859	121.860	33.677	-188.672	-101.332

LaCl₃(c,l)
Lanthanum trichloride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	23.430	32.880	0	-256.000	-237.916
400*	24.701	39.955	2.455	-255.477	-231.820
600	26.586	50.342	7.591	-254.326	-220.236
800	28.194	58.215	13.072	-252.877	-209.088
1000	29.644	64.664	18.858	-251.281	-198.317
1131	30.525	68.367	22.800	-250.166	-191.450
1131	37.700	79.861	35.800	-237.166	-191.450
1200	37.700	82.094	38.401	-238.365	-188.637
1400	37.700	87.905	45.941	-235.174	-180.606

*Data 400-1100 K estimated.

1131 K, melting point; ΔH° = 13.000

LaCl₃(g)
Lanthanum trichloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.744	85.210	0	-175.300	-172.818
400	19.214	90.793	1.936	-175.296	-171.974
600	19.569	98.665	5.821	-175.396	-170.300
800	19.700	104.315	9.750	-175.499	-168.590
1000	19.761	108.718	13.697	-175.742	-166.832
1200	19.795	112.324	17.652	-178.414	-164.962
1400	19.815	115.377	21.614	-178.801	-162.694
1600	19.828	118.024	25.578	-179.198	-160.359
1800	19.837	120.360	29.545	-179.601	-157.989
2000	19.844	122.450	33.513	-180.014	-155.551

LiCl(c,l)
Lithium chloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.470	14.170	0	-97.660	-91.867
400	12.136	17.639	1.204	-97.510	-89.911
600	13.286	22.780	3.747	-97.960	-85.934
800	14.396	26.754	6.516	-97.465	-81.994
883	14.853	28.198	7.730	-97.193	-80.402
883	14.960	33.475	12.390	-92.533	-80.402
1000	14.960	35.337	14.140	-92.114	-78.823
1200	14.960	38.064	17.132	-91.396	-76.232
1400	14.960	40.370	20.124	-90.678	-73.760

883 K, melting point; $\Delta H^\circ = 4.660$

LiCl(g)
Lithium chloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.946	50.864	0	-46.700	-51.848
400	8.312	53.255	.829	-46.926	-53.573
600	8.677	56.705	2.534	-48.213	-56.542
800	8.847	59.227	4.288	-48.733	-59.241
1000	8.945	61.212	6.068	-49.226	-61.810
1200	9.012	62.849	7.864	-49.704	-64.282
1400	9.064	64.243	9.672	-50.170	-66.675
1600	9.108	65.456	11.489	-50.624	-69.001
1800	9.147	66.531	13.315	-85.933	-67.806
2000	9.182	67.497	15.148	-86.010	-65.788

$(\text{LiCl})_2(\text{g})$
Dimeric lithium chloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.255	68.993	0	-141.900	-142.435
400	18.316	74.231	1.818	-142.191	-142.574
600	19.146	81.845	5.580	-144.413	-142.133
800	19.456	87.402	9.444	-145.097	-141.271
1000	19.604	91.761	13.352	-145.735	-140.240
1200	19.685	95.343	17.281	-146.355	-139.084
1400	19.735	98.382	21.224	-146.960	-137.824
1600	19.767	101.019	25.174	-147.552	-136.477
1800	19.789	103.349	29.130	-217.866	-128.129
2000	19.805	105.434	33.089	-217.726	-118.162

$(\text{LiCl})_3(\text{g})$
Trimeric lithium chloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.380	80.223	0	-230.000	-223.866
400	26.976	87.786	2.628	-230.535	-221.686
600	29.376	99.255	8.301	-233.839	-216.311
800	30.372	107.861	14.289	-234.673	-210.340
1000	30.865	114.697	20.418	-235.363	-204.175
1200	31.142	120.351	26.621	-235.983	-197.881
1400	31.312	125.165	32.867	-236.559	-191.483
1600	31.424	129.354	39.141	-237.098	-185.006
1800	31.501	133.060	45.434	-342.210	-168.070
2000	31.556	136.382	51.740	-341.633	-148.748

$\text{LuCl}_3(\text{g})$
Lutetium trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.656	84.218	0	-149.700	-147.346
400	19.161	89.780	1.929	-149.691	-146.544
600	19.544	97.636	5.807	-149.688	-144.970
800	19.685	103.281	9.732	-149.734	-143.389
1000	19.752	107.681	13.676	-149.867	-141.790
1200	19.788	111.286	17.630	-150.114	-140.156
1400	19.810	114.338	21.590	-150.509	-138.463
1600	19.825	116.984	25.554	-151.084	-136.709
1800	19.835	119.320	29.520	-151.871	-134.867
2000	19.842	121.410	33.487	-157.337	-132.774

MgCl(g)
Magnesium monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.324	55.760	0	-10.400	-16.752
400	8.587	58.247	.863	-10.580	-18.894
600	8.819	61.780	2.607	-11.002	-22.963
800	8.922	64.333	4.382	-11.526	-26.877
1000	8.983	66.331	6.173	-14.295	-30.467
1200	9.027	67.973	7.974	-15.022	-33.640
1400	9.063	69.367	9.783	-45.950	-35.867
1600	9.094	70.580	11.599	-46.035	-34.423
1800	9.123	71.652	13.421	-46.116	-32.964
2000	9.150	72.615	15.248	-46.197	-31.498

$\text{MgCl}_2(\text{c}, \text{l})$
Magnesium dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.040	21.400	0	-153.990	-142.153
400	18.239	26.606	1.807	-153.649	-138.161
600	19.011	34.172	5.544	-152.939	-130.570
800	19.667	39.724	9.408	-152.255	-123.220
980	20.594	43.800	13.025	-153.754	-116.623
980	22.180	53.540	22.570	-144.209	-116.623
1000	22.180	53.988	23.014	-144.101	-116.061
1200	22.180	58.032	27.450	-143.092	-110.555
1400	22.180	61.451	31.886	-172.296	-104.393

980 K, melting point; $\Delta H^\circ = 9.545$

$\text{MgCl}_2(\text{g})$
Magnesium dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.646	66.184	0	-93.800	-95.316
400	14.115	70.267	1.416	-93.850	-95.827
600	14.519	76.080	4.286	-94.007	-96.783
800	14.680	80.282	7.208	-94.265	-97.676
1000	14.758	83.567	10.153	-96.772	-98.311
1200	14.802	86.262	13.109	-97.243	-98.582
1400	14.828	88.546	16.073	-127.919	-97.949
1600	14.846	90.527	19.040	-127.760	-93.680
1800	14.858	92.276	22.010	-127.603	-89.429
2000	14.866	93.842	24.983	-127.451	-85.193

$(\text{MgCl}_2)_2(\text{g})$
Dimeric magnesium dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	29.543	100.098	0	-228.100	-221.510
400	30.458	108.924	3.061	-227.971	-219.281
600	31.170	121.435	9.237	-227.849	-214.966
800	31.437	130.444	15.502	-227.944	-210.670
1000	31.564	137.474	21.803	-232.547	-205.965
1200	31.634	143.236	28.123	-233.081	-200.614
1400	31.676	148.116	34.455	-294.029	-193.523
1600	31.704	152.347	40.793	-293.307	-179.216
1800	31.723	156.083	47.136	-292.590	-164.997
2000	31.736	159.426	53.482	-291.886	-150.854

*Data except enthalpy of formation at 298 K estimated.

$\text{MnCl}_2(\text{c}, \text{l})$
Manganese dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.450	28.260	0	-115.030	-105.286
400	18.387	33.532	1.830	-114.709	-102.008
600	19.506	41.215	5.627	-114.074	-95.793
800	20.375	46.948	9.617	-113.448	-89.800
923	20.869	49.897	12.153	-113.057	-86.194
923	22.540	59.659	21.163	-104.047	-86.194
1000	22.540	61.465	22.899	-104.212	-84.709
1200	22.540	65.574	27.407	-103.322	-80.892
1400	22.540	69.049	31.915	-103.028	-77.199

923 K, melting point; $\Delta H^\circ = 9.010$

$\text{MoCl}_3(\text{c})$
Molybdenum trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	22.658	28.240	0	-94.000	-76.545
300*	22.697	28.380	.042	-93.992	-76.437
400	24.321	35.152	2.400	-93.465	-70.662
500	25.359	40.698	4.887	-92.865	-65.028
600	26.099	45.391	7.462	-92.219	-59.522
700	26.666	49.458	10.101	-91.534	-54.125
800	27.120	53.049	12.791	-90.822	-48.831
900	27.498	56.266	15.523	-90.083	-43.625
1000	27.818	59.180	18.289	-89.328	-38.505

*Data above 298 K are estimated.

$\text{MoCl}_4(\text{c})$
Molybdenum tetrachloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	28.280	37.580	0	-114.000	-91.385
300*	28.323	37.755	.052	-113.989	-91.246
400	29.774	46.134	2.968	-113.320	-83.764
500	30.570	52.867	5.987	-112.614	-76.454
600	31.142	58.498	9.077	-111.887	-69.291

*Data above 298 K estimated

$\text{MoCl}_4(\text{g})$
Molybdenum tetrachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.448	88.869	0	-92.000	-84.677
400	24.412	95.911	2.443	-91.845	-82.200
600	25.168	105.981	7.415	-91.549	-77.442
800	25.452	113.266	12.481	-91.297	-72.781
1000	25.587	118.961	17.587	-91.088	-68.177
1200	25.663	123.634	22.712	-90.939	-63.610
1400	25.714	127.594	27.850	-90.859	-59.062
1600	25.756	131.030	32.997	-90.855	-54.521
1800	25.799	134.066	38.153	-90.934	-49.973
2000	25.848	136.787	43.317	-91.115	-45.413

*Data except enthalpy of formation at 298 K estimated.

$\text{MoCl}_5(\text{c,l,g})$
Molybdenum pentachloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	37.200	57.000	0	-126.000	-101.231
400	40.000	68.320	3.931	-124.780	-92.953
467	41.800	74.652	6.670	-123.869	-87.694
467	42.000	84.288	11.170	-119.369	-87.694
537	42.000	90.154	14.110	-118.369	-83.017
537	30.660	112.564	26.144	-106.335	-83.017
600	30.895	115.985	28.079	-106.168	-80.300
800	31.280	124.933	34.301	-105.642	-71.761
1000	31.470	131.935	40.578	-105.155	-63.349
1200	31.594	137.685	46.885	-104.722	-55.029
1400	31.701	142.563	53.215	-104.353	-46.775
1600	31.809	146.803	59.566	-104.052	-38.571
1800	31.924	150.556	65.939	-103.824	-30.399
2000	32.042	153.926	72.336	-103.686	-22.247

*Data except enthalpy of formation at 298 K and fusion temperature estimated.

467 K, melting point; $\Delta H^\circ = 4.500$

537 K, boiling point; $\Delta H^\circ = 12.034$

$\text{MoCl}_5(\text{g})$
Molybdenum pentachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	28.556	95.043	0	-107.000	-93.574
400	29.868	103.642	2.984	-106.727	-89.029
600	30.895	115.985	9.079	-106.168	-80.300
800	31.280	124.933	15.301	-105.642	-71.761
1000	31.470	131.935	21.578	-105.155	-63.349
1200	31.594	137.685	27.885	-104.722	-55.029
1400	31.701	142.563	34.215	-104.353	-46.775
1600	31.809	146.803	40.566	-104.052	-38.571
1800	31.924	150.556	46.939	-103.824	-30.399
2000	32.042	153.926	53.336	-103.686	-22.247

*Data except enthalpy of formation at 298 K estimated.

$\text{MoCl}_6(\text{g})$
Molybdenum hexachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	34.446	100.272	0	-105.000	-85.189
400	35.815	110.612	3.587	-104.546	-78.492
600	36.859	125.371	10.874	-103.657	-65.657
800	37.244	136.035	18.290	-102.819	-53.120
1000	37.427	144.368	25.759	-102.031	-40.789
1200	37.526	151.201	33.255	-101.308	-28.608
1400	37.587	156.991	40.767	-100.660	-16.544
1600	37.626	162.013	48.288	-100.096	-4.568
1800	37.654	166.446	55.817	-99.622	7.347
2000	37.673	170.414	63.349	-99.262	19.214

*Data estimated.

$\text{NaCl}(\text{c,l})$
Sodium chloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.070	17.240	0	-98.268	-91.797
400	12.536	20.861	1.256	-98.791	-89.556
600	13.264	26.077	3.834	-98.535	-84.984
800	14.243	30.019	6.579	-98.073	-80.532
1000	15.591	33.335	9.556	-97.368	-76.222
1074	16.188	34.466	10.728	-97.040	-74.675
1074	16.360	40.761	17.488	-90.280	-74.675
1200	16.360	42.579	19.553	-112.907	-72.419
1400	16.360	45.101	22.825	-111.531	-65.778
1600	16.360	47.286	26.097	-110.160	-59.337
1800	16.360	49.213	29.369	-108.792	-53.067

1073.8 K, melting point; $\Delta H^\circ = 6.760$

1722 K, boiling point to equilibrium mixture; $\Delta H^\circ = 41$

$\text{NaCl}(\text{g})$
Sodium chloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.553	54.897	0	-42.220	-46.977
400	8.749	57.441	.882	-43.117	-48.514
600	8.921	61.026	2.652	-43.670	-51.088
800	9.006	63.605	4.445	-44.160	-53.487
1000	9.064	65.622	6.252	-44.625	-55.766
1200	9.110	67.278	8.070	-45.342	-57.493
1400	9.152	68.686	9.896	-46.412	-59.678
1600	9.190	69.910	11.730	-47.479	-62.854
1800	9.227	70.995	13.572	-48.541	-66.023
2000	9.263	71.969	15.421	-49.600	-69.184

(NaCl)₂(g)
Dimeric sodium chloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.831	77.757	0	-136.500	-136.462
400	19.278	83.362	1.944	-138.113	-136.299
600	19.603	91.253	5.838	-138.865	-135.222
800	19.720	96.911	9.772	-139.497	-133.912
1000	19.775	101.318	13.722	-140.091	-132.447
1200	19.804	104.926	17.680	-187.204	-129.950
1400	19.822	107.980	21.643	-187.033	-120.415
1600	19.834	110.628	25.609	-186.869	-110.912
1800	19.842	112.965	29.577	-186.709	-101.429
2000	19.848	115.056	33.546	-186.555	-91.959

NdCl₃(c,l)
Neodymium trichloride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	23.720	36.670	0	-249.000	-231.002
400*	24.800	43.790	2.470	-248.480	-224.933
600	27.000	54.250	7.646	-247.339	-213.397
800	29.100	62.300	13.254	-246.008	-202.278
1000	31.300	69.030	19.293	-244.514	-191.517
1032	31.600	70.020	20.300	-244.262	-189.825
1032	35.000	81.650	32.300	-232.262	-189.825
1200	35.000	86.930	38.180	-231.160	-183.023

*Data 300-1000 K estimated.

1032 K, melting point; ΔH° = 12.00

NbCl₅(c,l,g)
Niobium pentachloride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	35.350	51.160	0	-190.570	-163.508
400	35.350	61.548	3.600	-189.693	-154.404
479	35.350	67.912	6.389	-189.068	-147.501
479	52.180	84.819	14.486	-180.971	-147.501
520	51.281	89.052	16.598	-179.990	-144.690
520	30.534	113.031	29.060	-167.528	-144.690
600	30.846	117.444	31.526	-167.311	-141.175
800	31.249	126.381	37.741	-166.783	-132.551
1000	31.442	133.377	44.012	-166.288	-124.050
1200	31.548	139.119	50.312	-165.837	-115.628
1400	31.613	143.988	56.629	-165.436	-107.291
1600	31.655	148.212	62.956	-165.106	-99.001
1800	31.684	151.942	69.290	-164.849	-90.751
2000	31.705	155.282	75.629	-164.678	-82.531

478.9 K, melting point; ΔH° = 8.097

519.7 K, boiling point; ΔH° = 12.462

NbCl₅(g)
Niobium pentachloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	28.451	96.557	0	-168.100	-154.574
400	29.782	105.128	2.974	-167.850	-149.992
600	30.846	117.444	9.056	-167.311	-141.175
800	31.249	126.381	15.271	-166.783	-132.551
1000	31.442	133.377	21.542	-166.288	-124.050
1200	31.548	139.119	27.842	-165.837	-115.628
1400	31.613	143.988	34.159	-165.436	-107.291
1600	31.655	148.212	40.486	-165.106	-99.001
1800	31.684	151.942	46.820	-164.849	-90.751
2000	31.705	155.282	53.159	-164.678	-82.531

NdCl₃(g)
Neodymium trichloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.721	89.453	0	-171.800	-169.539
400	19.278	95.039	1.938	-171.813	-168.765
600	20.003	103.000	5.869	-171.915	-167.224
800	20.570	108.836	9.929	-172.133	-165.632
1000	20.974	113.472	14.086	-172.521	-163.966
1200	21.217	117.320	18.308	-173.832	-162.163
1400	21.330	120.601	22.564	-176.108	-160.035
1600	21.349	123.451	26.834	-176.663	-157.707
1800	21.308	125.964	31.100	-177.231	-155.302
2000	21.234	128.205	35.355	-177.821	-152.829

NiCl(g)
Nickel monochloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.446	60.061	0	43.000	35.166
400	8.800	62.595	.879	42.793	32.520
600	9.275	66.262	2.691	42.252	27.488
800	9.502	68.966	4.572	41.715	22.658
1000	9.575	71.096	6.482	41.223	17.946
1200	9.584	72.843	8.398	40.667	13.349
1400	9.592	74.321	10.315	40.031	8.843
1600	9.632	75.604	12.237	39.309	4.438
1800	9.718	76.743	14.171	34.404	.299
2000	9.850	77.773	16.127	33.587	-3.446

$\text{NiCl}_2(\text{c,l})$
Nickel dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.130	23.424	0	-72.980	-61.947
400	18.167	28.616	1.802	-72.687	-58.223
600	19.085	36.190	5.544	-72.159	-51.115
800	19.446	41.733	9.400	-71.602	-44.174
1000	20.067	46.128	13.340	-70.956	-37.396
1200	21.697	49.909	17.494	-70.173	-30.745
1304	23.189	51.770	19.823	-69.630	-27.353
1304	23.900	65.932	38.290	-51.163	-27.353
1400	23.900	67.630	40.584	-50.539	-25.622

1230 K, estimated sublimation point; $\Delta H^\circ = 52.7$

1304 K, melting point; $\Delta H^\circ = 18.467$

$\text{NiCl}_2(\text{g})$
Nickel dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.487	71.252	0	-16.800	-20.027
400	15.204	75.620	1.516	-16.793	-21.131
600	15.780	81.918	4.626	-16.897	-23.290
800	15.911	86.482	7.799	-17.023	-25.394
1000	15.909	90.033	10.982	-17.134	-27.479
1200	15.894	92.932	14.162	-17.325	-29.524
1400	15.896	95.382	17.341	-17.602	-31.538
1600	15.911	97.505	20.522	-17.972	-33.502
1800	15.932	99.381	23.706	-22.537	-35.245
2000	15.952	101.060	26.894	-23.036	-36.628

$\text{PCl}(\text{g})$
Phosphorus monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	8.298	56.829	0	30.800	24.728
400	8.566	59.310	.860	30.451	22.724
600	8.801	62.835	2.601	27.246	19.190
800	8.904	65.383	4.372	27.185	16.513
1000	8.964	67.376	6.160	27.113	13.854
1200	9.005	69.015	7.957	27.036	11.208
1400	9.038	70.405	9.761	26.956	8.577
1600	9.066	71.614	11.571	26.875	5.956
1800	9.091	72.683	13.387	26.795	3.347
2000	9.114	73.642	15.208	26.715	.748

*Data estimated.

$\text{PCl}_3(\text{g})$
Phosphorus trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.108	74.467	0	-69.000	-64.442
400	18.173	79.661	1.803	-69.251	-62.828
600	19.057	87.228	5.541	-72.182	-59.345
800	19.401	92.764	9.392	-71.927	-55.105
1000	19.566	97.113	13.290	-71.672	-50.929
1200	19.658	100.689	17.214	-71.419	-46.805
1400	19.714	103.724	21.151	-71.172	-42.723
1600	19.751	106.359	25.098	-70.930	-38.675
1800	19.776	108.687	29.051	-70.693	-34.656
2000	19.794	110.771	33.008	-70.464	-30.662

$\text{PCl}_5(\text{g})$
Phosphorus pentachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	26.743	87.043	0	-89.600	-72.903
400	28.698	95.208	2.835	-89.664	-67.170
600	30.313	107.207	8.764	-92.125	-55.748
800	30.939	116.025	14.898	-91.351	-43.740
1000	31.240	122.965	21.119	-90.558	-31.929
1200	31.407	128.677	27.385	-89.760	-20.280
1400	31.509	133.527	33.678	-88.963	-8.763
1600	31.576	137.739	39.987	-88.173	2.641
1800	31.622	141.461	46.307	-87.389	13.947
2000	31.655	144.794	52.634	-86.617	25.167

$\text{PbCl}(\text{g})$
Lead monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.660	62.022	0	3.600	-2.329
400	8.805	64.589	.890	3.412	-4.326
600	8.929	68.187	2.666	2.969	-8.107
800	8.989	70.765	4.458	1.283	-11.334
1000	9.032	72.775	6.260	.775	-14.432
1200	9.073	74.425	8.071	.298	-17.422
1400	9.122	75.827	9.890	-.157	-20.349
1600	9.185	77.049	11.720	-.602	-23.225
1800	9.263	78.136	13.565	-1.035	-26.002
2000	9.354	79.116	15.426	-1.456	-28.753

$\text{PbCl}_2(\text{c,l})$
Lead dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	18.380	32.500	0	-85.900	-75.083
400	18.983	37.981	1.901	-85.499	-71.449
600	20.437	45.946	5.840	-84.640	-64.608
771	21.803	51.233	9.450	-84.926	-58.679
771	26.050	58.016	14.680	-79.696	-58.679
800	26.738	58.991	15.445	-79.396	-57.894
1000	31.482	65.467	21.268	-76.775	-52.804
1200	36.227	71.626	28.038	-73.191	-48.327

*Heat capacity at 298 K estimated.

771 K, melting point; $\Delta H^\circ = 5.230$

1236 K, boiling point to $\text{PbCl}_2(\text{g})$; $\Delta H^\circ = 28$

$\text{PbCl}_2(\text{g})$
Lead dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.189	75.787	0	-41.600	-43.689
400	13.490	79.710	1.361	-41.739	-44.381
600	13.717	85.231	4.086	-42.094	-45.633
800	13.800	89.191	6.838	-43.703	-46.361
1000	13.839	92.275	9.603	-44.140	-46.977
1200	13.861	94.800	12.373	-44.556	-47.501
1400	13.874	96.938	15.147	-44.959	-47.969
1600	13.882	98.791	17.922	-45.366	-48.393
1800	13.888	100.426	20.699	-45.777	-48.720
2000	13.893	101.890	23.477	-46.194	-49.026

$\text{PbCl}_4(\text{g})$
Lead tetrachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.028	91.191	0	-132.028	-122.821
400	24.775	98.371	2.490	-131.883	-119.699
600	25.345	108.546	7.513	-131.662	-113.662
800	25.555	115.870	12.606	-132.694	-107.297
1000	25.654	121.584	17.728	-132.558	-100.966
1200	25.708	126.267	22.864	-132.405	-94.659
1400	25.741	130.232	28.010	-132.242	-88.388
1600	25.763	133.671	33.160	-132.088	-82.157
1800	25.777	136.707	38.314	-131.942	-75.899
2000	25.788	139.423	43.471	-131.807	-69.677

$\text{PrCl}_3(\text{c,l})$
Praseodymium trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.650	36.640	0	-252.600	-234.423
400	25.200	43.810	2.488	-252.059	-228.296
600	27.600	54.490	7.774	-250.780	-216.682
800	29.600	62.710	13.498	-249.304	-205.534
1000	31.600	69.530	19.616	-247.671	-194.773
1059	32.300	71.360	21.500	-247.159	-191.676
1059	32.000	82.790	33.600	-235.059	-191.676
1200	32.000	86.780	38.112	-234.509	-185.880
1400	32.000	91.720	44.512	-234.514	-177.643

*Data 300-1000 K estimated.

1059 K, melting point; $\Delta H^\circ = 12.100$

$\text{PrCl}_3(\text{g})$
Praseodymium trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.732	89.353	0	-174.800	-172.340
400	19.261	94.939	1.937	-174.810	-171.498
600	19.924	102.880	5.859	-174.895	-169.031
800	20.478	108.690	9.900	-175.102	-168.116
1000	20.926	113.310	14.043	-175.443	-166.326
1200	21.249	117.155	18.262	-176.559	-164.380
1400	21.449	120.447	22.534	-178.692	-162.039
1600	21.545	123.319	26.835	-179.167	-159.632
1800	21.562	125.858	31.147	-179.639	-157.160
2000	21.523	128.128	35.456	-180.125	-154.618

$\text{PuCl}_3(\text{c,l})$
Plutonium trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	24.580	38.000	0	-229.800	-213.296
400	25.200	45.311	2.535	-230.214	-207.714
600	26.400	55.756	7.695	-229.632	-196.614
800	27.700	63.521	13.100	-229.070	-185.722
1000	29.000	69.841	18.770	-228.559	-174.963
1033	29.230	70.786	19.731	-228.375	-173.197
1033	32.000	85.500	34.931	-213.175	-173.197
1200	32.000	90.294	40.275	-211.770	-166.841
1400	32.000	95.227	46.675	-210.099	-159.485

*Data except enthalpy of formation at 298 K and temperature and enthalpy of fusion estimated.

1033 K, melting point; $\Delta H^\circ = 15.200$

RbCl(g)
Rubidium chloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.814	59.664	0	-54.700	-59.074
400	8.915	62.270	.903	-55.556	-60.370
600	9.014	65.905	2.697	-56.128	-62.651
800	9.075	68.507	4.506	-56.615	-64.751
1000	9.124	70.538	6.326	-74.249	-66.280
1200	9.170	72.205	8.156	-74.311	-64.679
1400	9.213	73.622	9.994	-74.369	-63.068
1600	9.255	74.855	11.841	-74.424	-61.450
1800	9.296	75.948	13.696	-74.475	-59.826
2000	9.337	76.929	15.560	-74.527	-58.195

SCl(g)
Sulfur monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	8.973	56.696	0	22.045	21.211
400	9.100	59.355	.922	22.139	20.911
600	9.108	63.050	2.744	22.262	20.267
800	9.091	65.667	4.564	22.334	19.590
1000	9.085	67.695	6.382	22.377	18.899
1200	9.087	69.352	8.199	22.397	18.201
1400	9.094	70.753	10.017	22.399	17.501
1600	9.104	71.968	11.837	22.384	16.802
1800	9.117	73.041	13.659	22.355	16.107
2000	9.131	74.002	15.483	22.311	15.415

*Data estimated.

$\text{SCl}_2(\text{g})$
Sulfur dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.164	67.285	0	-19.555	-15.602
400	12.821	70.962	1.276	-19.530	-14.256
600	13.382	76.286	3.906	-19.459	-11.633
800	13.604	80.170	6.607	-19.389	-9.035
1000	13.711	83.219	9.340	-19.323	-6.455
1200	13.771	85.725	12.089	-19.270	-3.887
1400	13.807	87.850	14.847	-19.231	-1.326
1600	13.831	89.696	17.611	-19.208	1.229
1800	13.848	91.326	20.379	-19.201	3.784
2000	13.860	92.785	23.150	-19.211	6.341

$\text{S}_2\text{Cl(g)}$
Chlorosulfanyl radical (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	12.178	69.799	0	-11.910	-8.525
400	12.829	73.479	1.277	-11.868	-7.376
600	13.386	78.806	3.908	-11.772	-5.151
800	13.606	82.691	6.610	-11.685	-2.956
1000	13.713	85.740	9.343	-11.610	-1.784
1200	13.772	88.246	12.092	-11.557	1.375
1400	13.808	90.371	14.851	-11.527	3.530
1600	13.832	92.217	17.615	-11.525	5.679
1800	13.848	93.847	20.383	-11.550	7.832
2000	13.860	95.307	23.154	-11.601	9.988

*Data except enthalpy of formation at 298 K estimated.

$\text{S}_2\text{Cl}_2(\text{g})$
Dichlorodisulfane (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.392	78.180	0	-34.710	-25.880
400	18.411	83.445	1.827	-34.540	-22.890
600	19.316	91.107	5.613	-34.151	-17.146
800	19.739	96.728	9.522	-33.738	-11.540
1000	19.964	101.160	13.495	-33.316	-6.041
1200	20.060	104.809	17.499	-32.906	-1.624
1400	20.069	107.903	21.513	-32.524	4.726

$\text{SbCl}_3(\text{g})$
Antimony trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.340	81.020	0	-75.000	-72.080
300	18.350	81.130	.034	-75.000	-72.060
400	18.970	86.500	1.904	-74.987	-71.080
500	19.280	90.770	3.818	-74.979	-70.102
600	19.450	94.310	5.755	-74.986	-69.136
700	19.560	97.310	7.706	-75.010	-68.151
800	19.630	99.930	9.666	-75.065	-67.176
900	19.680	102.250	11.632	-75.155	-66.186
1000	19.720	104.320	13.602	-80.024	-64.677

$\text{ScCl}_3(\text{c,l})$
Scandium trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	21.900	30.400	0	-221.100	-203.862
400	23.374	37.071	2.316	-220.684	-198.037
600	24.431	46.790	7.117	-219.749	-186.912
800	25.191	53.911	12.071	-218.793	-176.104
1000	27.131	59.707	17.272	-217.708	-165.568
1200	31.501	64.993	23.085	-216.141	-155.240
1240	32.773	66.046	24.370	-215.722	-153.216
1240	34.300	78.522	39.840	-200.252	-153.216
1400	34.300	82.685	45.328	-198.287	-147.303

*Entropy and heat capacity at 298 K estimated.
1240 K, melting point; $\Delta H^\circ = 15.470$

$\text{SeCl}_2(\text{g})$
Selenium dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.800	70.650	0	-24.650	-21.150
400	13.270	74.490	1.333	-24.668	-19.950
600	13.610	79.950	4.027	-24.706	-17.585
800	13.730	83.890	6.762	-24.744	-15.210
1000	13.790	86.960	9.514	-24.778	-12.824
1200	13.820	89.470	12.276	-24.804	-10.420
1400	13.850	91.610	15.043	-24.823	-8.032
1600	13.860	93.460	17.814	-24.833	-5.635
1800	13.880	95.090	20.588	-24.836	-3.225
2000	13.890	96.550	23.365	-24.829	-0.821

$\text{Se}_2\text{Cl}_2(\text{g})$
Diselenium dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	18.580	84.560	0	-38.500	-30.471
300	18.690	84.680	.035	-38.498	-30.422
400	19.160	90.120	1.928	-38.430	-27.740
500	19.440	94.430	3.860	-38.359	-25.075
600	19.610	97.990	5.813	-38.286	-22.426
700	19.730	101.020	7.780	-38.207	-19.786
800	19.810	103.660	9.757	-38.124	-17.158
900	19.890	106.000	11.742	-38.033	-14.546
1000	19.950	108.100	13.734	-37.934	-11.946

*Data estimated.

$\text{SiCl}(\text{g})$
Silicon monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.551	56.016	0	47.400	39.746
400	8.710	59.354	.880	47.342	37.137
600	8.864	62.919	2.639	47.122	32.078
800	8.938	65.480	4.420	46.825	27.108
1000	8.984	67.480	6.213	46.478	22.227
1200	9.018	69.121	8.013	46.098	17.402
1400	9.047	70.513	9.820	45.695	12.656
1600	9.071	71.723	11.632	45.269	7.951
1800	9.094	72.793	13.448	32.818	4.149
2000	9.116	73.752	15.269	32.506	.976

$\text{SiCl}_2(\text{g})$
Silicon dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.248	67.214	0	-40.300	-43.110
400	12.881	70.912	1.283	-40.378	-44.061
600	13.414	76.254	3.922	-40.579	-45.860
800	13.623	80.146	6.628	-40.833	-47.583
1000	13.724	83.198	9.364	-41.129	-49.229
1200	13.780	85.705	12.115	-41.456	-50.827
1400	13.814	87.832	14.875	-41.809	-52.357
1600	13.836	89.678	17.640	-42.189	-53.851
1800	13.852	91.309	20.409	-54.597	-54.449
2000	13.863	92.769	23.180	-54.873	-54.423

$\text{SiCl}_3(\text{g})$
Silicon trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	16.906	76.023	0	-93.300	-90.792
400	18.015	81.163	1.784	-93.300	-89.938
600	18.969	88.681	5.499	-93.285	-88.258
800	19.347	94.197	9.336	-93.291	-86.583
1000	19.530	98.536	13.225	-93.326	-84.895
1200	19.633	102.107	17.142	-93.385	-83.213
1400	19.695	105.138	21.076	-93.467	-81.505
1600	19.736	107.771	25.019	-93.576	-79.804
1800	19.764	110.097	28.969	-105.713	-77.238
2000	19.785	112.181	32.924	-105.719	-74.078

$\text{SiCl}_4(\text{g})$
Silicon tetrachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	21.573	79.070	0	-158.400	-148.856
400	23.133	85.651	2.285	-158.321	-145.609
600	24.505	95.337	7.071	-158.097	-139.300
800	25.057	102.473	12.035	-157.857	-133.071
1000	25.328	108.096	17.076	-157.632	-126.892
1200	25.479	112.728	22.158	-157.425	-120.772
1400	25.571	116.663	27.264	-157.238	-114.674
1600	25.632	120.082	32.384	-157.077	-108.619
1800	25.674	123.104	37.515	-168.943	-101.735
2000	25.704	125.810	42.653	-168.679	-94.283

$\text{SnCl}_3(\text{c,l})$
Samarium trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.790	35.880	0	-245.200	-227.107
400	25.100	43.064	2.493	-244.734	-221.000
600	26.600	53.538	7.670	-243.923	-209.314
800	28.000	61.390	13.135	-243.139	-197.889
950	29.000	66.285	17.410	-242.463	-189.461
950	34.000	77.864	28.410	-231.463	-189.461
1000	34.000	79.608	30.110	-230.973	-187.264
1200	34.000	85.807	36.910	-229.845	-178.693

*Data above 298 K estimated.
950 K, melting point; $\Delta H^\circ = 11.00$

$\text{SnCl}(\text{g})$
Tin monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.565	60.540	0	8.284	1.826
400	8.771	63.088	.883	8.066	-.347
600	9.114	66.708	2.671	5.908	-4.129
800	9.464	69.379	4.530	5.521	-7.414
1000	9.730	71.522	6.451	5.190	-10.610
1200	9.885	73.311	8.414	4.894	-13.741
1400	9.954	74.841	10.400	4.617	-16.823
1600	9.968	76.171	12.392	4.342	-19.868
1800	9.953	77.345	14.385	4.065	-22.878
2000	9.927	78.392	16.373	3.779	-25.856

$\text{SnCl}_2(\text{c,l,g})$
Tin dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	18.654	32.051	0	-78.400	-68.419
400	19.710	37.681	1.955	-77.969	-65.074
520	21.100	43.021	4.400	-79.084	-61.233
520	24.000	49.752	7.900	-75.584	-61.233
600	24.000	53.186	9.820	-74.911	-59.070
800	24.000	60.091	14.620	-73.239	-54.044
886	24.000	62.543	16.690	-72.519	-52.013
886	13.802	87.826	39.090	-50.119	-52.013
1000	13.826	89.498	40.662	-50.341	-52.247
1200	13.851	92.021	43.430	-50.730	-52.591
1400	13.867	94.158	46.202	-51.124	-52.870
1600	13.877	96.010	48.977	-51.523	-53.093
1800	13.884	97.645	51.753	-51.927	-53.264
2000	13.889	99.108	54.530	-52.337	-53.391

*Heat capacities for $\text{SnCl}_2(\text{c,l})$ above 298 K estimated.
520 K, melting point; $\Delta H^\circ = 3.500$
886 K, boiling point; $\Delta H^\circ = 22.400$

$\text{SnCl}_2(\text{g})$
Tin dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.058	73.075	0	-47.310	-49.561
400	13.410	76.968	1.350	-47.484	-50.304
600	13.679	82.467	4.064	-49.577	-51.305
800	13.778	86.418	6.811	-49.958	-51.824
1000	13.826	89.498	9.572	-50.341	-52.247
1200	13.851	92.021	12.340	-50.730	-52.591
1400	13.867	94.158	15.112	-51.124	-52.870
1600	13.877	96.010	17.887	-51.523	-53.093
1800	13.884	97.645	20.663	-51.927	-53.264
2000	13.889	99.108	23.440	-52.337	-53.391

$\text{SnCl}_4(\text{l,g})$
Tin tetrachloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	39.500	61.840	0	-122.200	-105.213
300	39.600	62.090	.070	-122.172	-105.112
382	44.660	72.220	3.520	-120.623	-100.632
382	24.340	93.140	11.510	-112.633	-100.632
400	24.460	94.260	11.950	-112.619	-100.065
500	24.930	99.780	14.420	-112.566	-96.938
600	25.200	104.350	16.930	-114.168	-93.498
700	25.360	108.240	19.460	-114.078	-90.053
800	25.470	111.640	22.000	-113.990	-86.636
900	25.540	114.640	24.550	-113.900	-83.217
1000	25.600	117.340	27.110	-113.808	-79.818

*Data extrapolated 294 to 382 K.
240 K, melting point; $\Delta H^\circ = 2.190$
382 K, boiling point; $\Delta H^\circ = 7.990$

$\text{SnCl}_4(\text{g})$
Tin tetrachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	23.530	87.200	0	-112.700	-103.274
300	23.560	87.350	.045	-112.697	-103.215
400	24.460	94.260	2.450	-112.619	-100.065
500	24.930	99.780	4.920	-112.566	-96.938
600	25.200	104.350	7.430	-114.168	-93.498
700	25.360	108.240	9.960	-114.078	-90.053
800	25.470	111.640	12.500	-113.990	-86.636
900	25.540	114.640	15.050	-113.900	-83.217
1000	25.600	117.340	17.610	-113.808	-79.818

$\text{SrCl}(\text{g})$
Strontium monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.664	60.270	0	-29.600	-35.898
400	8.809	62.839	.891	-29.802	-38.019
600	8.932	66.438	2.667	-30.329	-42.022
800	8.993	69.017	4.460	-31.057	-45.817
1000	9.035	71.028	6.263	-32.123	-49.367
1200	9.069	72.679	8.073	-34.875	-52.441
1400	9.100	74.079	9.890	-35.641	-55.307
1600	9.129	75.296	11.713	-36.405	-58.063
1800	9.160	76.373	13.542	-69.398	-57.861
2000	9.194	77.340	15.377	-69.479	-56.574

$\text{SrCl}_2(\text{c,l})$
Strontium dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.070	27.450	0	-198.100	-186.669
400	18.952	32.891	1.888	-197.728	-182.821
600	19.853	40.735	5.763	-197.016	-175.523
800	21.570	46.684	9.906	-196.276	-168.471
990	40.604	52.279	14.950	-194.813	-161.952
990	57.671	52.279	14.950	-194.813	-161.952
1000	51.111	52.825	15.493	-194.450	-161.622
1146	27.708	57.291	20.245	-194.219	-156.818
1146	23.900	60.729	24.185	-190.279	-156.818
1200	23.900	61.830	25.476	-189.928	-155.249
1400	23.900	65.514	30.256	-188.634	-149.571
1600	23.900	68.705	35.036	-187.348	-144.078
1800	23.900	71.520	39.816	-218.300	-135.882
2000	23.900	74.038	44.596	-216.349	-126.827

990 K, transition point; $\Delta H^\circ = 0$

1146 K, melting point; $\Delta H^\circ = 3.940$

$\text{SrCl}_2(\text{g})$
Strontium dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.330	75.580	0	-113.100	-116.019
400	13.575	79.536	1.372	-113.244	-116.995
600	13.757	85.082	4.108	-113.671	-118.787
800	13.823	89.050	6.867	-114.315	-120.403
1000	13.854	92.138	9.635	-115.308	-121.793
1200	13.871	94.665	12.408	-117.996	-122.719
1400	13.881	96.804	15.183	-118.707	-123.450
1600	13.888	98.659	17.960	-119.424	-124.080
1800	13.893	100.295	20.739	-152.377	-121.754
2000	13.896	101.759	23.517	-152.428	-118.348

$\text{TaCl}(\text{g})$
Tantalum monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.360	61.940	0	86.000	78.434
400	8.600	64.430	.870	85.821	75.885
600	8.810	67.970	2.610	85.445	70.990
800	8.900	70.510	4.380	85.054	66.233
1000	8.950	72.500	6.170	84.650	61.580
1200	8.980	74.140	7.960	84.216	56.998
1400	9.010	75.530	9.760	83.759	52.493

$\text{TaCl}_2(\text{g})$
Tantalum dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.720	71.290	0	-16.000	-18.409
400	14.190	75.390	1.430	-16.042	-19.217
600	14.570	81.230	4.310	-16.139	-20.786
800	14.710	85.450	7.240	-16.251	-22.325
1000	14.780	88.740	10.190	-16.387	-23.828
1200	14.820	91.440	13.150	-16.550	-25.303
1400	14.840	93.720	16.110	-16.750	-26.745

$\text{TaCl}_3(\text{g})$
Tantalum trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.050	82.670	0	-77.000	-74.858
400	18.780	88.090	1.880	-77.015	-74.124
600	19.360	95.830	5.700	-77.033	-72.676
800	19.580	101.430	9.600	-77.057	-71.216
1000	19.680	105.810	13.530	-77.104	-69.746
1200	19.740	109.410	17.470	-77.186	-68.277
1400	19.770	112.450	21.420	-77.299	-66.778

$\text{TaCl}_4(\text{g})$
Tantalum tetrachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	23.650	90.150	0	-137.090	-129.234
400	24.540	97.240	2.460	-136.947	-126.572
600	25.230	107.350	7.450	-136.656	-121.447
800	25.490	114.640	12.520	-136.392	-116.420
1000	25.610	120.350	17.630	-136.152	-111.465
1200	25.680	125.020	22.760	-135.942	-106.540
1400	25.720	128.980	27.900	-135.768	-101.651

$\text{TaCl}_5(\text{c,l,g})$
Tantalum pentachloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	35.350	53.000	0	-205.300	-178.423
400	35.350	63.388	3.600	-204.439	-169.379
490	35.350	70.540	6.771	-203.740	-161.588
490	51.960	87.693	15.171	-195.340	-161.588
507	51.590	89.484	16.062	-194.927	-160.411
507	30.600	114.485	28.735	-182.254	-160.411
600	30.931	119.675	31.602	-181.997	-156.420
800	31.300	128.631	37.830	-181.458	-147.979
1000	31.475	135.636	44.109	-180.941	-139.671
1200	31.572	141.384	50.415	-180.453	-131.462
1400	31.630	146.256	56.735	-180.002	-123.334
1600	31.669	150.482	63.065	-179.596	-115.267
1800	31.695	154.214	69.402	-179.234	-107.248
2000	31.714	157.554	75.743	-178.928	-99.264

*Data for $\text{TaCl}_5(\text{c,l})$ estimated.

489.7 K, melting point; $\Delta H^\circ = 6.400$

506.9 K, boiling point; $\Delta H^\circ = 12.673$

$\text{TaCl}_5(\text{g})$
Tantalum pentachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	28.713	98.675	0	-182.800	-169.541
400	29.953	107.309	2.995	-182.545	-165.052
600	30.931	119.675	9.102	-181.997	-156.420
800	31.300	128.631	15.330	-181.458	-147.979
1000	31.475	135.636	21.609	-180.941	-139.671
1200	31.572	141.384	27.915	-180.453	-131.462
1400	31.630	146.256	34.235	-180.002	-123.334
1600	31.669	150.482	40.565	-179.596	-115.267
1800	31.695	154.214	46.902	-179.234	-107.248
2000	31.714	157.554	53.243	-178.928	-99.264

$\text{TbCl}_3(\text{c,l})$
Terbium trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.300	36.600	0	-238.300	-220.156
400	24.430	43.613	2.433	-237.833	-214.031
600	26.117	53.850	7.494	-236.730	-202.363
783	27.487	60.978	12.400	-235.611	-192.030
783	29.860	65.276	15.765	-232.246	-192.030
800	29.860	65.917	16.273	-232.098	-191.158
855	29.860	67.902	17.915	-231.625	-188.360
855	34.530	73.311	22.540	-227.000	-188.360
1000	34.530	78.721	27.547	-225.141	-181.965
1200	34.530	85.017	34.453	-222.719	-173.559

*Entropy and heat capacity at 298 K estimated.

783 K, transition point; $\Delta H^\circ = 3.365$

855 K, melting point; $\Delta H^\circ = 4.625$

$\text{TbCl}_3(\text{g})$
Terbium trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.695	89.681	0	-165.200	-162.882
400	19.229	95.258	1.934	-165.231	-162.088
600	19.851	103.179	5.846	-165.279	-160.508
800	20.354	108.961	9.867	-165.403	-158.899
1000	20.765	113.549	13.981	-165.606	-157.258
1200	21.057	117.362	18.165	-165.907	-155.561
1400	21.232	120.623	22.396	-166.351	-153.794
1600	21.311	123.464	26.652	-166.003	-151.932
1800	21.319	125.975	30.916	-171.139	-149.644
2000	21.282	128.220	35.177	-171.840	-147.218

$\text{TeCl}_2(\text{g})$
Tellurium dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.990	73.030	0	-46.165	-42.827
400	13.390	76.920	1.347	-46.111	-41.699
600	13.660	82.410	4.058	-46.026	-39.508
800	13.760	86.350	6.802	-45.984	-37.341
1000	13.810	89.430	9.560	-45.979	-35.186
1200	13.840	91.950	12.325	-46.013	-33.021
1400	13.860	94.090	15.095	-46.082	-30.859
1600	13.870	95.940	17.869	-46.166	-28.680
1800	13.880	97.570	20.645	-46.250	-26.476
2000	13.890	99.040	23.422	-46.333	-24.285

$\text{TeCl}_4(\text{c,l})$
Tellurium tetrachloride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	33.100	48.000	0	-102.700	-78.729
300	33.100	48.200	.061	-102.674	-78.579
400	33.100	57.740	3.376	-101.266	-70.762
497	33.100	64.930	6.586	-99.949	-63.514
497	55.000	74.000	11.096	-95.439	-63.514
500	55.000	74.340	11.261	-95.334	-63.325
600	55.000	84.360	16.761	-91.819	-57.249
700	55.000	92.840	22.261	-88.323	-51.768

*Entropy at 298 K estimated.

497 K, melting point; ΔH° = 4.510

689 K, boiling point; ΔH°(at 298 K) = 28.

$\text{ThCl}_4(\text{c,l})$
Thorium tetrachloride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	28.750	45.500	0	-283.642	-261.627
400	30.060	54.150	3.000	-283.009	-254.204
600	31.680	66.660	9.184	-281.663	-240.084
679	32.210	70.610	11.708	-281.098	-234.646
679	32.210	72.380	12.908	-279.898	-234.646
800	32.970	77.720	16.851	-278.997	-226.657
1000	34.160	85.210	23.565	-277.403	-213.759
1042	34.410	86.620	25.006	-277.050	-211.093
1042	40.000	100.720	39.696	-262.360	-211.093
1200	40.000	106.360	46.016	-260.174	-203.470
1400	40.000	112.530	54.016	-257.489	-194.237

*Entropy at 298 K estimated.

679 K, transition point; ΔH° = 1.200

1042 K, melting point; ΔH° = 14.690

$\text{ThCl}_4(\text{g})$
Thorium tetrachloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	24.273	95.000	0	-230.942	-223.685
400	24.922	102.236	2.510	-230.799	-221.229
600	25.414	112.453	7.552	-230.595	-216.492
800	25.594	119.793	12.656	-230.492	-211.810
1000	25.679	125.514	17.784	-230.484	-207.144
1200	25.726	130.201	22.925	-230.565	-202.471
1400	25.754	134.169	28.073	-230.732	-197.775
1600	25.773	137.609	33.226	-230.985	-193.051
1800	25.785	140.645	38.382	-232.076	-188.206
2000	25.794	143.362	43.540	-232.409	-183.313

$\text{TiCl}(\text{g})$
Titanium monochloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	8.915	59.538	0	36.900	29.275
400	9.491	62.243	.939	36.790	26.689
600	10.135	66.232	2.911	36.594	21.680
800	10.370	69.186	4.966	36.365	16.747
1000	10.442	71.509	7.048	36.059	11.878
1200	10.470	73.416	9.140	34.694	7.112
1400	10.494	75.031	11.236	34.425	2.536
1600	10.526	76.434	13.338	34.078	-1.996
1800	10.564	77.676	15.447	33.635	-6.481
2000	10.606	78.792	17.564	29.652	-10.814

*Data estimated.

$\text{TiCl}_2(\text{c,g})$
Titanium dichloride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	16.690	20.876	0	-123.200	-111.353
400	17.541	25.902	1.744	-122.928	-107.347
600	18.732	33.270	5.387	-122.314	-99.686
800	19.636	38.783	9.223	-121.644	-92.240
1000	20.540	43.262	13.241	-120.906	-84.970
1200	21.444	47.086	17.439	-121.063	-77.823
1400	22.348	50.460	21.819	-119.951	-70.703
1582	23.168	53.233	25.950	-118.862	-64.385
1582	15.132	90.818	85.390	-59.422	-64.385
1600	15.146	90.994	85.670	-59.456	-64.443
1800	15.324	92.788	88.716	-59.872	-65.043
2000	15.516	94.412	91.800	-63.802	-65.494

*Data above 298 K estimated.

1581.5 K, sublimation point; ΔH° = 59.440

$\text{TiCl}_2(\text{g})$
Titanium dichloride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	13.743	66.500	0	-56.700	-58.456
400	14.218	70.614	1.427	-56.745	-59.049
600	14.585	76.462	4.314	-56.887	-60.174
800	14.724	80.679	7.247	-57.120	-61.233
1000	14.803	83.974	10.200	-57.447	-62.223
1200	14.885	86.680	13.168	-58.834	-63.107
1400	14.997	88.982	16.156	-59.114	-63.797
1600	15.146	90.994	19.170	-59.456	-64.443
1800	15.324	92.788	22.216	-59.872	-65.043
2000	15.516	94.412	25.300	-63.802	-65.494

*Data except enthalpy of formation at 298 K estimated.

$\text{TiCl}_3(\text{c})$
Titanium trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	23.220	33.400	0	-172.300	-156.243
300	23.230	33.544	.043	-172.290	-156.143
400	23.676	40.289	2.389	-171.806	-150.834
500	24.077	45.616	4.777	-171.340	-145.646
600	24.431	50.037	7.202	-170.983	-140.551
700	24.739	53.827	9.661	-170.430	-135.526
800	25.000	57.148	12.149	-169.984	-130.572
900	25.216	60.106	14.660	-169.546	-125.671
1000	25.385	62.772	17.190	-169.115	-120.819

$\text{TiCl}_3(\text{g})$
Titanium trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	17.344	75.703	0	-129.500	-126.056
400	18.796	81.027	1.849	-129.546	-124.869
600	19.924	88.908	5.744	-129.540	-122.532
800	20.261	94.695	9.769	-129.564	-120.190
1000	20.377	99.231	13.834	-129.671	-117.835
1200	20.424	102.951	17.915	-130.843	-115.416
1400	20.445	106.101	22.002	-130.927	-112.839
1600	20.452	108.832	26.092	-131.100	-110.245
1800	20.452	111.241	30.183	-131.381	-107.622
2000	20.448	113.395	34.273	-135.219	-104.863

*Data except enthalpy of formation at 298 K estimated.

$\text{TiCl}_4(\text{l}, \text{g})$
Titanium tetrachloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	34.704	60.326	0	-192.200	-176.227
400	34.936	70.557	3.547	-190.970	-170.961
409	34.956	71.330	3.862	-190.864	-170.509
409	24.062	92.225	12.408	-182.318	-170.509
600	24.962	101.639	17.107	-182.161	-165.027
800	25.330	108.877	22.141	-182.057	-159.330
1000	25.507	114.551	27.227	-182.035	-153.650
1200	25.605	119.211	32.339	-183.075	-147.934
1400	25.665	123.163	37.466	-183.022	-142.083
1600	25.704	126.592	42.603	-183.055	-136.233
1800	25.731	129.622	47.747	-183.193	-130.374
2000	25.750	132.334	52.895	-186.886	-124.394

409 K, boiling point; $\Delta H^\circ = 8.546$

$\text{TiCl}_4(\text{g})$
Titanium tetrachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	22.852	84.793	0	-182.400	-173.722
400	24.008	91.690	2.393	-182.324	-170.768
600	24.962	101.639	7.307	-182.161	-165.027
800	25.330	108.877	12.341	-182.057	-159.330
1000	25.507	114.551	17.427	-182.035	-153.650
1200	25.605	119.211	22.539	-183.075	-147.934
1400	25.665	123.163	27.666	-183.022	-142.083
1600	25.704	126.592	32.803	-183.055	-136.233
1800	25.731	129.622	37.947	-183.193	-130.374
2000	25.750	132.334	43.095	-186.886	-124.394

$\text{TlCl}(\text{c}, \text{l})$
Thallium monochloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.170	26.590	0	-48.790	-44.200
400	12.640	30.250	1.270	-48.596	-42.663
600	13.640	35.550	3.890	-49.348	-39.714
704	14.040	37.780	5.320	-49.113	-38.080
704	17.900	43.060	9.040	-45.393	-38.080
800	17.900	45.350	10.760	-44.780	-37.128
1000	17.900	49.340	14.340	-43.512	-35.353
1200	17.900	52.610	17.920	-42.250	-33.852

704 K, melting point; $\Delta H^\circ = 3.720$

$\text{TlCl}(\text{g})$
Thallium monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.660	61.220	0	-16.120	-21.855
400	8.780	63.790	.889	-16.307	-23.790
600	8.870	67.370	2.656	-17.912	-27.370
800	8.900	69.920	4.433	-18.437	-30.441
1000	8.920	71.910	6.215	-18.967	-33.378
1200	8.920	73.540	7.999	-19.501	-36.219
1400	8.930	74.910	9.784	-20.039	-38.947

$(\text{TlCl})_2(\text{g})$
Dimeric thallium monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.390	92.440	0	-57.100	-59.625
400	19.600	98.170	1.987	-57.264	-60.466
600	19.750	106.150	5.925	-60.070	-61.832
800	19.800	111.840	9.881	-60.718	-62.328
1000	19.830	116.260	13.844	-61.379	-62.641
1200	19.840	119.880	17.811	-62.049	-62.846
1400	19.850	122.940	21.780	-62.726	-62.911

$\text{ImCl}_3(\text{g})$
Thulium trichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.664	89.392	0	-159.100	-156.645
400	19.165	94.956	1.930	-159.098	-155.809
600	19.546	102.813	5.808	-159.106	-154.164
800	19.686	108.458	9.733	-159.185	-152.509
1000	19.752	112.859	13.678	-159.381	-150.813
1200	19.789	116.464	17.632	-159.664	-149.080
1400	19.811	119.516	21.592	-160.027	-147.279
1600	19.825	122.162	25.556	-160.470	-145.436
1800	19.835	124.498	29.522	-160.988	-143.531
2000	19.842	126.588	33.490	-165.765	-141.158

$\text{UCl}_3(\text{c})$
Uranium trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.500	38.000	0	-206.000	-189.919
300	24.500	38.150	.045	-205.990	-189.819
400	24.680	45.210	2.500	-205.465	-184.511
500	25.160	50.770	4.990	-204.991	-179.329
600	25.770	55.410	7.535	-204.546	-174.240
700	26.420	59.430	10.145	-204.121	-169.221
800	27.110	63.000	12.825	-203.724	-164.259
900	27.820	66.240	15.570	-203.363	-159.353
1000	28.540	69.200	18.385	-203.624	-154.438

$\text{UCl}_4(\text{c}, \text{l})$
Uranium tetrachloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	29.100	47.140	0	-243.600	-222.300
300	29.119	47.320	.054	-243.588	-222.168
400	30.129	55.836	3.016	-242.972	-215.123
500	31.106	62.664	6.078	-242.352	-208.230
600	32.068	68.421	9.237	-241.728	-201.464
700	33.021	73.435	12.492	-241.097	-194.802
800	33.971	77.907	15.841	-240.473	-188.235
863	34.568	80.504	18.000	-240.083	-184.134
863	38.218	93.134	28.900	-229.183	-184.134
900	38.755	94.750	30.324	-228.819	-182.210
1000	40.205	98.908	34.272	-228.394	-177.048

863 K, melting point; $\Delta H^\circ = 10.900$

$\text{VCl}_2(\text{c})$
Vanadium dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.176	23.200	0	-108.000	-96.967
400	17.848	28.350	1.786	-107.683	-93.248
600	18.684	35.755	5.445	-107.032	-86.167
800	19.348	41.223	9.250	-106.332	-79.318
1000	19.962	45.607	13.181	-105.589	-72.650
1200	20.556	49.299	17.233	-104.911	-66.134

$\text{VCl}_3(\text{c})$
Vanadium trichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	22.270	31.300	0	-138.890	-122.328
300	22.304	31.438	.041	-138.882	-122.225
400	23.647	38.068	2.349	-138.432	-116.739
500	24.370	43.429	4.753	-137.944	-111.371
600	24.870	47.919	7.216	-137.434	-106.104
700	25.266	51.783	9.723	-136.909	-100.925
800	25.605	55.179	12.267	-136.370	-95.822
900	25.911	58.213	14.843	-135.822	-90.784

$\text{VCl}_4(\text{g})$
Vanadium tetrachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	22.960	87.580	0	-125.600	-117.873
400	24.080	94.500	2.410	-125.504	-115.239
600	25.000	104.470	7.330	-125.314	-110.150
800	25.350	111.720	12.370	-125.143	-105.128
1000	25.520	117.390	17.460	-125.025	-100.131
1200	25.620	122.060	22.570	-124.986	-95.171
1400	25.670	126.010	27.700	-125.034	-90.194

247 K, melting point; $\Delta H^\circ = 0.550$

428 K, boiling point; $\Delta H^\circ = 9.5$

WCl(g)
Tungsten monochloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	8.327	62.567	0	132.300	123.915
400	8.582	65.054	.863	132.139	121.078
600	8.802	68.583	2.604	131.795	115.615
800	8.904	71.130	4.376	131.427	110.278
1000	8.985	73.126	6.165	131.037	105.040
1200	9.071	74.771	7.970	130.629	99.881
1400	9.164	76.177	9.794	130.202	94.806
1600	9.257	77.406	11.636	129.756	89.778
1800	9.349	78.502	13.497	129.294	84.804
2000	9.439	79.492	15.375	128.814	79.884

*Data estimated.

$\text{WCl}_2(\text{c})$
Tungsten dichloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	18.600	31.200	0	-61.500	-52.588
300	18.610	31.315	.034	-61.492	-52.533
400	19.133	36.740	1.922	-61.025	-49.615
500	19.656	41.065	3.861	-60.545	-46.818
600	20.179	44.696	5.853	-60.040	-44.124
700	20.702	47.845	7.897	-59.500	-41.509
800	21.225	50.644	9.993	-58.922	-38.983
900	21.750	53.174	12.142	-58.304	-36.521

*Data except enthalpy of formation at 298 K estimated.

$\text{WCl}_2(\text{g})$
Tungsten dichloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	13.877	73.925	0	-3.000	-6.827
400	14.290	78.068	1.437	-3.010	-8.131
600	14.617	83.936	4.334	-3.059	-10.687
800	14.756	88.162	7.272	-3.143	-13.218
1000	14.881	91.467	10.235	-3.250	-15.719
1200	15.056	94.195	13.228	-3.369	-18.200
1400	15.295	96.533	16.262	-3.489	-20.646
1600	15.582	98.594	19.349	-3.597	-23.093
1800	15.890	100.447	22.496	-3.683	-25.528
2000	16.192	102.137	25.705	-3.746	-27.952

*Data estimated.

$\text{WCl}_4(\text{c})$
Tungsten tetrachloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	31.000	47.400	0	-105.900	-85.930
300	31.030	47.592	.057	-105.884	-85.806
400	32.335	56.697	3.226	-104.966	-79.249
500	33.640	64.053	6.524	-103.980	-72.933
600	34.945	70.302	9.954	-102.906	-66.826
700	36.250	75.786	13.513	-101.729	-60.901
800	37.555	80.712	17.204	-100.442	-55.159

*Data except enthalpy of formation at 298 K estimated.
770 K, pressure of decomposition products = 1 atm.

$\text{WCl}_4(\text{g})$
Tungsten tetrachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.629	90.624	0	-80.300	-73.217
400	24.526	97.709	2.458	-80.134	-70.822
600	25.224	107.812	7.446	-79.814	-66.240
800	25.485	115.110	12.521	-79.525	-61.760
1000	25.609	120.811	17.631	-79.269	-57.344
1200	25.678	125.487	22.760	-79.049	-52.979
1400	25.725	129.449	27.901	-78.868	-48.632
1600	25.765	132.887	33.050	-78.728	-44.326
1800	25.806	135.924	38.207	-78.624	-40.036
2000	25.854	138.645	43.373	-78.557	-35.751

*Data except enthalpy of formation at 298 K estimated.

$\text{WCl}_5(\text{c,l,g})$
Tungsten pentachloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	37.200	52.000	0	-122.600	-96.057
400	40.018	63.326	3.933	-121.382	-87.171
526	43.462	74.739	9.194	-119.580	-76.643
526	43.500	84.087	14.111	-114.663	-76.643
561	43.500	86.920	15.651	-114.112	-74.106
561	30.812	115.894	31.917	-97.846	-74.106
600	30.947	117.951	33.108	-97.735	-72.481
800	31.311	126.911	39.339	-97.173	-64.149
1000	31.490	133.919	45.621	-96.637	-55.951
1200	31.608	139.671	51.931	-96.134	-47.859
1400	31.711	144.552	58.263	-95.665	-39.836
1600	31.817	148.793	64.616	-95.228	-31.893
1800	31.930	152.547	70.991	-94.816	-24.003
2000	32.047	155.917	77.388	-94.431	-16.155

*Data estimated except enthalpy of formation and fusion.

526 K, melting point; $\Delta H^\circ = 4.917$ 561.4 K, boiling point; $\Delta H^\circ = 16.266$

$\text{WCl}_5(\text{g})$
Tungsten pentachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	28.736	96.935	0	-98.600	-85.455
400	29.979	105.576	2.998	-98.316	-81.006
600	30.947	117.951	9.108	-97.735	-72.481
800	31.311	126.911	15.339	-97.173	-64.149
1000	31.490	133.919	21.621	-96.636	-55.951
1200	31.608	139.671	27.931	-96.134	-47.859
1400	31.711	144.552	34.263	-95.665	-39.836
1600	31.817	148.793	40.616	-95.228	-31.893
1800	31.930	152.547	46.991	-94.816	-24.003
2000	32.047	155.917	53.388	-94.431	-16.155

*Data except enthalpy of formation are estimated.

$(\text{WCl}_5)_2(\text{g})$
Dimeric tungsten pentachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	62.969	170.521	0	-207.600	-174.348
400	64.828	189.319	6.520	-206.509	-163.155
600	66.283	215.934	19.658	-204.429	-141.938
800	66.830	235.088	32.976	-202.447	-121.413
1000	67.090	250.032	46.371	-200.544	-101.366
1200	67.233	262.278	59.805	-198.725	-81.699
1400	67.320	272.649	73.261	-196.995	-62.300
1600	67.377	281.642	86.731	-195.357	-43.176
1800	67.416	289.580	100.210	-193.804	-24.253
2000	67.444	296.685	113.696	-192.343	-5.493

*Data except enthalpy of formation at 298 K estimated.

$\text{WCl}_6(\text{c,l,g})$
Tungsten hexachloride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	41.926	57.000	0	-141.900	-108.904
400	46.000	69.890	4.478	-140.559	-97.829
450	48.000	75.317	6.778	-139.833	-92.535
450	50.000	77.539	7.778	-138.833	-92.535
503	50.000	83.106	10.428	-137.870	-87.136
503	45.000	90.601	14.198	-134.100	-87.136
555	45.000	95.028	16.538	-133.434	-82.318
555	48.000	97.911	18.138	-131.834	-82.318
600	48.000	101.653	20.298	-131.129	-78.331
614	48.000	102.729	20.951	-130.918	-77.137
614	36.882	126.065	35.270	-116.599	-77.137
800	37.239	135.901	42.182	-115.795	-65.265
1000	37.423	144.233	49.650	-114.965	-52.724
1200	37.524	151.065	57.146	-114.175	-40.347
1400	37.585	156.855	64.658	-113.429	-28.086
1600	37.625	161.876	72.179	-112.731	-15.945
1800	37.653	166.310	79.707	-112.076	-3.891
2000	37.672	170.278	87.239	-111.470	8.098

450 K, transition point; $\Delta H^\circ = 1.000$

503 K, transition point; $\Delta H^\circ = 3.770$

555 K, melting point; $\Delta H^\circ = 1.600$

613.6 K, boiling point; $\Delta H^\circ = 14.319$

$\text{WCl}_6(\text{g})$
Tungsten hexachloride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	34.402	100.155	0	-118.000	-97.870
400	35.793	110.486	3.584	-117.553	-91.061
600	36.850	125.239	10.868	-116.659	-78.013
800	37.239	135.901	18.282	-115.795	-65.265
1000	37.423	144.233	25.750	-114.965	-52.724
1200	37.524	151.065	33.246	-114.175	-40.347
1400	37.585	156.855	40.758	-113.429	-28.086
1600	37.625	161.876	48.279	-112.731	-15.945
1800	37.653	166.310	55.807	-112.076	-3.891
2000	37.672	170.278	63.339	-111.470	8.098

$\text{YCl}_3(\text{c,l})$
Yttrium trichloride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	22.000	32.700	0	-239.000	-221.751
400	23.430	39.391	2.323	-238.598	-215.919
600	24.646	49.157	7.148	-237.686	-204.768
800	25.293	56.342	12.146	-236.734	-193.942
994	25.763	61.885	17.100	-235.802	-183.671
994	32.400	69.450	24.620	-228.282	-183.671
1000	32.400	69.645	24.814	-228.214	-183.401
1200	32.400	75.552	31.294	-225.972	-174.658

*Entropy and heat capacity at 298 K estimated.
994 K, melting point; $\Delta \text{H}^\circ = 7.520$

$\text{YbCl}_3(\text{g})$
Ytterbium trichloride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	18.659	88.403	0	-152.700	-150.961
400	19.163	93.967	1.929	-152.697	-150.369
600	19.545	101.823	5.807	-152.845	-149.176
800	19.685	107.468	9.732	-153.016	-147.932
1000	19.752	111.869	13.677	-153.246	-146.638
1200	19.788	115.473	17.631	-155.947	-145.038
1400	19.810	118.526	21.591	-156.454	-143.174
1600	19.825	121.172	25.555	-187.261	-138.470
1800	19.835	123.507	29.521	-187.018	-132.382
2000	19.842	125.598	33.488	-186.786	-126.326

$\text{ZnCl}_2(\text{c,l})$
Zinc dichloride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	17.050	26.645	0	-99.200	-88.289
300	17.070	26.751	.030	-99.196	-88.223
400	17.880	31.781	1.780	-98.894	-84.610
500	18.490	35.839	3.600	-98.567	-81.077
570	18.880	38.287	4.910	-98.327	-78.642
570	18.890	42.375	7.240	-95.997	-78.642
600	19.060	43.348	7.810	-95.892	-77.730
700	19.610	46.327	9.740	-97.290	-74.718

570 K, melting point; $\Delta \text{H}^\circ = 2.330$

$\text{ZrCl}(\text{g})$
Zirconium monochloride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	8.366	60.754	0	49.100	41.709
400	8.612	63.251	.866	48.892	39.215
600	8.888	66.798	2.617	48.424	34.475
800	9.162	69.392	4.422	47.898	29.903
1000	9.453	71.468	6.284	47.340	25.468
1200	9.720	73.215	8.201	45.891	21.201
1400	9.940	74.731	10.168	45.566	17.111
1600	10.110	76.070	12.174	45.211	13.069
1800	10.235	77.268	14.209	44.818	9.075
2000	10.323	78.351	16.266	44.379	5.128

*Data except enthalpy of formation at 298 K estimated.

$\text{ZrCl}_2(\text{c,l,g})$
Zirconium dichloride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	17.350	26.300	0	-103.000	-92.174
400	18.168	31.521	1.812	-102.684	-88.524
600	19.130	39.082	5.548	-102.029	-81.584
800	19.868	44.692	9.451	-101.338	-74.875
1000	20.536	49.199	13.493	-100.609	-68.342
1000	21.750	55.599	19.893	-94.209	-68.342
1200	21.750	59.564	24.243	-94.123	-63.206
1400	21.750	62.917	28.593	-92.968	-58.146
1565	21.750	65.345	32.188	-92.069	-54.088
1565	15.119	94.068	77.148	-47.109	-54.088
1600	15.146	94.400	77.673	-47.156	-54.242
1800	15.323	96.194	80.720	-47.447	-55.111
2000	15.516	97.818	83.804	-47.772	-55.944

*Data estimated.

1000 K, melting point; $\Delta \text{H}^\circ = 6.400$

1565.3 K, boiling point; $\Delta \text{H}^\circ = 44.960$

$\text{ZrCl}_2(\text{g})$
Zirconium dichloride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	13.785	69.896	0	-44.500	-46.672
400	14.231	74.017	1.429	-44.567	-47.406
600	14.587	79.868	4.318	-44.759	-48.786
800	14.724	84.085	7.250	-45.039	-50.090
1000	14.803	87.380	10.204	-45.398	-51.312
1200	14.885	90.086	13.172	-46.694	-52.404
1400	14.997	92.388	16.160	-46.901	-53.338
1600	15.146	94.400	19.173	-47.156	-54.242
1800	15.323	96.194	22.220	-47.447	-55.111
2000	15.516	97.818	25.304	-47.772	-55.944

*Data except enthalpy of formation at 298 K estimated.

$\text{ZrCl}_3(\text{c}, \text{g})$
Zirconium trichloride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	22.990	34.850	0	-170.700	-154.479
400	24.069	41.768	2.400	-170.219	-149.013
600	25.235	51.767	7.340	-169.221	-138.623
800	26.064	59.143	12.472	-168.182	-128.581
1000	26.788	65.038	17.759	-167.100	-118.803
1046	26.908	66.243	18.991	-166.848	-116.593
1046	20.709	105.718	60.278	-125.561	-116.593
1200	20.817	108.573	63.478	-126.544	-115.212
1400	20.889	111.788	67.650	-126.470	-113.330
1600	20.915	114.579	71.831	-126.464	-111.454
1800	20.913	117.043	76.014	-126.529	-109.576
2000	20.895	119.245	80.195	-126.671	-107.683

*Data except enthalpy of formation at 298 K estimated.
1045.9 K, sublimation point; $\Delta \text{H}^\circ = 41.287$

$\text{ZrCl}_3(\text{g})$
Zirconium trichloride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	18.170	81.070	0	-125.300	-122.860
400	18.969	86.531	1.895	-125.324	-122.023
600	19.874	94.412	5.788	-125.372	-120.362
800	20.389	100.207	9.819	-125.436	-118.685
1000	20.669	104.790	13.928	-125.532	-116.986
1200	20.817	108.573	18.078	-126.544	-115.212
1400	20.889	111.788	22.250	-126.470	-113.330
1600	20.915	114.579	26.431	-126.464	-111.454
1800	20.913	117.043	30.614	-126.529	-109.576
2000	20.895	119.245	34.795	-126.671	-107.683

*Data except enthalpy of formation at 298 K estimated.

$\text{ZrCl}_4(\text{c}, \text{g})$
Zirconium tetrachloride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	28.650	43.400	0	-234.350	-212.734
400	29.952	52.031	2.995	-233.696	-205.450
600	31.470	64.456	9.133	-232.361	-191.613
610	31.557	64.954	9.437	-232.292	-190.958
610	25.190	105.381	34.081	-207.648	-190.958
800	25.455	112.267	38.906	-207.564	-185.762
1000	25.589	117.963	44.012	-207.555	-180.314
1200	25.663	122.635	49.137	-208.491	-174.808
1400	25.708	126.595	54.275	-208.354	-169.206
1600	25.737	130.030	59.419	-208.292	-163.620
1800	25.757	133.062	64.569	-208.300	-158.035
2000	25.771	135.777	69.722	-208.383	-152.445

609.6 K, sublimation point of ZrCl_4 ; $\Delta \text{H}^\circ = 24.644$

$\text{ZrCl}_4(\text{g})$
Zirconium tetrachloride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	23.478	87.859	0	-207.930	-199.570
400	24.426	94.908	2.445	-207.826	-196.731
600	25.174	104.981	7.419	-207.655	-191.222
800	25.455	112.267	12.486	-207.564	-185.762
1000	25.589	117.963	17.592	-207.555	-180.314
1200	25.663	122.635	22.717	-208.491	-174.808
1400	25.708	126.595	27.855	-208.354	-169.206
1600	25.737	130.030	32.999	-208.292	-163.620
1800	25.757	133.062	38.149	-208.300	-158.035
2000	25.771	135.777	43.302	-208.383	-152.445

Fluorides

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

Source of data: reference 25.

AlF(g)
Aluminum monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.632	51.398	0	-63.500	-69.582
400	8.031	53.699	.799	-63.701	-71.629
600	8.485	57.053	2.456	-64.136	-75.501
800	8.705	59.528	4.178	-64.671	-79.212
1000	8.828	61.485	5.932	-67.902	-82.590
1200	8.907	63.102	7.706	-68.535	-85.468
1400	8.962	64.479	9.493	-69.163	-88.241
1600	9.006	65.679	11.290	-69.788	-90.924
1800	9.041	66.742	13.095	-70.411	-93.529
2000	9.072	67.696	14.906	-71.034	-96.063

$\text{AlF}_3(\text{g})$
Aluminum trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.945	66.150	0	-289.400	-285.437
400	16.402	70.760	1.601	-289.582	-284.054
600	17.985	77.753	5.061	-289.848	-281.230
800	18.723	83.040	8.741	-290.134	-278.316
1000	19.107	87.264	12.527	-293.085	-275.137
1200	19.329	90.769	16.373	-293.423	-271.515
1400	19.468	93.760	20.254	-293.752	-267.838
1600	19.560	96.365	24.157	-294.080	-264.112
1800	19.624	98.673	28.076	-294.410	-260.346
2000	19.670	100.743	32.005	-294.743	-256.543

$\text{AlF}_2(\text{g})$
Aluminum difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	10.960	63.120	0	-166.000	-168.356
400	11.844	66.473	1.164	-166.228	-169.125
600	12.801	71.483	3.642	-166.659	-170.480
800	13.239	75.233	6.251	-167.161	-171.682
1000	13.465	78.214	8.924	-170.349	-172.559
1200	13.595	80.661	11.631	-170.937	-172.945
1400	13.676	82.764	14.358	-171.523	-173.235
1600	13.729	84.613	17.099	-172.109	-173.439
1800	13.767	86.233	19.849	-172.697	-173.570
2000	13.794	87.685	22.605	-173.289	-173.635

$(\text{AlF}_3)_2(\text{g})$
Dimeric aluminum trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	31.964	92.476	0	-628.000	-608.201
400	35.684	102.431	3.460	-628.107	-601.415
600	39.466	117.725	11.029	-627.990	-588.084
800	41.155	129.340	19.111	-627.840	-574.811
1000	42.022	138.626	27.438	-632.986	-561.199
1200	42.518	146.335	35.896	-632.895	-546.836
1400	42.826	152.914	44.432	-632.780	-532.504
1600	43.030	158.647	53.019	-632.656	-518.187
1800	43.171	163.723	61.640	-632.531	-503.883
2000	43.273	168.278	70.285	-632.412	-489.596

*Data except enthalpy of formation at 298 K estimated

$\text{AlF}_3(\text{c})$
Aluminum trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.950	15.890	0	-361.000	-342.052
400	20.619	21.577	1.978	-360.806	-335.604
600	23.247	30.470	6.381	-360.128	-323.140
728	26.044	35.189	9.510	-359.511	-315.306
728	23.321	35.374	9.645	-359.376	-315.306
800	23.541	37.584	11.331	-359.145	-310.961
1000	24.107	42.899	16.097	-361.115	-298.803
1200	24.605	47.339	20.969	-360.427	-286.403
1400	25.036	51.165	25.934	-359.672	-274.125
1600	25.398	54.533	30.979	-358.858	-261.959

$\text{AsF}_3(\text{g})$
Arsenic trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	15.460	68.990	0	-187.800	-184.160
300	15.490	69.090	.029	-187.803	-184.139
400	16.950	73.760	1.657	-187.929	-182.895
500	17.830	77.640	3.399	-188.006	-181.624
600	18.380	80.950	5.212	-188.064	-180.346
700	18.740	83.810	7.069	-188.120	-179.055
800	18.990	86.330	8.956	-188.179	-177.757
900	19.160	88.580	10.864	-196.509	-176.226
1000	19.290	90.600	12.787	-196.399	-173.974

728 K, transition point; $\Delta H^\circ = 0.135$

BF(g)
Boron monofluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.073	47.890	0	-29.200	-35.836
400	7.309	50.000	.732	-29.182	-38.110
600	7.832	55.065	2.247	-29.366	-42.543
800	8.211	55.374	3.854	-29.678	-46.888
1000	8.457	57.234	5.523	-30.041	-51.148
1200	8.620	58.792	7.231	-30.445	-55.338
1400	8.732	60.129	8.967	-30.888	-59.448
1600	8.814	61.301	10.722	-31.379	-63.503
1800	8.877	62.343	12.492	-31.917	-67.474
2000	8.927	63.281	14.272	-32.506	-71.405

BF₃(g)
Boron trifluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	12.057	60.766	0	-271.500	-267.532
400	13.753	64.556	1.318	-271.678	-266.149
600	16.030	70.605	4.317	-272.013	-263.311
800	17.344	75.413	7.666	-272.293	-260.365
1000	18.117	79.374	11.219	-272.523	-257.355
1200	18.595	82.723	14.893	-272.737	-254.306
1400	18.905	85.614	18.646	-272.959	-251.213
1600	19.117	88.153	22.449	-273.211	-248.097
1800	19.268	90.414	26.288	-273.500	-244.928
2000	19.378	92.450	30.153	-273.833	-241.747

BF₂(g)
Boron difluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	9.693	59.046	0	-141.000	-143.741
400	10.614	62.026	1.035	-141.070	-144.668
600	11.909	66.598	3.299	-141.322	-146.418
800	12.628	70.133	5.760	-141.635	-148.068
1000	13.035	72.999	8.330	-141.973	-149.637
1200	13.280	75.399	10.963	-142.340	-151.141
1400	13.436	77.458	13.636	-142.744	-152.572
1600	13.542	79.260	16.335	-143.195	-153.953
1800	13.617	80.859	19.051	-143.697	-155.255
2000	13.673	82.297	21.780	-144.252	-156.522

BaF(g)
Barium monofluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.305	58.823	0	-77.000	-82.869
400	8.571	61.305	.861	-77.269	-84.838
600	8.805	64.832	2.602	-78.368	-88.415
800	8.907	67.381	4.375	-79.370	-91.622
1000	8.967	69.375	6.162	-80.410	-94.565
1200	9.009	71.014	7.960	-83.364	-96.925
1400	9.044	72.405	9.765	-84.397	-99.104
1600	9.081	73.615	11.578	-85.428	-101.132
1800	9.125	74.687	13.398	-86.459	-103.035
2000	9.163	75.652	15.229	-87.482	-104.822

(BF₂)₂(g)
Dimeric boron difluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.378	76.093	0	-344.200	-337.160
400	21.204	81.907	2.022	-344.388	-334.727
600	24.896	91.274	6.667	-344.775	-329.813
800	26.964	98.747	11.873	-345.117	-324.767
1000	28.157	104.904	17.395	-345.411	-319.645
1200	28.886	110.107	23.105	-345.701	-314.473
1400	29.357	114.598	28.933	-346.027	-309.238
1600	29.676	118.540	34.838	-346.422	-303.971
1800	29.902	122.049	40.797	-346.899	-298.610
2000	30.066	125.208	46.795	-347.469	-293.237

BaF₂(c,l)
Barium difluoride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	17.181	23.030	0	-290.500	-278.475
400	17.854	28.180	1.786	-290.235	-274.414
600	19.197	35.670	5.490	-290.188	-266.537
800	20.249	41.344	9.440	-289.869	-258.707
1000	22.533	46.045	13.661	-289.350	-250.968
1200	32.153	50.823	18.931	-289.720	-243.032
1310	44.391	54.123	23.080	-287.624	-238.833
1310	28.240	54.123	23.080	-287.624	-238.833
1400	28.240	55.999	25.621	-286.766	-235.512
1480	28.240	57.569	27.880	-286.005	-232.605
1480	17.013	57.920	28.400	-285.485	-232.605
1600	34.244	59.909	31.475	-284.661	-228.335
1640	39.987	60.825	32.960	-283.927	-226.934
1640	23.700	63.874	37.960	-278.927	-226.934
1800	23.700	66.080	41.752	-278.144	-221.899
2000	23.700	68.577	46.492	-277.174	-215.702

1310 K, transition point; ΔH° = 0

1480 K, transition point; ΔH° = 0.520

1640 K, melting point; ΔH° = 5.000

$\text{BaF}_2(\text{g})$
Barium difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.854	71.985	0	-192.100	-194.671
400	13.277	75.829	1.333	-192.288	-195.527
600	13.613	81.288	4.028	-193.250	-196.969
800	13.740	85.224	6.765	-194.144	-198.086
1000	13.800	88.297	9.520	-195.091	-198.961
1200	13.833	90.816	12.284	-197.967	-199.270
1400	13.853	92.950	15.052	-198.935	-199.412
1600	13.867	94.801	17.824	-199.912	-199.413
1800	13.876	96.435	20.599	-200.897	-199.291
2000	13.882	97.897	23.375	-201.891	-199.059

$\text{BeF}(\text{g})$
Beryllium monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.140	49.149	0	-40.600	-47.355
400	7.431	51.286	.741	-40.693	-49.652
600	7.978	54.408	2.285	-41.012	-54.066
800	8.335	56.756	3.919	-41.407	-58.363
1000	8.555	58.642	5.610	-41.846	-62.550
1200	8.698	60.215	7.336	-42.354	-66.651
1400	8.797	61.564	9.086	-42.935	-70.648
1600	8.869	62.743	10.853	-47.094	-74.470
1800	8.925	63.791	12.633	-47.632	-77.875
2000	8.970	64.734	14.423	-48.165	-81.191

$\text{BeF}_2(\text{c,l})$
Beryllium difluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.390	12.750	0	-245.400	-234.081
400	14.985	16.746	1.392	-245.234	-230.236
500	17.580	20.369	3.020	-244.911	-226.524
500	15.323	20.519	3.095	-244.836	-226.524
600	15.948	23.365	4.657	-244.649	-222.875
800	17.777	28.185	8.017	-244.172	-215.686
825	18.060	28.737	8.465	-244.094	-214.798
825	20.300	30.095	9.585	-242.974	-214.798
1000	20.300	34.000	13.137	-242.058	-208.913
1200	20.300	37.701	17.197	-241.120	-202.379

500 K, transition point; $\Delta H^\circ = 0.075$

825 K, melting point; $\Delta H^\circ = 1.120$

$\text{BeF}_2(\text{vitreous})$
Beryllium difluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	11.850	14.300	0	-244.280	-218.980
300	11.913	14.373	.022	-244.293	-218.825
400	14.119	18.147	1.339	-244.950	-210.233
500	15.124	21.418	2.807	-245.591	-201.482
600	15.650	24.227	4.348	-246.255	-192.595

*Entropy and heat capacity at 298 K estimated.

$\text{BeF}_2(\text{g})$
Beryllium difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.081	54.360	0	-190.250	-191.337
400	11.955	57.747	1.176	-190.300	-191.703
600	13.038	62.819	3.685	-190.471	-192.369
800	13.663	66.664	6.361	-190.678	-192.976
1000	14.036	69.756	9.134	-190.911	-193.522
1200	14.269	72.337	11.966	-191.201	-194.023
1400	14.422	74.549	14.837	-191.559	-194.458
1600	14.527	76.482	17.732	-195.494	-194.752
1800	14.602	78.198	20.645	-195.809	-194.657
2000	14.656	79.739	23.571	-196.121	-194.495

$\text{BiF}_3(\text{c,l})$
Bismuth trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	20.500	29.300	0	-217.300	-200.328
300	20.565	29.427	.038	-217.294	-200.222
400	23.087	35.723	2.233	-216.874	-194.591
500	24.642	41.050	4.623	-216.348	-189.078
600	26.242	45.677	7.163	-216.461	-183.408
700	28.771	49.894	9.902	-217.687	-177.623
800	33.062	53.992	12.976	-216.584	-171.967
900	39.933	58.254	16.601	-214.932	-166.485
922	41.871	59.241	17.500	-214.468	-165.307
922	44.100	64.805	22.630	-209.338	-165.307
1000	44.100	68.386	26.070	-207.442	-161.656
1100	44.100	72.590	30.480	-205.014	-157.197

*Heat capacity at 298 K estimated.

922 K, melting point; $\Delta H^\circ = 5.130$

$\text{BiF}_3(\text{g})$
Bismuth trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	17.360	75.920	0.000	-169.200	-166.128
300	17.390	76.030	0.030	-169.202	-166.111
400	18.440	81.200	1.830	-169.176	-165.084
500	18.920	85.370	3.700	-169.171	-164.061
600	19.200	88.840	5.610	-171.913	-162.759
700	19.360	91.820	7.540	-171.949	-161.233
800	19.480	94.410	9.480	-171.980	-159.697
900	19.560	96.710	11.430	-172.003	-158.167
1000	19.620	98.770	13.390	-172.022	-156.619

*Data except enthalpy of formation at 298 K estimated.

$\text{BrF}(\text{g})$
Bromine monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.877	54.700	0	-14.000	-17.664
400	8.255	57.072	.823	-17.706	-18.155
600	9.640	60.503	2.518	-17.713	-18.378
800	8.820	63.015	4.266	-17.714	-18.599
1000	8.922	64.995	6.041	-17.714	-18.821
1200	8.992	66.629	7.833	-17.713	-19.042
1400	9.044	68.019	9.636	-17.713	-19.264
1600	9.087	69.229	11.450	-17.712	-19.484
1800	9.125	70.302	13.271	-17.712	-19.707
2000	9.160	71.265	15.099	-17.712	-19.928

$\text{BrF}_3(\text{g})$
Bromine trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	15.893	69.867	0	-61.100	-54.843
400	17.345	74.763	1.700	-64.712	-51.958
600	18.627	82.081	5.319	-64.429	-45.638
800	19.145	87.521	9.103	-64.104	-39.424
1000	19.398	91.823	12.960	-63.773	-33.292
1200	19.540	95.373	16.855	-63.446	-27.226
1400	19.627	98.392	20.772	-63.127	-21.215
1600	19.684	101.017	24.704	-62.817	-15.248
1800	19.723	103.338	28.644	-62.518	-9.321
2000	19.751	105.417	32.592	-62.228	-3.424

$\text{BrF}_5(\text{g})$
Bromine pentafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.236	77.337	0	-102.500	-84.027
400	27.005	84.888	2.624	-105.971	-76.987
600	29.439	96.380	8.309	-105.256	-62.641
800	30.419	105.002	14.307	-104.427	-48.562
1000	30.899	111.847	20.444	-103.567	-34.695
1200	31.167	117.506	26.653	-102.703	-21.000
1400	31.331	122.324	32.904	-101.845	-7.453
1600	31.439	126.515	39.182	-100.998	5.976
1800	31.513	130.223	45.478	-100.163	19.297
2000	31.566	133.546	51.786	-99.343	32.527

$\text{CF}(\text{g})$
Carbon monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.184	50.889	0	61.000	53.458
400	7.432	53.033	.744	61.104	50.864
600	7.954	56.149	2.284	61.133	45.730
800	8.312	58.490	3.914	61.026	40.610
1000	8.538	60.371	5.600	60.842	35.524
1200	8.686	61.942	7.324	60.615	30.482
1400	8.789	63.289	9.072	60.357	25.479
1600	8.864	64.468	10.837	60.075	20.515
1800	8.923	65.515	12.616	59.775	15.589
2000	8.970	66.458	14.406	59.460	10.696

$\text{CF}_2(\text{g})$
Carbon difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	9.309	57.533	0	-43.500	-45.801
400	10.300	60.410	1.000	-43.531	-46.582
600	11.716	64.880	3.214	-43.645	-48.086
800	12.504	68.370	5.644	-43.808	-49.543
1000	12.950	71.213	8.193	-44.004	-50.957
1200	13.219	73.599	10.812	-44.224	-52.325
1400	13.391	75.651	13.474	-44.466	-53.658
1600	13.507	77.447	16.165	-44.726	-54.952
1800	13.591	79.043	18.875	-45.005	-56.214
2000	13.655	80.478	21.600	-45.300	-57.442

$\text{CF}_3(\text{g})$
Carbon trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.903	63.329	0	-112.400	-109.208
400	13.735	67.092	1.309	-112.514	-108.097
600	16.172	73.170	4.323	-112.645	-105.858
800	17.503	78.024	7.704	-112.712	-103.585
1000	18.253	82.018	11.286	-112.750	-101.300
1200	18.706	85.389	14.986	-112.778	-99.006
1400	18.995	88.296	18.758	-112.807	-96.710
1600	19.190	90.846	22.578	-112.843	-94.406
1800	19.328	93.114	26.430	-112.890	-92.098
2000	19.428	95.156	30.306	-112.949	-89.784

$\text{C}_2\text{F}_4(\text{g})$
Tetrafluoroethylene (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.230	71.678	0	-157.400	-149.066
400	21.965	77.731	2.105	-157.357	-146.223
600	25.531	87.377	6.887	-157.231	-140.682
800	27.611	95.033	12.219	-157.085	-135.190
1000	28.858	101.339	17.876	-156.918	-129.737
1200	29.641	106.675	23.732	-156.740	-124.315
1400	30.157	111.286	29.715	-156.565	-118.927
1600	30.512	115.337	35.784	-156.398	-113.558
1800	30.764	118.946	41.913	-156.247	-108.212
2000	30.950	122.198	48.085	-156.115	-102.883

$\text{CF}_4(\text{g})$
Carbon tetrafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.592	62.454	0	-223.040	-212.365
400	17.304	67.139	1.631	-223.223	-208.685
600	20.741	74.877	5.471	-223.345	-201.381
800	22.580	81.122	9.021	-223.298	-194.065
1000	23.613	86.282	14.450	-223.165	-186.772
1200	24.234	90.647	19.239	-222.992	-179.509
1400	24.631	94.414	24.129	-222.801	-172.276
1600	24.899	97.722	29.083	-222.607	-165.071
1800	25.087	100.666	34.083	-222.416	-157.890
2000	25.224	103.317	39.115	-222.234	-150.730

$\text{C}_2\text{F}_6(\text{g})$
Hexafluoroethane (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	25.432	79.368	0	-321.200	-300.716
400	30.006	87.513	2.834	-321.211	-293.710
600	35.542	100.855	9.453	-320.882	-280.017
800	38.315	111.504	16.869	-320.362	-266.474
1000	39.791	120.226	24.692	-319.780	-253.071
1200	40.652	127.562	32.742	-319.185	-239.782
1400	41.185	133.870	40.928	-318.602	-226.597
1600	41.541	139.394	49.203	-318.038	-213.488
1800	41.771	144.301	57.535	-317.504	-200.452
2000	41.957	148.712	65.908	-317.001	-187.473

$\text{C}_2\text{F}_2(\text{g})$
Difluoroacetylene (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.608	58.305	0	5.000	2.878
400	15.117	62.525	1.467	5.188	2.124
600	17.111	69.066	4.706	5.405	.537
800	18.310	74.167	8.258	5.481	-1.101
1000	19.049	78.339	12.000	5.484	-2.750
1200	19.523	81.857	15.861	5.444	-4.391
1400	19.839	84.892	19.799	5.369	-6.027
1600	20.058	87.556	23.790	5.267	-7.645
1800	20.215	89.928	27.818	5.137	-9.252
2000	20.332	92.064	31.873	4.982	-10.842

$\text{CaF}(\text{g})$
Calcium monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.045	54.860	0	-65.000	-71.171
400	8.383	57.276	.838	-65.181	-73.251
600	8.702	60.745	2.552	-65.611	-77.198
800	8.844	63.270	4.308	-66.408	-80.951
1000	8.923	65.253	6.085	-67.264	-84.499
1200	8.976	66.885	7.875	-70.175	-87.692
1400	9.016	68.271	9.674	-70.674	-90.571
1600	9.049	69.477	11.481	-71.172	-93.386
1800	9.078	70.545	13.294	-108.209	-95.196
2000	9.107	71.503	15.112	-108.305	-93.746

$\text{CaF}_2(\text{c,l})$
Calcium difluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	16.050	16.460	0	-293.800	-281.301
400	17.472	21.385	1.711	-293.499	-277.073
600	19.095	28.829	5.393	-292.778	-269.014
800	19.945	34.436	9.295	-292.284	-261.175
1000	21.213	39.014	13.404	-291.684	-253.473
1200	23.484	43.044	17.831	-292.847	-245.734
1400	36.515	47.348	23.445	-290.428	-238.040
1430	41.323	48.170	24.610	-289.743	-236.923
1430	28.304	48.170	24.610	-289.743	-236.923
1600	30.020	51.450	29.576	-287.506	-230.776
1690	30.726	53.112	32.310	-286.219	-227.610
1690	23.700	57.325	39.430	-279.099	-227.610
1800	23.700	58.820	42.037	-314.805	-223.360

1430 K, transition point; $\Delta H^\circ = 0$
1690 K, melting point; $\Delta H^\circ = 7.120$

$\text{CaF}_2(\text{g})$
Calcium difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.253	65.412	0	-189.100	-191.196
400	12.875	69.110	1.283	-189.227	-191.891
600	13.408	74.449	3.920	-189.551	-193.159
800	13.619	78.339	6.626	-190.253	-194.267
1000	13.721	81.591	9.361	-191.027	-195.193
1200	13.778	83.898	12.111	-193.867	-195.779
1400	13.812	86.024	14.870	-194.303	-196.061
1600	13.835	87.870	17.635	-194.747	-196.289
1800	13.851	89.501	20.404	-231.738	-195.518
2000	13.862	90.961	23.175	-231.796	-191.492

$\text{CeF}_3(\text{c,l})$
Cerium trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	22.250	27.600	0	-403.660	-385.096
400	23.309	34.303	2.326	-403.181	-378.826
600	24.474	43.986	7.110	-402.268	-366.849
800	25.703	51.188	12.122	-401.387	-355.175
1000	27.341	57.090	17.419	-401.157	-343.734
1200	29.472	62.256	23.091	-401.255	-332.200
1400	32.127	66.991	29.242	-399.599	-320.813
1600	35.316	71.483	35.978	-397.379	-309.705
1710	37.301	73.896	39.970	-395.876	-303.720
1710	32.000	81.674	53.270	-382.576	-303.720
1800	32.000	83.315	56.150	-381.739	-299.601
2000	32.000	86.687	62.550	-379.886	-290.574

1710 K, melting point; $\Delta H^\circ = 13.300$

$\text{CeF}_3(\text{g})$
Cerium trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.345	80.543	0	-298.400	-295.621
400	18.336	85.792	1.822	-298.424	-294.665
600	19.439	93.456	5.609	-298.508	-292.772
800	20.140	99.151	9.572	-298.677	-290.836
1000	20.560	103.695	13.646	-299.670	-288.852
1200	20.760	107.464	17.781	-301.305	-286.499
1400	20.818	110.670	21.941	-301.640	-284.004
1600	20.796	113.448	26.103	-301.993	-281.464
1800	20.737	115.895	30.257	-302.372	-278.878
2000	20.664	118.076	34.397	-302.779	-276.244

$\text{ClF}(\text{g})$
Chlorine monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.668	52.062	0	-12.020	-12.376
400	8.067	54.375	.802	-12.032	-12.497
600	8.513	57.742	2.466	-12.046	-12.726
800	8.729	60.224	4.193	-12.056	-12.951
1000	8.850	62.186	5.952	-12.065	-13.174
1200	8.929	63.807	7.730	-12.074	-13.395
1400	8.986	65.188	9.522	-12.082	-13.615
1600	9.032	66.391	11.324	-12.092	-13.833
1800	9.072	67.457	13.134	-12.102	-14.050
2000	9.114	68.415	14.953	-12.111	-14.265

$\text{ClF}_3(\text{g})$
Chlorine trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	15.260	67.279	0	-37.970	-28.420
400	16.875	72.012	1.644	-37.923	-25.163
600	18.366	79.184	5.192	-37.687	-18.829
800	18.984	84.564	8.935	-37.391	-12.589
1000	19.291	88.837	12.766	-37.079	-6.424
1200	19.464	92.370	16.643	-36.766	-3.321
1400	19.570	95.379	20.547	-36.457	5.728
1600	19.640	97.997	24.468	-36.157	11.734
1800	19.688	100.314	28.402	-35.863	17.703
2000	19.723	102.390	32.343	-35.580	23.640

$\text{ClF}_5(\text{g})$
Chlorine pentafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.223	74.241	0	-57.000	-35.083
400	26.295	81.539	2.537	-56.843	-27.614
600	29.058	92.815	8.117	-56.209	-13.127
800	30.188	101.350	14.057	-55.426	1.117
1000	30.746	108.153	20.156	-54.597	15.157
1200	31.058	113.789	26.339	-53.755	29.029
1400	31.250	118.592	32.571	-52.913	42.759
1600	31.376	122.773	38.835	-52.078	56.372
1800	31.463	126.474	45.119	-51.255	69.879
2000	31.525	129.792	51.418	-50.444	83.296

*Enthalpy of formation at 298 K estimated

$\text{CoF}_2(\text{c,l})$
Cobalt difluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	16.440	19.590	0	-160.700	-149.957
400	18.074	24.683	1.769	-160.339	-146.344
600	19.394	32.302	5.536	-159.553	-139.511
800	20.049	37.979	9.486	-158.901	-132.931
1000	20.511	42.504	13.544	-158.248	-126.527
1200	20.897	46.279	17.685	-157.792	-120.225
1400	21.248	49.526	21.900	-157.698	-113.987
1400*	24.000	59.312	35.600	-143.998	-113.987

*Heat capacity of liquid estimated
1400 K, melting point; $\Delta H^\circ = 13.700$

$\text{CoF}_2(\text{g})$
Cobalt difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.239	66.421	0	-85.200	-88.419
400	12.793	70.102	1.277	-85.331	-89.504
600	13.341	75.409	3.899	-85.690	-91.512
800	13.613	79.288	6.596	-86.291	-93.368
1000	13.803	82.347	9.338	-86.954	-95.076
1200	13.960	84.877	12.115	-87.862	-96.612
1400	14.093	87.040	14.921	-89.177	-97.986
1600	14.202	88.929	17.751	-90.076	-99.185
1800	14.293	90.607	20.601	-94.637	-100.213
2000	14.366	92.117	23.467	-95.904	-100.766

$\text{CoF}_3(\text{c})$
Cobalt trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	21.940	22.600	0	-188.900	-171.833
400	23.296	29.274	2.316	-188.383	-166.085
600	24.009	38.896	7.067	-187.430	-155.144
800	24.374	45.853	11.905	-186.745	-144.489
1000	24.825	51.338	16.823	-186.108	-134.014
1200	25.394	55.913	21.843	-185.661	-123.634
1400	26.036	59.876	26.986	-185.537	-113.324

*Data except enthalpy of formation at 298 K estimated

$\text{CrF}_2(\text{c})$
Chromium difluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	15.480	20.762	0	-186.000	-176.062
400*	16.720	25.504	1.647	-185.727	-172.709
600	17.970	32.543	5.127	-185.161	-166.320
800	18.950	37.847	8.819	-184.578	-160.126
1000	19.940	42.182	12.708	-183.922	-154.089
1200	20.840	45.899	16.789	-183.228	-148.181

*Data above 298 K estimated
1167 K, melting point; $\Delta H^\circ = \text{unknown}$
Sublimation at 298 K; $\Delta H^\circ = 82.0$

$\text{CrF}_3(\text{c})$
Chromium trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.820	22.438	0	-280.400	-263.740
400*	20.970	28.298	2.036	-280.129	-258.089
600	22.910	37.231	6.456	-279.440	-247.211
800	23.800	43.953	11.133	-278.728	-236.576
1000	24.500	49.340	15.963	-278.006	-226.123
1200	25.160	53.867	20.931	-277.314	-215.807

*Data above 298 K estimated
1680 K, melting point; $\Delta H^\circ = \text{unknown}$

CsF(c,l)
Cesium fluoride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	12.210	22.230	0	-132.300	-125.633
400	13.259	25.930	1.285	-132.682	-123.207
600	16.976	31.974	4.292	-131.984	-118.591
800	21.243	37.436	8.109	-130.501	-114.329
976	25.135	42.033	12.190	-144.631	-110.568
976	17.900	47.689	17.710	-139.111	-110.568
1000	17.900	48.124	18.140	-138.906	-109.869
1200	17.900	51.388	21.720	-137.208	-104.220
1400	17.900	54.147	25.300	-135.520	-98.855

976 K, melting point; ΔH° = 5.520

CsF(g)
Cesium fluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.565	58.102	0	-85.800	-89.828
400	8.750	60.648	.883	-86.585	-90.997
600	8.909	64.231	2.651	-87.125	-93.086
800	8.985	66.806	4.441	-87.670	-94.993
1000	9.035	68.816	6.244	-104.302	-95.957
1200	9.075	70.467	8.055	-104.373	-94.280
1400	9.110	71.869	9.873	-104.447	-92.593
1600	9.142	73.087	11.699	-104.522	-90.893
1800	9.173	74.166	13.530	-104.603	-89.186
2000	9.202	75.134	15.368	-104.692	-87.468

(CsF)₂(g)
Dimeric cesium fluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	19.093	84.179	0	-212.740	-211.248
400	19.430	89.844	1.964	-214.111	-210.354
600	19.672	97.777	5.879	-214.812	-208.324
800	19.759	103.450	9.823	-215.538	-206.055
1000	19.799	107.864	13.780	-248.452	-201.993
1200	19.821	111.476	17.742	-248.253	-192.718
1400	19.835	114.533	21.708	-248.072	-183.477
1600	19.843	117.182	25.676	-247.905	-174.260
1800	19.849	119.519	29.645	-247.760	-165.063
2000	19.854	121.611	33.615	-247.644	-155.882

CuF(c)
Copper monofluoride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	12.400	15.500	0	-50.000	-45.037
400	13.180	19.255	1.304	-49.693	-43.387
600	14.240	24.820	4.055	-48.996	-40.383
800	14.820	29.004	6.967	-48.229	-37.625
1000	15.140	32.349	9.967	-47.444	-35.064
1200	15.310	35.126	13.013	-46.694	-32.660

CuF(g)
Copper monofluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.982	54.108	0	14.000	7.452
400	8.341	56.508	.833	13.837	5.241
600	8.692	59.967	2.541	13.490	1.015
800	8.855	62.493	4.298	13.102	-3.086
1000	8.949	64.479	6.079	12.668	-7.082
1200	9.014	66.117	7.875	12.168	-10.987
1400	9.064	67.510	9.683	8.432	-14.706
1600	9.106	68.723	11.500	7.785	-17.966
1800	9.143	69.798	13.325	7.139	-21.147
2000	9.178	70.763	15.157	6.496	-24.256

CuF₂(c,l)
Copper difluoride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	15.813	18.650	0	-129.020	-117.775
400	17.465	23.540	1.699	-128.709	-113.977
600	19.618	31.066	5.426	-127.854	-106.786
800	20.976	36.909	9.494	-126.786	-99.921
1000	22.015	41.703	13.795	-125.575	-93.342
1109	22.590	44.009	16.225	-124.866	-89.865
1109*	24.000	55.912	29.425	-111.666	-89.865
1200	24.000	57.805	31.609	-110.945	-88.105
1400	24.000	61.504	36.409	-112.587	-84.324
1600	24.000	64.709	41.209	-111.156	-80.383
1800	24.000	67.536	46.009	-109.736	-76.623
2000	24.000	70.064	50.809	-108.326	-73.018

*Data for liquid estimated
1109 K, melting point; ΔH° = 13.200

$\text{CuF}_2(\text{g})$
Copper difluoride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	12.340	60.966	0	-67.200	-68.571
400	13.199	64.723	1.304	-67.284	-69.026
600	14.029	70.257	4.040	-67.420	-69.867
800	14.384	74.348	6.886	-67.574	-70.660
1000	14.564	77.579	9.782	-67.768	-71.411
1200	14.673	80.245	12.707	-68.027	-72.115
1400	14.758	82.513	15.650	-71.526	-72.675
1600	14.846	84.490	18.610	-71.935	-72.812
1800	14.949	86.244	21.589	-72.336	-72.898
2000	15.072	87.825	24.591	-72.724	-72.938

$\text{DyF}_3(\text{c,l})$
Dysprosium trifluoride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	22.500	28.400	0	-404.400	-385.866
400	23.674	35.195	2.358	-403.900	-379.610
600	25.014	45.065	7.236	-402.820	-367.695
800	26.134	52.416	12.351	-401.652	-356.159
1000	27.268	58.368	17.690	-400.402	-344.927
1200	28.441	63.443	23.261	-399.102	-333.954
1400	29.636	67.917	29.068	-397.824	-323.204
1430	29.815	68.547	29.960	-397.637	-321.606
1430	37.500	78.337	43.960	-383.637	-321.606
1600	37.500	82.550	50.335	-381.404	-314.365
1800	37.500	86.966	57.835	-382.514	-305.851
2000	37.500	90.918	65.335	-380.146	-297.475

*Entropy and heat capacity at 298 K estimated
1430 K, melting point; $\Delta \text{H}^\circ = 14.000$

$\text{DyF}_3(\text{g})$
Dysprosium trifluoride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	17.044	81.501	0	-297.700	-294.998
400	18.076	86.669	1.794	-297.764	-294.064
600	19.015	94.205	5.517	-297.840	-292.198
800	19.480	99.744	9.370	-297.934	-290.302
1000	19.815	104.128	13.301	-298.091	-288.376
1200	20.081	107.765	17.292	-298.371	-286.410
1400	20.282	110.877	21.329	-298.863	-284.387
1600	20.423	113.595	25.400	-299.639	-282.272
1800	20.512	116.006	29.495	-304.155	-279.763
2000	20.561	118.170	33.602	-305.179	-277.013

$\text{ErF}_3(\text{c,l})$
Erbium trifluoride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	23.000	28.100	0	-404.800	-386.298
400	23.917	35.003	2.395	-404.267	-380.057
600	24.917	44.904	7.285	-403.203	-368.185
800	25.771	52.188	12.353	-402.122	-356.678
1000	26.712	58.038	17.600	-400.994	-345.439
1200	27.799	63.002	23.048	-399.794	-334.442
1390	28.983	67.171	28.440	-398.568	-324.180
1390	32.240	72.250	35.500	-391.508	-324.180
1400	32.240	72.481	35.822	-391.409	-323.697
1419	32.240	72.915	36.435	-391.221	-322.778
1419	33.250	77.545	43.005	-384.651	-322.778
1600	33.250	81.537	49.023	-382.750	-315.003
1800	33.250	85.453	55.673	-385.565	-306.646
2000	33.250	88.957	62.323	-383.512	-297.979

*Entropy and heat capacity at 298 K estimated
1390 K, transition point; $\Delta \text{H}^\circ = 7.060$
1419 K, melting point; $\Delta \text{H}^\circ = 6.750$

$\text{ErF}_3(\text{g})$
Erbium trifluoride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	16.972	81.262	0	-297.500	-294.849
400	18.023	86.412	1.787	-297.576	-293.928
600	18.960	93.928	5.501	-297.688	-292.084
800	19.339	99.442	9.336	-297.840	-290.199
1000	19.525	103.779	13.224	-298.070	-288.257
1200	19.628	107.349	17.141	-298.402	-286.265
1400	19.692	110.380	21.073	-298.858	-284.204
1600	19.734	113.012	25.016	-299.458	-282.070
1800	19.762	115.338	28.966	-304.973	-279.846
2000	19.783	117.421	32.920	-305.615	-277.011

$\text{EuF}_3(\text{c})$
Europium trifluoride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	23.800	25.600	0	-378.600	-359.022
400	24.994	32.777	2.490	-377.962	-352.429
600	26.596	43.221	7.653	-376.638	-339.944
800	28.362	51.105	13.142	-375.221	-327.923
920	29.636	55.152	16.620	-374.299	-320.891
920	36.000	56.817	18.150	-372.769	-320.891
1000	36.000	59.818	21.030	-371.652	-316.429
1200	36.000	66.382	28.230	-371.171	-305.414
1400	36.000	71.931	35.430	-368.485	-294.666

*Entropy and heat capacity at 298 K estimated
920 K, transition point; $\Delta \text{H}^\circ = 1.530$

$\text{EuF}_3(\text{g})$
Europium trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.482	78.459	0	-274.300	-270.482
400	20.489	84.339	2.040	-274.111	-269.203
600	21.433	92.854	6.247	-273.743	-266.830
800	21.850	99.085	10.580	-273.483	-264.569
1000	22.040	103.984	14.972	-273.410	-262.353
1200	22.077	108.008	19.386	-275.714	-259.909
1400	22.006	111.407	23.796	-275.819	-257.266
1600	21.870	114.337	28.184	-275.966	-254.605
1800	21.703	116.903	32.542	-276.160	-251.925
2000	21.529	119.181	36.865	-310.177	-245.417

$\text{FeF}(\text{g})$
Iron monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	7.950	57.417	0	11.400	3.447
400	8.306	59.808	.829	11.201	.759
600	8.652	63.252	2.531	10.667	-4.354
800	8.807	65.765	4.278	9.898	-9.253
1000	8.891	67.740	6.049	8.696	-13.916
1200	8.946	69.366	7.833	7.038	-18.280
1400	8.985	70.748	9.626	6.273	-22.440
1600	9.017	71.950	11.426	5.427	-26.484
1800	9.043	73.014	13.232	4.195	-30.399
2000	9.067	73.968	15.043	-.403	-33.833

*All data estimated

$\text{FeF}_2(\text{c,l})$
Iron difluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	16.280	20.790	0	-168.700	-158.511
400	17.200	25.708	1.707	-168.413	-155.075
600	18.440	32.938	5.281	-167.892	-148.522
800	19.180	38.351	9.048	-167.495	-142.131
1000	19.630	42.684	12.934	-167.458	-135.807
1200	19.880	46.287	16.887	-167.835	-129.437
1213	19.889	46.501	17.145	-167.799	-129.022
1213	23.500	55.487	28.045	-156.899	-129.022
1400	23.500	60.856	32.440	-155.738	-124.809
1600	23.500	61.994	37.140	-154.589	-120.469
1800	23.500	64.762	41.840	-153.836	-116.248

*Data above 298 K estimated except temperature of fusion.

1213 K, melting point; $\Delta H^\circ = 10.900$

$\text{FeF}_2(\text{g})$
Iron difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	13.324	63.361	0	-93.100	-95.604
400	14.673	67.482	1.432	-93.088	-96.459
600	15.647	73.672	4.491	-93.082	-98.153
800	15.714	78.191	7.633	-93.310	-99.818
1000	15.644	81.690	10.769	-94.023	-101.378
1200	15.600	84.537	13.893	-95.229	-102.731
1400	15.588	86.941	17.011	-95.567	-103.957
1600	15.594	89.023	20.129	-96.000	-105.126
1800	15.604	90.860	23.249	-96.827	-106.216
2000	15.612	92.504	26.371	-101.029	-106.869

*Data except enthalpy of formation at 298 K estimated.

$\text{FeF}_3(\text{c})$
Iron trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	21.750	23.500	0	-248.400	-231.798
400	23.033	30.477	2.423	-247.788	-226.218
600*	23.140	39.778	7.011	-247.070	-215.603
800	23.740	46.517	11.699	-246.607	-205.191
1000	24.340	51.879	16.507	-246.524	-194.060
1200	24.940	56.369	21.435	-246.814	-184.494

*Data above 450 K estimated

$\text{FeF}_3(\text{g})$
Iron trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	15.666	72.690	0	-196.200	-194.264
400	17.027	77.500	1.670	-196.341	-193.580
600	18.389	84.702	5.232	-196.650	-192.137
800	18.986	90.084	8.977	-197.129	-190.567
1000	19.288	94.357	12.807	-198.024	-188.839
1200	19.460	97.890	16.684	-199.365	-186.970
1400	19.566	100.898	20.587	-199.816	-184.753
1600	19.637	103.516	24.508	-200.351	-182.565
1800	19.685	105.832	28.440	-201.275	-180.286
2000	19.720	107.908	32.381	-205.574	-177.559

*Data except enthalpy of formation at 298 K estimated.

GaF(g)
Gallium monofluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.974	54.422	0	-55.600	-61.695
400	8.330	56.820	.832	-57.166	-63.312
600	8.678	60.273	2.538	-57.561	-66.297
800	8.837	62.794	4.291	-57.933	-69.153
1000	8.928	64.777	6.068	-58.302	-71.916
1200	8.990	66.410	7.860	-58.668	-74.605
1400	9.039	67.800	9.663	-59.033	-77.233
1600	9.081	69.010	11.475	-59.396	-79.808
1800	9.120	70.082	13.295	-59.756	-82.338
2000	9.156	71.044	15.123	-60.112	-84.826

GaF₃(g)
Gallium trifluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	15.766	69.990	0	-220.250	-216.543
400	17.088	74.822	1.678	-221.754	-214.820
600	18.421	82.043	5.249	-221.917	-211.312
800	19.005	87.432	8.999	-222.003	-207.763
1000	19.301	91.708	12.832	-222.066	-204.196
1200	19.469	95.244	16.711	-222.122	-200.618
1400	19.573	98.253	20.616	-222.180	-197.029
1600	19.642	100.872	24.538	-222.242	-193.432
1800	19.689	103.188	28.471	-222.309	-189.826
2000	19.724	105.264	32.413	-222.382	-186.212

GaF₂(g)
Gallium difluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.350	66.776	0	-128.300	-130.857
400	12.155	70.232	1.200	-129.890	-131.261
600	12.989	75.342	3.726	-130.281	-131.858
800	13.358	79.136	6.365	-130.623	-132.332
1000	13.546	82.139	9.058	-130.951	-132.720
1200	13.653	84.619	11.779	-131.277	-133.043
1400	13.720	86.729	14.517	-131.604	-133.312
1600	13.764	88.564	17.265	-131.935	-133.533
1800	13.795	90.187	20.021	-132.269	-133.713
2000	13.820	91.642	22.783	-132.607	-133.855

GdF₃(c,l)
Gadolinium trifluoride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	21.126	27.431	0	-406.100	-387.772
400	22.962	33.932	2.258	-405.770	-381.558
600	24.394	43.561	7.017	-404.820	-369.645
800	25.077	50.680	11.969	-403.867	-358.064
1000	25.572	56.331	17.036	-402.940	-346.729
1200	26.018	61.033	22.195	-402.046	-335.566
1348	26.345	64.077	26.070	-401.410	-327.404
1348	31.275	65.142	27.505	-399.975	-327.404
1400	31.275	66.326	29.132	-399.506	-324.605
1505	31.275	68.588	32.415	-398.588	-319.021
1505	30.550	76.914	44.945	-386.058	-319.021
1600	30.550	78.784	47.847	-388.533	-314.765
1800	30.550	82.382	53.957	-386.928	-305.631

1348 K, transition point; ΔH° = 1.435

1505 K, melting point; ΔH° = 12.530

GaF₃(c)
Gallium trifluoride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	21.272	22.945	0	-280.800	-263.067
400	22.183	29.323	2.213	-281.768	-256.636
600	23.973	38.656	6.828	-280.887	-244.251
800	25.763	45.797	11.802	-279.749	-232.202
1000	27.552	51.739	17.134	-278.314	-220.475
1200	29.342	56.920	22.823	-276.560	-209.067
1400	31.132	61.577	28.871	-274.475	-197.978
1600	32.922	65.851	35.276	-272.053	-187.210
1800	34.712	69.832	42.039	-269.290	-176.767
2000	36.501	73.582	49.160	-266.184	-166.650

GdF₃(g)
Gadolinium trifluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	17.095	80.122	0	-298.000	-295.381
400	18.114	85.303	1.798	-298.129	-294.467
600	19.010	92.848	5.526	-298.211	-292.608
800	19.369	98.373	9.368	-298.367	-290.719
1000	19.545	102.716	13.262	-298.614	-288.788
1200	19.643	106.289	17.181	-298.960	-286.787
1400	19.703	109.321	21.116	-299.422	-284.714
1600	19.742	111.955	25.061	-303.219	-282.524
1800	19.769	114.282	29.012	-303.773	-279.896
2000	19.788	116.366	32.968	-304.339	-277.225

GeF(g)
Germanium monofluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.313	55.903	0	-15.918	-23.149
400	8.978	58.446	.883	-16.011	-25.606
600	9.491	62.211	2.743	-16.159	-30.366
800	9.538	64.952	4.650	-16.328	-35.080
1000	9.481	67.076	6.552	-16.569	-39.747
1200	9.419	68.798	8.442	-16.903	-44.347
1400	9.371	70.246	10.321	-26.072	-47.502
1600	9.340	71.495	12.191	-26.427	-50.542
1800	9.322	72.594	14.058	-26.790	-53.529
2000	9.314	73.576	15.921	-27.162	-56.471

GeF₄(g)
Germanium tetrafluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	19.503	72.130	0	-284.450	-274.854
400	21.518	78.171	2.100	-284.501	-271.565
600	23.568	87.344	6.638	-284.421	-265.103
800	24.475	94.264	11.454	-284.246	-258.694
1000	24.937	99.780	16.400	-284.070	-252.330
1200	25.200	104.352	21.416	-283.943	-245.989
1400	25.364	108.250	26.473	-292.627	-238.285
1600	25.471	111.644	31.557	-292.481	-230.532
1800	25.546	114.649	36.659	-292.339	-222.792
2000	25.600	117.343	41.774	-292.204	-215.062

GeF₂(g)
Germanium difluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	11.436	64.692	0	-137.190	-139.819
400	12.272	68.180	1.211	-137.347	-140.695
600	13.076	73.333	3.758	-137.624	-142.303
800	13.416	77.147	6.412	-137.901	-143.825
1000	13.586	80.161	9.114	-138.218	-145.274
1200	13.682	82.647	11.841	-138.603	-146.645
1400	13.741	84.762	14.584	-147.806	-146.566
1600	13.780	86.599	17.337	-148.182	-146.363
1800	13.807	88.224	20.096	-148.563	-146.108
2000	13.827	89.680	22.859	-148.950	-145.806

HF(g)
Hydrogen fluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	6.964	41.508	0	-65.320	-65.822
400	6.967	43.555	.709	-65.356	-65.989
600	6.986	46.383	2.104	-65.478	-66.281
800	7.063	48.401	3.508	-65.632	-66.526
1000	7.211	49.992	4.934	-65.797	-66.731
1200	7.402	51.323	6.395	-65.955	-66.902
1400	7.606	52.479	7.896	-66.103	-67.047
1600	7.800	53.508	9.437	-66.238	-67.174
1800	7.977	54.437	11.015	-66.362	-67.283
2000	8.133	55.286	12.626	-66.477	-67.379
2200	8.270	56.067	14.267	-66.582	-67.463
2400	8.389	56.792	15.933	-66.682	-67.539
2600	8.493	57.468	17.621	-66.778	-67.608
2800	8.584	58.101	19.329	-66.870	-67.669
3000	8.664	58.696	21.054	-66.960	-67.722

GeF₃(g)
Germanium trifluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	15.817	71.130	0	-179.970	-177.297
400	17.213	75.991	1.688	-180.042	-176.374
600	18.527	83.261	5.283	-180.087	-174.522
800	19.077	88.676	9.050	-180.106	-172.669
1000	19.352	92.966	12.896	-180.155	-170.808
1200	19.506	96.509	16.783	-180.268	-168.924
1400	19.601	99.523	20.695	-189.200	-165.632
1600	19.663	102.145	24.621	-189.307	-162.261
1800	19.707	104.464	28.559	-189.419	-158.868
2000	19.738	106.542	32.503	-189.541	-155.458

DF(g)
Deuterium fluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	6.964	42.924	0	-65.850	-66.265
400	6.973	44.971	.710	-65.887	-66.401
600	7.065	47.811	2.111	-66.006	-66.635
800	7.281	49.871	3.544	-66.145	-66.824
1000	7.549	51.524	5.027	-66.280	-66.978
1200	7.806	52.924	6.563	-66.402	-67.106
1400	8.029	54.144	8.147	-66.511	-67.214
1600	8.215	55.229	9.772	-66.608	-67.308
1800	8.367	56.206	11.431	-66.696	-67.390
2000	8.493	57.094	13.117	-66.777	-67.463

(HF)₂(g)
Dimeric hydrogen fluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	10.725	57.060	0	-136.870	-130.135
400	11.879	60.378	1.153	-137.207	-127.779
600	13.512	65.530	3.705	-137.688	-122.954
800	14.579	69.572	6.520	-137.991	-117.993
1000	15.404	72.917	9.521	-138.170	-112.972
1200	16.093	75.788	12.673	-138.257	-107.921
1400	16.673	78.314	15.951	-138.276	-102.864
1600	17.155	80.573	19.336	-138.244	-97.807
1800	17.553	82.617	22.808	-138.176	-92.755
2000	17.880	84.484	26.352	-138.083	-87.713

(HF)₅(g)
Pentameric hydrogen fluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	32.820	97.594	0	-356.050	-325.779
400	36.615	107.804	3.548	-356.227	-315.402
600	41.077	123.586	11.363	-355.994	-295.016
800	43.902	135.811	19.875	-355.277	-274.788
1000	46.098	145.852	28.883	-354.219	-254.784
1200	47.859	154.419	38.286	-352.914	-235.013
1400	49.257	161.905	48.003	-351.440	-215.479
1600	50.356	168.558	57.968	-349.857	-196.166
1800	51.222	174.541	68.130	-348.205	-177.049
2000	51.906	179.974	78.445	-346.517	-158.120

(HF)₃(g)
Trimeric hydrogen fluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	18.128	68.917	0	-210.110	-195.036
400	20.394	74.582	1.969	-210.376	-189.841
600	23.063	83.411	6.342	-210.553	-179.521
800	24.755	90.290	11.132	-210.439	-169.189
1000	26.071	95.960	16.220	-210.122	-158.909
1200	27.128	100.810	21.543	-209.657	-148.707
1400	27.966	105.058	27.056	-209.090	-138.594
1600	28.625	108.837	32.718	-208.457	-128.566
1800	29.144	112.239	38.497	-207.784	-118.617
2000	29.555	115.332	44.368	-207.090	-108.746

(HF)₆(g)
Hexameric hydrogen fluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	40.166	111.451	0	-432.040	-394.026
400	44.726	123.934	4.338	-432.172	-381.009
600	50.084	143.193	13.874	-431.735	-355.494
800	53.475	158.091	24.247	-430.716	-330.223
1000	56.111	170.317	35.215	-429.288	-305.260
1200	58.225	180.742	46.657	-427.563	-280.609
1400	59.903	189.848	58.476	-425.635	-256.269
1600	61.222	197.937	70.594	-423.576	-232.214
1800	62.260	205.210	82.946	-421.436	-208.419
2000	63.082	211.814	95.483	-419.252	-184.866

(HF)₄(g)
Tetrameric hydrogen fluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	25.474	83.437	0	-282.940	-260.321
400	28.504	91.375	2.759	-283.161	-252.553
600	32.070	103.680	8.852	-283.134	-237.238
800	34.328	113.232	15.504	-282.718	-221.993
1000	36.084	121.088	22.551	-282.031	-206.889
1200	37.493	127.796	29.914	-281.146	-191.938
1400	38.611	133.663	37.529	-280.125	-177.151
1600	39.491	138.879	45.343	-279.017	-162.516
1800	40.183	143.572	53.313	-277.855	-148.021
2000	40.731	147.835	61.407	-276.663	-133.657

(HF)₇(g)
Heptameric hydrogen fluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	47.512	125.077	0	-502.520	-456.695
400	52.836	139.833	5.127	-502.608	-441.015
600	59.091	162.569	16.384	-501.966	-410.325
800	63.049	180.139	28.618	-500.645	-379.963
1000	66.124	194.551	41.547	-498.846	-349.995
1200	68.591	206.834	55.028	-496.702	-320.417
1400	70.548	217.560	68.949	-494.320	-291.225
1600	72.088	227.085	83.219	-491.786	-262.384
1800	73.299	235.648	97.763	-489.156	-233.861
2000	74.258	243.423	112.522	-486.475	-205.638

$\text{HfF}_4(\text{c}, \text{g})$
Hafnium tetrafluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	24.000	27.000	0	-461.400	-437.460
400	27.042	34.537	2.620	-460.982	-429.341
600	29.635	46.067	8.324	-459.849	-413.755
800	31.038	54.798	14.401	-458.569	-398.580
1000	32.096	61.841	20.717	-457.204	-383.745
1200	33.019	67.776	27.230	-455.767	-369.182
1236	35.175	68.741	28.403	-455.507	-366.627
1236	25.527	114.883	85.411	-398.499	-366.627
1400	25.641	118.081	89.619	-398.563	-362.380

*Heat capacity at 298 K and gas data estimated
1235.5 K, estimated sublimation point; $\Delta H^\circ = 57.008$

$\text{HfF}_4(\text{g})$
Hafnium tetrafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	21.760	80.385	0	-399.100	-391.076
400	23.244	87.010	2.300	-399.002	-388.350
600	24.555	96.726	7.101	-398.772	-383.074
800	25.091	103.874	12.073	-398.597	-377.869
1000	25.348	109.503	17.119	-398.502	-372.705
1200	25.503	114.139	22.205	-398.492	-367.543
1400	25.641	118.081	27.319	-398.563	-362.380

*Data except enthalpy of formation at 298 K estimated

$\text{HgF}(\text{g})$
Mercury monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.282	59.338	0	0.700	-4.362
400	8.570	61.816	.860	.496	-6.057
600	8.834	65.349	2.604	.122	-9.254
800	8.958	67.909	4.384	-14.142	-8.529
1000	9.036	69.917	6.184	-14.212	-7.117
1200	9.095	71.570	7.998	-14.280	-5.691
1400	9.145	72.976	9.822	-14.347	-4.254
1600	9.189	74.200	11.655	-14.413	-2.809
1800	9.231	75.285	13.497	-14.474	-1.355
2000	9.270	76.259	15.348	-14.531	.108

$\text{Hg}_2\text{F}_2(\text{c})$
Dimeric mercury fluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	24.000	38.400	0	-116.000	-102.189
300	24.020	38.549	.044	-115.994	-102.103
400	25.020	45.599	2.498	-115.631	-97.523
500	25.910	51.280	5.045	-115.192	-93.047
600	26.690	56.075	7.676	-114.689	-88.666
700	27.370	60.241	10.380	-114.217	-81.223
800	27.950	63.935	13.147	-141.306	-72.572
900	28.430	67.255	15.966	-140.352	-64.036

*Data estimated except Gibbs energy of formation at
298 K.
949 K, decomposition pressure = 1 atm.

$\text{HgF}_2(\text{c}, \text{l}, \text{g})$
Mercury difluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	17.891	27.800	0	-101.000	-89.437
400	18.400	33.128	1.848	-100.608	-85.546
600	19.400	40.778	5.628	-99.763	-78.194
800	20.400	46.496	9.608	-112.682	-67.353
918	20.990	49.340	12.050	-111.855	-60.721
918	24.400	55.331	17.550	-106.355	-60.721
920	24.400	55.383	17.599	-106.334	-60.620
920	14.615	79.291	39.594	-84.339	-60.620
1000	14.659	80.512	40.765	-84.270	-58.563
1200	14.732	83.192	43.705	-84.101	-53.437
1400	14.777	85.466	46.656	-83.938	-48.339
1600	14.807	87.441	49.615	-83.782	-43.264
1800	14.827	89.187	52.578	-83.632	-38.209
2000	14.842	90.750	55.545	-83.489	-33.169

*Data estimated except temperatures of fusion and
boiling.

918 K, melting point; $\Delta H^\circ = 5.500$

920 K, boiling point; $\Delta H^\circ = 21.995$

$\text{HgF}_2(\text{g})$
Mercury difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	12.899	63.545	0	-70.190	-69.284
400	13.614	67.445	1.354	-70.292	-68.956
600	14.263	73.110	4.152	-70.429	-68.259
800	14.529	77.254	7.035	-84.445	-63.723
1000	14.659	80.512	9.955	-84.270	-58.563
1200	14.732	83.192	12.895	-84.101	-53.437
1400	14.777	85.466	15.846	-83.938	-48.339
1600	14.807	87.441	18.805	-83.782	-43.264
1800	14.827	89.187	21.768	-83.632	-38.209
2000	14.842	90.750	24.735	-83.489	-33.169

*All data estimated.

$\text{HoF}_3(\text{c,l})$
Holmium trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	21.800	28.400	0	-405.800	-387.257
400	22.833	34.959	2.276	-405.368	-380.988
600	24.176	44.497	6.990	-404.452	-368.991
800	24.866	51.559	11.903	-403.466	-357.318
1000	25.159	57.144	16.909	-402.540	-345.891
1200	25.306	61.744	21.956	-401.773	-334.635
1343	25.462	64.601	25.585	-401.357	-326.660
1343	30.160	64.601	25.585	-401.357	-326.660
1400	30.160	65.855	27.304	-400.962	-323.497
1416	30.160	66.197	27.787	-400.855	-322.611
1416	22.940	75.703	41.247	-387.395	-322.611
1600	22.940	78.506	45.468	-387.650	-314.189
1800	22.940	81.208	50.056	-391.915	-304.815
2000	22.940	83.625	54.644	-392.172	-295.136

*Entropy and heat capacity at 298 K estimated.

1343 K, transition point; $\Delta H^\circ = <0.200$

1416 K, melting point; $\Delta H^\circ = 13.460$

$\text{HoF}_3(\text{g})$
Holmium trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.016	81.776	0	-297.000	-294.371
400	18.051	86.936	1.791	-297.054	-293.464
600	18.975	94.461	5.509	-297.133	-291.651
800	19.361	99.979	9.347	-297.222	-289.810
1000	19.588	104.325	13.243	-297.406	-287.938
1200	19.770	107.913	17.179	-297.751	-286.015
1400	19.939	110.974	21.151	-298.315	-284.017
1600	20.095	113.646	25.154	-299.164	-281.927
1800	20.234	116.022	29.187	-303.984	-279.550
2000	20.351	118.160	33.246	-304.771	-276.805

$\text{IF}(\text{g})$
Iodine monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.021	56.451	0	-22.648	-28.119
400	8.384	58.864	.837	-24.801	-29.886
600	8.743	62.341	2.555	-30.107	-30.758
800	8.915	64.882	4.322	-30.095	-30.977
1000	9.020	66.883	6.116	-30.081	-31.199
1200	9.097	68.535	7.928	-30.066	-31.425
1400	9.160	69.942	9.754	-30.048	-31.652
1600	9.215	71.169	11.592	-30.028	-31.882
1800	9.266	72.258	13.440	-30.006	-32.117
2000	9.313	73.236	15.298	-29.983	-32.350

$\text{IF}_5(\text{g})$
Iodine pentafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.588	79.959	0	-200.840	-184.434
400	27.188	87.586	2.650	-202.745	-178.760
600	29.512	99.127	8.358	-207.330	-165.247
800	30.457	107.764	14.367	-206.496	-151.344
1000	30.922	114.615	20.510	-205.635	-137.655
1200	31.182	120.278	26.723	-204.773	-124.139
1400	31.342	125.098	32.976	-203.917	-110.770
1600	31.446	129.290	39.256	-203.074	-97.518
1800	31.519	132.999	45.553	-202.243	-84.374
2000	31.571	136.322	51.862	-201.428	-71.320

282.57 K, melting point; $\Delta H^\circ = 2.680$

377.63 K, boiling point; $\Delta H^\circ = 8.60$

$\text{IF}_7(\text{g})$
Iodine heptafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	32.134	83.085	0	-229.700	-199.782
400	36.323	93.175	3.508	-231.531	-189.500
600	40.052	108.733	11.207	-235.758	-167.035
800	41.569	120.491	19.388	-234.462	-144.322
1000	42.315	129.856	27.785	-233.098	-121.944
1200	42.733	137.611	36.293	-231.717	-99.842
1400	42.990	144.219	44.867	-230.337	-77.973
1600	43.158	149.971	53.483	-228.965	-56.298
1800	43.274	155.062	62.127	-227.608	-34.796
2000	43.358	159.626	70.791	-226.269	-13.444

$\text{InF}(\text{g})$
Indium monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.162	56.438	0	-46.300	-51.785
400	8.473	58.884	.849	-46.519	-53.627
600	8.760	62.383	2.576	-47.794	-56.765
800	8.890	64.923	4.343	-48.281	-59.681
1000	8.966	66.915	6.129	-48.761	-62.475
1200	9.021	68.555	7.928	-49.240	-65.173
1400	9.066	69.949	9.737	-49.719	-67.790
1600	9.107	71.163	11.554	-50.196	-70.340
1800	9.144	72.238	13.379	-50.672	-72.831
2000	9.181	73.203	15.212	-51.144	-75.268

$\text{InF}_2(\text{g})$
Indium difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.815	69.723	0	-114.120	-116.344
400	12.533	73.305	1.243	-114.336	-117.073
600	13.214	78.537	3.828	-115.571	-118.032
800	13.500	82.383	6.504	-116.003	-118.787
1000	13.642	85.412	9.219	-116.430	-119.434
1200	13.721	87.907	11.956	-116.860	-119.994
1400	13.771	90.026	14.706	-117.295	-120.481
1600	13.803	91.867	17.463	-117.737	-120.907
1800	13.827	93.495	20.226	-118.184	-121.278
2000	13.846	94.952	22.994	-118.636	-121.596

$\text{InF}_3(\text{c,l})$
Indium trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	21.988	26.291	0	-284.400	-266.453
400	22.880	32.877	2.285	-283.965	-260.391
600	24.630	42.485	7.036	-283.851	-248.480
800	26.381	49.810	12.137	-282.714	-236.854
1000	28.131	55.885	17.588	-281.280	-225.549
1200	29.882	61.169	23.390	-279.534	-214.561
1400	31.632	65.906	29.541	-277.465	-203.891
1445	32.026	66.912	30.970	-276.958	-201.536
1445	32.027	77.500	46.270	-261.658	-201.536
1600	32.027	80.762	51.234	-259.875	-195.176
1800	32.027	84.534	57.639	-257.591	-187.227
2000	32.027	87.909	64.044	-255.321	-179.533

1445 K, melting point; $\Delta H^\circ = 15.300$

$\text{InF}_3(\text{g})$
Indium trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	16.690	74.060	0	-205.000	-201.296
400	17.810	79.140	1.760	-205.090	-200.021
600	18.840	86.600	5.440	-206.048	-197.145
800	19.260	92.090	9.260	-206.191	-194.155
1000	19.480	96.420	13.130	-206.338	-191.142
1200	19.590	99.980	17.040	-206.484	-188.085
1400	19.660	103.010	20.970	-206.636	-185.007
1600	19.710	105.640	24.910	-206.799	-181.905
1800	19.750	107.970	28.850	-206.979	-178.800

$\text{IrF}_6(\text{g})$
Iridium hexafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	28.890	82.524	0	-130.000	-108.746
400	31.957	91.480	3.112	-129.853	-101.502
600	34.833	105.123	9.844	-129.269	-87.466
800	32.027	115.239	16.933	-128.610	-73.575
1000	36.624	123.329	24.204	-127.948	-59.872
1200	36.961	129.982	31.571	-127.327	-46.242
1400	37.168	136.018	39.020	-126.737	-33.189
1600	37.305	140.951	46.468	-126.251	-19.795
1800	37.396	145.279	53.923	-125.854	-6.399
2000	37.462	149.033	61.366	-125.563	7.191

$\text{KF}(\text{c,l})$
Potassium fluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.750	15.910	0	-135.580	-128.493
400	12.373	19.454	1.230	-136.069	-125.977
600	13.286	24.653	3.800	-135.785	-120.986
800	13.976	28.574	6.530	-135.338	-116.117
1000	14.492	31.751	9.379	-134.797	-111.373
1130	14.740	33.538	11.280	-133.258	-106.785
1130	14.882	39.763	18.315	-146.223	-106.785
1200	15.086	40.664	19.364	-145.835	-104.352
1400	15.669	43.033	22.439	-144.650	-97.530

1130 K, melting point; $\Delta H^\circ = 7.035$

$\text{KF}(\text{g})$
Potassium fluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.420	54.135	0	-77.780	-82.090
400	8.662	56.647	.871	-78.627	-83.413
600	8.877	60.206	2.628	-79.157	-85.690
800	8.979	62.775	4.415	-79.652	-87.792
1000	9.045	64.786	6.218	-80.158	-89.770
1200	9.096	66.440	8.032	-89.367	-88.816
1400	9.140	67.846	9.856	-89.433	-87.051
1600	9.181	69.069	11.688	-89.501	-85.278
1800	9.218	70.152	13.528	-89.566	-83.496
2000	9.255	71.126	15.375	-89.634	-81.708

(KF)₂(g)
Dimeric potassium fluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.768	76.444	0	-206.200	-205.331
400	19.240	82.035	1.939	-207.698	-204.766
600	19.585	89.914	5.828	-208.381	-203.148
800	19.709	95.568	9.759	-209.016	-201.310
1000	19.767	99.973	13.707	-209.685	-199.309
1200	19.799	103.580	17.664	-247.773	-191.511
1400	19.818	106.634	21.626	-247.592	-182.148
1600	19.831	109.281	25.591	-247.426	-172.810
1800	19.839	111.617	29.558	-247.271	-163.494
2000	19.845	113.708	33.527	-247.132	-154.192

LaF₃(c,l)
Lanthanum trifluoride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	21.580	25.570	0	-406.200	-388.104
400	23.045	32.135	2.279	-405.760	-381.990
600	24.403	41.782	7.046	-404.847	-370.307
800	25.027	48.892	11.993	-403.850	-358.946
1000	25.889	54.558	17.074	-402.909	-347.824
1200	27.694	59.419	22.411	-404.169	-336.845
1400	30.947	63.911	28.248	-402.665	-325.741
1600	35.963	68.350	34.908	-401.359	-314.888
1766	41.565	72.161	41.325	-397.568	-306.162
1766*	40.000	78.956	53.325	-385.568	-306.162
1800	40.000	79.719	54.685	-384.952	-304.639
2000	40.000	83.933	62.685	-381.337	-295.896

*Heat capacity of liquid estimated.

1766 K, melting point; ΔH° = 12.000

LaF₃(g)
Lanthanum trifluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	17.379	76.900	0	-302.200	-299.408
400	18.316	82.153	1.823	-302.216	-298.453
600	19.118	89.759	5.580	-302.313	-296.559
800	19.434	95.308	9.439	-302.405	-294.633
1000	19.588	99.663	13.343	-302.640	-292.661
1200	19.673	103.242	17.270	-305.311	-290.574
1400	19.725	106.279	21.210	-305.703	-288.094
1600	19.759	108.916	25.159	-306.108	-285.543
1800	19.783	111.244	29.113	-306.523	-282.956
2000	19.799	113.329	33.071	-306.951	-280.303

LiF(c,l)
Lithium fluoride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.000	8.520	0	-147.220	-140.465
400	11.205	11.652	1.088	-147.156	-138.167
600	12.274	16.419	3.447	-147.744	-133.465
800	13.171	20.070	5.989	-147.450	-128.746
1000	14.297	23.124	8.731	-146.964	-124.122
1121	15.137	24.807	10.515	-146.552	-121.374
1121	15.380	30.573	16.980	-140.087	-121.374
1200	15.380	31.616	18.190	-139.770	-120.072
1400	15.380	33.987	21.266	-138.962	-116.853

1121.3 K, melting point; ΔH° = 6.465

LiF(g)
Lithium fluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.478	47.840	0	-81.220	-86.189
400	7.879	50.096	.783	-81.461	-87.849
600	8.391	53.399	2.415	-82.776	-90.685
800	8.660	55.854	4.123	-83.315	-93.239
1000	8.816	57.804	5.872	-83.823	-95.660
1200	8.919	59.421	7.646	-84.314	-97.982
1400	8.994	60.802	9.438	-84.790	-100.222
1600	9.052	62.007	11.243	-85.254	-102.394
1800	9.102	63.076	13.058	-120.574	-101.045
2000	9.145	64.037	14.883	-120.660	-98.869

(LiF)₂(g)
Dimeric lithium fluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	15.088	61.788	0	-224.800	-224.632
400	16.813	66.487	1.633	-225.214	-224.510
600	18.359	73.648	5.176	-227.567	-223.494
800	18.987	79.028	8.919	-228.318	-222.022
1000	19.295	83.301	12.750	-229.000	-220.368
1200	19.467	86.836	16.628	-229.651	-218.581
1400	19.572	89.845	20.532	-230.284	-216.686
1600	19.642	92.463	24.454	-230.899	-214.699
1800	19.689	94.780	28.387	-301.236	-205.710
2000	19.724	96.856	32.329	-301.116	-195.100

(LiF)₃(g)
Trimeric lithium fluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	24.498	75.997	0	-361.900	-356.674
400	27.074	83.592	2.639	-362.331	-354.819
600	29.429	95.092	8.327	-365.487	-350.149
800	30.402	103.709	14.322	-366.233	-344.923
1000	30.884	110.551	20.456	-366.869	-339.520
1200	31.155	116.207	26.662	-367.457	-333.995
1400	31.321	121.023	32.911	-368.013	-328.373
1600	31.430	125.213	39.187	-368.542	-322.672
1800	31.506	128.920	45.481	-473.654	-306.515
2000	31.560	132.242	51.788	-473.079	-287.971

LuF₃(c,l)
Lutetium trifluoride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	20.810	22.665	0	-401.800	-383.261
400	22.182	28.993	2.197	-401.431	-376.984
600	23.579	38.278	6.786	-400.584	-364.939
800	24.626	45.207	11.608	-399.651	-353.191
1000	25.691	50.815	16.638	-399.649	-341.691
1200	26.864	55.600	21.891	-397.568	-330.401
1230	27.052	56.266	22.700	-397.398	-328.724
1230	25.440	61.132	28.685	-391.413	-328.724
1400	25.440	64.425	33.010	-390.787	-320.098
1457	25.440	65.441	34.460	-390.607	-317.226
1457	24.738	70.403	41.690	-383.377	-317.226
1600	29.260	72.936	45.564	-382.764	-310.760
1800	33.671	76.659	51.895	-381.186	-301.846

1230 K, transition point; ΔH° = 5.985

1457 K, melting point; ΔH° = 7.230

LuF₃(g)
Lutetium trifluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	16.869	75.354	0	-297.900	-295.070
400	17.949	80.477	1.778	-297.949	-294.096
600	18.920	87.971	5.481	-297.990	-292.160
800	19.315	93.476	9.310	-298.049	-290.204
1000	19.509	97.809	13.194	-298.193	-288.229
1200	19.617	101.376	17.108	-298.451	-286.215
1400	19.683	104.405	21.038	-298.859	-284.142
1600	19.727	107.037	24.980	-299.448	-282.005
1800	19.757	109.362	28.928	-300.253	-279.778
2000	19.779	111.445	32.882	-305.737	-277.301

MgF(g)
Magnesium monofluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	7.784	52.814	0	-56.600	-62.796
400	8.173	55.159	1.814	-56.799	-64.882
600	8.503	58.562	2.495	-57.239	-68.831
800	8.776	61.061	4.233	-57.772	-72.620
1000	8.885	63.032	6.000	-60.549	-76.083
1200	8.957	64.658	7.785	-61.283	-79.127
1400	9.009	66.043	9.582	-92.217	-81.226
1600	9.051	67.249	11.388	-92.310	-79.650
1800	9.088	68.317	13.202	-92.398	-78.062
2000	9.120	69.276	15.022	-92.488	-76.464

MgF₂(c,l)
Magnesium difluoride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	14.710	13.680	0	-268.700	-256.007
400	16.440	18.277	1.598	-268.506	-251.697
600	17.915	25.265	5.054	-267.989	-243.401
800	18.707	30.534	8.721	-267.448	-235.290
1000	19.300	34.775	12.524	-269.064	-227.134
1200	19.817	38.340	16.437	-268.558	-218.800
1400	20.296	41.431	20.448	-298.176	-209.735
1536	20.610	43.327	23.230	-297.299	-201.186
1536	22.600	52.363	37.110	-283.419	-201.186
1600	22.600	53.286	38.556	-282.871	-197.770
1800	22.600	55.948	43.076	-281.164	-187.235
2000	22.600	58.329	47.596	-279.468	-176.988

1536 K, melting point; ΔH° = 13.880

MgF₂(g)
Magnesium difluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	11.534	61.280	0	-173.700	-175.199
400	12.279	64.782	1.216	-173.888	-175.681
600	13.045	69.927	3.759	-174.284	-176.493
800	13.389	73.733	6.406	-174.763	-177.164
1000	13.565	76.742	9.104	-177.484	-177.521
1200	13.666	79.225	11.828	-178.167	-177.471
1400	13.729	81.336	14.568	-209.056	-176.482
1600	13.770	83.173	17.318	-209.109	-171.827
1800	13.799	84.796	20.075	-209.165	-167.162
2000	13.820	86.251	22.837	-209.227	-162.491

(MgF₂)₂(g)
Dimeric magnesium difluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	25.693	80.521	0	-410.700	-401.164
400	27.969	88.425	2.745	-410.763	-397.893
600	29.926	100.203	8.568	-410.818	-391.446
800	30.706	108.934	14.641	-410.997	-384.973
1000	31.086	115.831	20.825	-415.651	-378.072
1200	31.298	121.519	27.065	-416.225	-370.516
1400	31.428	126.354	33.338	-477.210	-361.217
1600	31.513	130.557	39.633	-476.521	-344.695
1800	31.571	134.272	45.942	-475.838	-328.256
2000	31.613	137.601	52.260	-475.168	-311.894

MnF₂(c)
Manganese difluoride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	16.202	22.250	0	-203.000	-192.910
400	17.426	27.198	1.718	-202.729	-189.504
600	18.805	34.549	5.353	-202.168	-183.012
800*	19.801	40.099	9.216	-201.615	-176.717
1000	20.761	44.620	13.272	-201.572	-170.547
1023	20.875	45.093	13.750	-201.505	-169.835
1023	20.875	45.582	14.250	-201.005	-169.835
1200	21.801	48.984	18.026	-200.416	-164.487

*Data above 770 K extrapolated.

1023 K, transition point; ΔH° = 0.500

1173 K, melting point; ΔH° = 7

MnF₂(g)
Manganese difluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	12.650	65.096	0	-127.000	-129.684
400	13.409	68.929	1.330	-127.117	-130.585
600	14.140	74.526	4.096	-127.425	-132.256
800	14.451	78.642	6.959	-127.872	-133.808
1000	14.606	81.885	9.867	-128.977	-135.217
1200	14.694	84.557	12.797	-129.645	-136.403

MoF(g)
Molybdenum monofluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	7.809	58.865	0	67.600	59.313
400	8.188	61.216	.816	67.426	56.509
600	8.580	64.622	2.498	67.060	51.127
800	8.758	67.117	4.234	66.655	45.878
1000	8.856	69.083	5.996	66.212	40.732
1200	8.918	70.704	7.774	65.719	35.683
1400	8.965	72.082	9.563	65.165	30.721
1600	9.012	73.282	11.360	64.542	25.842
1800	9.074	74.347	13.169	63.846	21.046
2000	9.169	75.308	14.992	63.063	16.330

*Data estimated.

MoF₂(g)
Molybdenum difluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	13.676	64.967	0	-38.900	-41.784
400	14.210	69.072	1.424	-38.857	-42.777
600	14.580	74.919	4.310	-38.837	-44.746
800	14.712	79.134	7.242	-38.901	-46.707
1000	14.776	82.425	10.191	-39.032	-48.646
1200	14.813	85.122	13.150	-39.232	-50.549
1400	14.835	87.407	16.115	-39.508	-52.415
1600	14.850	89.389	19.084	-39.863	-54.234
1800	14.861	91.139	22.055	-40.307	-56.005
2000	14.869	92.705	25.028	-40.855	-57.721

*Data estimated.

MoF₃(g)
Molybdenum trifluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	16.035	70.712	0	-145.100	-142.476
400	17.408	75.635	1.710	-145.163	-141.567
600	18.677	82.973	5.338	-145.218	-139.757
800	19.297	88.438	9.140	-145.267	-137.931
1000	19.725	92.792	13.044	-145.318	-136.091
1200	20.054	96.418	17.023	-145.387	-134.238
1400	20.307	99.530	21.061	-145.487	-132.373
1600	20.499	102.254	25.142	-145.635	-130.489
1800	20.651	104.678	29.257	-145.845	-128.584
2000	20.784	106.861	33.401	-146.137	-126.652

*Data except enthalpy of formation at 298 K estimated.

$\text{MoF}_4(\text{g})$
Molybdenum tetrafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	20.371	78.592	0	-226.500	-219.003
400	22.134	84.845	2.172	-226.492	-216.441
600	23.909	94.208	6.802	-226.362	-211.441
800	24.684	101.207	11.671	-226.199	-206.493
1000	25.077	106.761	16.651	-226.050	-201.585
1200	25.300	111.355	21.691	-225.946	-196.701
1400	25.438	115.266	26.765	-225.908	-191.832
1600	25.530	118.669	31.863	-225.943	-186.961
1800	25.598	121.680	36.976	-226.065	-182.080
2000	25.655	124.380	42.101	-226.291	-177.183

*Data except enthalpy of formation at 298 K estimated.

$\text{NF}(\text{g})$
Nitrogen monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	7.253	51.427	0	59.500	58.212
400	7.604	53.607	.756	59.510	57.770
600	8.156	56.804	2.337	59.566	56.890
800	8.480	59.199	4.003	59.641	55.986
1000	8.674	61.113	5.720	59.716	55.065
1200	8.799	62.707	7.468	59.782	54.127
1400	8.887	64.070	9.237	59.837	53.181
1600	8.953	65.261	11.022	59.885	52.227
1800	9.006	66.319	12.818	59.925	51.268
2000	9.050	67.270	14.623	59.960	50.303

*Data estimated.

$\text{MoF}_5(\text{g})$
Molybdenum pentafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.561	83.065	0	-296.700	-283.315
400	27.403	90.714	2.658	-296.598	-278.754
600	30.073	102.422	8.451	-296.122	-269.928
800	31.038	111.228	14.578	-295.556	-261.282
1000	31.424	118.201	20.829	-295.011	-252.779
1200	31.605	123.949	27.134	-294.531	-244.377
1400	31.710	128.829	33.466	-294.132	-236.052
1600	31.788	133.068	39.816	-293.820	-227.775
1800	31.856	136.817	46.181	-293.600	-219.533
2000	31.919	140.176	52.559	-293.488	-211.309

$\text{NF}_2(\text{g})$
Nitrogen difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	9.801	59.715	0	10.100	13.562
400	10.851	62.748	1.054	10.016	14.760
600	12.159	67.425	3.370	9.990	17.144
800	12.820	71.024	5.875	10.050	19.520
1000	13.177	73.927	8.478	10.135	21.877
1200	13.387	76.350	11.136	10.222	24.217
1400	13.519	78.424	13.828	10.303	26.544
1600	13.608	80.235	16.541	10.375	28.859
1800	13.670	81.842	19.269	10.437	31.166
2000	13.714	83.284	22.008	10.491	33.468

$\text{MoF}_6(\text{g})$
Molybdenum hexafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	28.747	83.796	0	-372.290	-351.902
400	31.806	92.710	3.097	-372.140	-344.955
600	34.722	106.250	9.795	-371.576	-331.477
800	35.958	116.430	16.879	-370.908	-318.211
1000	36.576	124.528	24.139	-370.230	-305.117
1200	36.926	131.230	31.492	-369.590	-292.153
1400	37.141	136.939	38.900	-369.013	-279.294
1600	37.283	141.909	46.343	-368.512	-266.512
1800	37.381	146.306	53.810	-368.100	-253.786
2000	37.451	150.248	61.294	-367.797	-241.101

$\text{NF}_3(\text{g})$
Nitrogen trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.756	62.300	0	-31.570	-21.657
400	14.785	66.349	1.409	-31.691	-18.246
600	17.072	72.836	4.624	-31.635	-11.526
800	18.158	77.914	8.159	-31.399	-4.857
1000	18.728	82.034	11.853	-31.099	1.744
1200	19.059	85.480	15.635	-30.777	8.283
1400	19.266	88.435	19.469	-30.451	14.767
1600	19.404	91.017	23.337	-30.129	21.205
1800	19.500	93.308	27.228	-29.814	27.605
2000	19.569	95.366	31.135	-29.507	33.968

$\text{N}_2\text{F}_2(\text{g}, \text{cis})$
Cis-dinitrogen difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.941	62.071	0	16.400	25.983
400	13.900	65.867	1.321	16.228	29.288
600	16.318	72.014	4.369	16.226	35.832
800	17.595	76.902	7.773	16.450	42.336
1000	18.313	80.912	11.370	16.762	48.773
1200	18.746	84.292	15.080	17.107	55.145
1400	19.025	87.205	18.859	17.459	61.455
1600	19.213	89.758	22.684	17.810	67.717
1800	19.345	92.029	26.540	18.155	73.935
2000	19.442	94.072	30.419	18.493	80.115

$\text{N}_2\text{F}_2(\text{g}, \text{trans})$
Trans-dinitrogen difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.779	62.752	0	19.400	28.780
400	14.392	66.744	1.387	19.294	32.004
600	16.473	73.014	4.494	19.351	38.357
800	17.641	77.928	7.916	19.593	44.659
1000	18.323	81.945	11.519	19.911	50.889
1200	18.744	85.325	15.229	20.256	57.054
1400	19.019	88.237	19.007	20.607	63.159
1600	19.206	90.789	22.830	20.956	69.214
1800	19.338	93.060	26.685	21.300	75.224
2000	19.435	95.102	30.563	21.637	81.199

$\text{N}_2\text{F}_4(\text{g})$
Dinitrogen tetrafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.922	71.962	0	-2.000	19.077
400	22.584	78.066	2.125	-2.151	26.310
600	26.717	88.112	7.108	-1.852	40.498
800	28.684	96.100	12.670	-1.180	54.518
1000	29.719	102.623	18.521	-.365	68.350
1200	30.320	108.099	24.530	.502	82.013
1400	30.696	112.803	30.634	1.384	95.528
1600	30.946	116.919	36.800	2.267	108.918
1800	31.120	120.575	43.007	3.143	122.197
2000	31.246	123.860	49.244	4.009	135.379

$\text{NaF}(\text{c}, \text{l})$
Sodium fluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.210	12.260	0	-137.105	-129.872
400	12.031	15.684	1.189	-137.663	-127.363
600	12.865	20.733	3.685	-137.447	-122.251
800	13.594	24.532	6.329	-137.059	-117.242
1000	14.457	27.655	9.132	-136.511	-112.347
1200	15.515	30.381	12.125	-159.044	-107.123
1269	15.929	31.260	13.210	-158.609	-104.146
1269	16.670	37.598	21.240	-150.579	-104.146
1400	16.670	39.225	23.424	-149.635	-99.400
1600	16.670	41.451	26.758	-148.200	-92.323
1800	16.670	43.415	30.092	-146.770	-85.425

1269 K, melting point; $\Delta H^\circ = 8.030$

$\text{NaF}(\text{g})$
Sodium fluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.178	51.983	0	-69.600	-74.210
400	8.494	54.435	.851	-70.496	-75.696
600	8.789	57.943	2.583	-71.043	-78.174
800	8.926	60.493	4.356	-71.526	-80.478
1000	9.010	62.494	6.150	-71.988	-82.662
1200	9.071	64.142	7.959	-95.704	-84.297
1400	9.121	65.545	9.778	-95.776	-82.389
1600	9.166	66.766	11.607	-95.846	-80.473
1800	9.206	67.848	13.444	-95.912	-78.548
2000	9.244	68.820	15.289	-95.977	-76.615

$(\text{NaF})_2(\text{g})$
Dimeric sodium fluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	16.926	68.655	0	-198.200	-196.893
400	18.092	73.812	1.790	-199.905	-196.281
600	19.031	81.360	5.519	-200.734	-194.280
800	19.388	86.891	9.366	-201.399	-192.027
1000	19.559	91.237	13.263	-202.013	-189.611
1200	19.653	94.812	17.185	-249.142	-186.160
1400	19.711	97.847	21.122	-248.986	-175.672
1600	19.748	100.481	25.068	-248.837	-165.210
1800	19.774	102.809	29.020	-248.693	-154.767
2000	19.792	104.893	32.977	-248.554	-144.336

*Data except enthalpy of formation at 298 K estimated.

$\text{NbF}_5(\text{c,l})$
Niobium pentafluoride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	32.230	38.300	0	-433.500	-406.217
300	32.420	38.500	.060	-433.486	-406.047
351	39.900	44.090	1.880	-432.931	-401.450
351	33.550	52.274	4.750	-430.061	-401.450
400	34.890	56.774	6.440	-429.629	-397.454
500	37.610	64.852	10.060	-428.634	-389.528

350.7 K, melting point; $\Delta \text{H}^\circ = 2.870$

500 K, boiling point to polymeric mixture; $\Delta \text{H}^\circ = 12$.

$\text{NdF}_3(\text{c,l})$
Neodymium trifluoride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	22.090	28.870	0	-401.400	-383.244
400	23.554	35.595	2.334	-400.923	-377.113
600	25.094	45.462	7.212	-399.947	-365.420
800	26.275	52.846	12.350	-399.005	-354.056
1000	27.434	58.833	17.721	-398.131	-342.921
1200	28.655	63.941	23.328	-398.026	-331.917
1400	29.967	68.455	29.189	-398.681	-320.838
1600	31.381	72.548	35.322	-397.366	-309.812
1650	31.752	73.520	36.900	-396.993	-307.077
1650	41.300	81.459	50.000	-383.893	-307.077
1800	41.300	85.052	56.195	-381.326	-300.209

1650 K, melting point; $\Delta \text{H}^\circ = 13.100$

$\text{NdF}_3(\text{g})$
Neodymium trifluoride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	17.256	81.419	0	-296.100	-293.612
400	18.302	86.649	1.815	-296.143	-292.754
600	19.508	94.320	5.607	-296.253	-291.040
800	20.278	100.045	9.591	-296.465	-289.274
1000	20.783	104.628	13.701	-296.851	-287.437
1200	21.083	108.446	17.890	-298.165	-285.461
1400	21.230	111.709	22.124	-300.446	-283.159
1600	21.272	114.548	26.375	-301.013	-280.659
1800	21.248	117.052	30.628	-301.594	-278.077
2000	21.184	119.288	34.872	-302.198	-275.428

$\text{NiF}(\text{g})$
Nickel monofluoride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	7.795	57.249	0	25.000	17.282
400	8.310	59.614	.821	24.765	14.680
600	9.009	63.130	2.560	24.195	9.749
800	9.350	65.775	4.400	23.646	5.026
1000	9.486	67.879	6.286	23.146	.425
1200	9.534	69.613	8.189	22.587	-4.060
1400	9.569	71.085	10.099	21.949	-8.453
1600	9.627	72.366	12.018	21.227	-12.746
1800	9.728	73.506	13.953	16.322	-16.774
2000	9.873	74.538	15.912	15.506	-20.408

*Enthalpy of formation at 298 K estimated.

$\text{NiF}_2(\text{c})$
Nickel difluoride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	15.310	17.590	0	-157.200	-145.872
400	16.500	22.285	1.630	-157.017	-142.031
600	17.468	29.177	5.036	-156.737	-134.610
800	18.230	34.308	8.607	-156.411	-127.272
1000	18.948	38.453	12.325	-155.954	-120.042
1200	19.707	41.973	16.188	-155.442	-112.900
1400	20.797	45.085	20.229	-154.846	-105.856
1600	22.864	47.981	24.571	-154.050	-98.906

$\text{NiF}_2(\text{g})$
Nickel difluoride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	12.555	65.238	0	-80.200	-83.079
400	13.549	69.074	1.332	-80.315	-84.045
600	14.773	74.827	4.178	-80.595	-85.858
800	15.356	79.168	7.199	-80.819	-87.568
1000	15.580	82.623	10.296	-80.983	-89.241
1200	15.627	85.469	13.419	-81.211	-90.864
1400	15.596	87.877	16.542	-81.533	-92.452
1600	15.537	89.955	19.656	-81.965	-93.979
1800	15.471	91.782	22.756	-86.614	-95.279
2000	15.408	93.408	25.844	-87.216	-96.208

$\text{NpF}_6(\text{c,l})$
Neptunium hexafluoride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	40.020	54.755	0	-474.500	-443.900
300	40.170	55.003	.074	-474.481	-443.711
328	42.540	58.680	1.228	-474.161	-440.862
328	44.560	71.453	5.416	-469.973	-440.862
350	45.140	74.377	6.407	-469.648	-438.911

*Enthalpy of formation at 298 K estimated.

327.91 K, melting point; ΔH° = 4.188

328.3 K, boiling point; ΔH° = 7.

$\text{NpF}_6(\text{g})$
Neptunium hexafluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	30.848	89.991	0	-463.000	-442.905
300	30.909	90.182	.057	-462.998	-442.781
400	33.366	99.446	3.283	-462.833	-436.065
500	34.755	107.054	6.696	-462.720	-429.387
600	35.592	113.471	10.216	-464.007	-422.612
700	36.129	119.001	13.804	-463.903	-415.721
800	36.492	123.850	17.436	-463.797	-408.847
900	36.750	128.164	21.099	-464.912	-401.907
1000	36.943	132.046	24.784	-466.166	-394.790

*Enthalpy of formation at 298 K estimated.

$\text{PF}(\text{g})$
Phosphorus monofluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	7.557	53.743	0	-12.518	-18.392
400	7.956	56.022	.791	-12.905	-20.322
600	8.430	59.349	2.435	-16.163	-23.690
800	8.664	61.810	4.147	-16.257	-26.185
1000	8.799	63.759	5.894	-16.352	-28.655
1200	8.895	65.372	7.664	-16.446	-31.108
1400	8.980	66.749	9.452	-16.537	-33.543
1600	9.066	67.954	11.256	-16.622	-35.967
1800	9.156	69.027	13.078	-16.696	-38.380
2000	9.249	69.996	14.919	-16.757	-40.785

*Enthalpy of formation at 298 K estimated.

$\text{PF}_2(\text{g})$
Phosphorus difluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	10.688	62.822	0	-116.696	-118.055
400	11.639	66.104	1.140	-117.126	-118.435
600	12.683	71.049	3.586	-120.399	-118.744
800	13.166	74.772	6.177	-120.468	-118.181
1000	13.416	77.739	8.837	-120.526	-117.602
1200	13.560	80.199	11.536	-120.580	-117.012
1400	13.650	82.297	14.258	-120.634	-116.414
1600	13.709	84.124	16.994	-120.691	-115.808
1800	13.751	85.741	19.740	-120.751	-115.193
2000	13.781	87.191	22.494	-120.814	-114.570

*Data estimated.

$\text{PF}_3(\text{g})$
Phosphorus trifluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	14.027	65.233	0	-229.100	-223.956
400	15.791	69.619	1.525	-229.537	-222.112
600	17.678	76.431	4.897	-232.701	-218.073
800	18.543	81.650	8.530	-232.583	-213.213
1000	18.990	85.841	12.287	-232.419	-208.390
1200	19.247	89.328	16.113	-232.234	-203.601
1400	19.407	92.308	19.980	-232.041	-198.844
1600	19.513	94.906	23.873	-231.846	-194.113
1800	19.587	97.209	27.783	-231.652	-189.407
2000	19.640	99.276	31.706	-231.461	-184.725

$\text{PF}_5(\text{g})$
Phosphorus pentafluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	20.276	71.868	0	-381.100	-363.491
400	23.718	78.342	2.252	-381.592	-357.377
600	27.416	88.760	7.416	-384.599	-344.965
800	29.128	96.910	13.090	-384.150	-331.818
1000	30.021	103.515	19.014	-383.570	-318.799
1200	30.536	109.038	25.074	-382.928	-305.905
1400	30.857	113.771	31.215	-382.256	-293.122
1600	31.071	117.907	37.410	-381.568	-280.435
1800	31.219	121.575	43.639	-380.875	-267.833
2000	31.327	124.870	49.895	-380.181	-255.308

PbF(g)
Lead monofluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.221	59.714	0	-19.184	-25.148
400	8.514	62.175	.854	-19.376	-27.154
600	8.775	65.685	2.587	-19.819	-30.956
800	8.891	68.227	4.355	-21.503	-34.203
1000	8.959	70.219	6.140	-22.011	-37.323
1200	9.013	71.858	7.938	-22.491	-40.335
1400	9.069	73.251	9.746	-22.951	-43.282
1600	9.135	74.466	11.566	-23.404	-46.176
1800	9.214	75.546	13.400	-23.848	-48.970
2000	9.305	76.522	15.252	-24.279	-51.741

PbF₂(c,l)
Lead difluoride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	17.034	26.400	0	-158.700	-147.510
400	18.098	31.564	1.792	-158.346	-143.740
583	19.531	38.644	5.240	-157.628	-137.201
583	21.076	39.279	5.610	-157.258	-137.201
600	21.917	39.896	5.975	-157.155	-136.618
745	41.827	46.217	10.260	-156.303	-131.546
800	25.723	48.143	11.746	-155.691	-129.740
1000	22.081	53.311	16.364	-154.242	-123.438
1103	23.995	55.547	18.715	-153.524	-120.305
1103	26.100	58.779	22.280	-149.959	-120.305
1200	26.100	60.979	24.812	-148.960	-117.729
1400	26.100	65.002	30.032	-146.906	-112.696

583 K, transition point; ΔH° = 0.370

745 K, transition point; ΔH° = 0

1103 K, melting point; ΔH° = 3.565

PbF₂(g)
Lead difluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	12.177	69.928	0	-104.000	-105.787
400	12.823	73.607	1.277	-104.161	-106.372
600	13.381	78.931	3.907	-104.523	-107.407
800	13.603	82.815	6.608	-106.129	-107.915
1000	13.710	85.863	9.340	-106.566	-108.314
1200	13.770	88.368	12.039	-106.983	-108.619
1400	13.807	90.494	14.847	-107.391	-108.869
1600	13.831	92.339	17.611	-107.804	-109.073
1800	13.847	93.969	20.379	-108.224	-109.180
2000	13.859	95.429	23.149	-108.652	-109.266

PbF₄(g)
Lead tetrafluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	21.734	79.706	0	-270.900	-261.159
400	23.249	86.328	2.299	-270.822	-257.841
600	24.570	96.050	7.103	-270.644	-251.396
800	25.097	103.200	12.077	-271.687	-244.612
1000	25.354	108.831	17.124	-271.560	-237.861
1200	25.497	113.467	22.211	-271.416	-231.128
1400	25.585	117.405	27.320	-271.268	-224.437
1600	25.643	120.825	32.443	-271.131	-217.776
1800	25.682	123.848	37.576	-271.006	-211.088
2000	25.711	126.555	42.715	-270.895	-204.437

*Data except enthalpy of formation at 298 K estimated.

PrF₃(c,l)
Praseodymium trifluoride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	22.140	28.970	0	-403.700	-385.404
400	23.817	35.726	2.346	-403.207	-379.226
600	25.917	45.821	7.339	-402.090	-367.478
800	27.060	53.451	12.649	-400.947	-356.113
1000	27.663	59.561	18.127	-399.904	-345.022
1200	28.080	64.641	23.702	-399.634	-334.052
1400	28.652	69.009	29.370	-400.354	-322.923
1600	29.717	72.897	35.196	-399.297	-311.933
1672	30.285	74.217	37.355	-398.857	-307.997
1672	31.250	82.410	51.055	-385.157	-307.997
1800	31.250	84.716	55.055	-384.222	-302.140

1672 K, melting point; ΔH° = 13.700

PrF₃(g)
Praseodymium trifluoride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	17.303	81.103	0	-300.700	-297.948
400	18.313	86.342	1.818	-300.736	-297.000
600	19.445	94.002	5.604	-300.825	-295.121
800	20.196	99.705	9.573	-301.023	-293.192
1000	20.741	104.273	13.669	-301.362	-291.192
1200	21.119	108.091	17.858	-302.478	-289.036
1400	21.353	111.365	22.107	-304.617	-286.484
1600	21.472	114.226	26.391	-305.102	-283.865
1800	21.503	116.757	30.690	-305.587	-281.179
2000	21.476	119.022	34.989	-306.087	-278.424

$\text{PuF}_3(\text{c,l})$
Plutonium trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	22.140	30.141	0	-371.000	-354.320
400*	23.647	36.972	2.337	-371.520	-348.659
600	25.622	46.860	7.277	-371.025	-337.356
800	27.116	54.442	12.555	-370.510	-326.242
1000	28.421	60.635	18.111	-370.063	-315.246
1200	29.636	65.926	23.917	-368.943	-304.386
1400	30.801	70.582	29.962	-367.610	-293.728
1600	31.938	74.769	36.236	-366.070	-283.274
1699	32.495	76.703	39.425	-365.229	-278.176
1699	35.000	84.355	52.425	-352.229	-278.176
1800	35.000	86.376	55.960	-351.096	-273.809
2000	35.000	90.064	62.960	-348.861	-265.342

*Data above 298 K estimated except temperature of fusion.

1699 K, melting point; $\Delta H^\circ = 13.000$

$\text{PuF}_4(\text{c,l})$
Plutonium tetrafluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	27.770	35.194	0	-425.000	-402.605
400	29.270	43.584	2.912	-425.336	-395.020
600	30.839	55.786	8.941	-424.570	-380.055
800	31.727	64.789	15.204	-423.924	-365.349
1000	32.343	71.938	21.614	-423.499	-350.777
1200	32.822	77.879	28.132	-422.555	-336.321
1310	33.051	80.768	31.755	-422.013	-328.439
1310	41.000	88.554	41.955	-411.813	-328.439
1400	41.000	91.278	45.645	-410.652	-322.752

*Data above 298 K estimated.

1310 K, melting point; $\Delta H^\circ = 10.200$

$\text{PuF}_6(\text{c,l})$
Plutonium hexafluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	40.000	53.000	0	-430.000	-398.471
300	40.020	53.247	.074	-429.983	-290.140
325	42.494	56.488	1.086	-429.730	-395.672
325	45.000	70.210	5.542	-425.274	-395.672
335	45.000	71.651	6.018	-425.127	-394.710

*Heat capacities estimated.

324.74 K, melting point; $\Delta H^\circ = 4.456$

335.31 K, boiling point; ΔH° (sublimation, 298 K) =

11.6

$\text{PuF}_6(\text{g})$
Plutonium hexafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	30.933	88.294	0	-418.000	-396.994
400	33.444	97.773	3.292	-418.739	-389.819
600	35.640	111.824	10.237	-418.691	-375.396
800	36.521	122.214	17.465	-418.790	-360.985
1000	36.952	130.415	24.816	-419.175	-346.515
1200	37.192	137.175	32.233	-419.109	-331.988
1400	37.340	142.920	39.687	-419.060	-317.473
1600	37.436	147.913	47.165	-419.029	-302.962
1800	37.502	152.326	54.660	-419.014	-288.453
2000	37.550	156.280	62.165	-419.019	-273.947

$\text{RbF}(\text{c,l})$
Rubidium fluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	12.040	19.200	0	-133.300	-126.332
400	12.875	22.867	1.273	-133.755	-123.813
600	13.986	28.308	3.964	-133.385	-118.913
800	14.931	32.463	6.857	-132.762	-114.177
1000	15.828	35.892	9.934	-149.122	-109.169
1068	16.129	36.943	11.020	-148.675	-106.466
1068	17.000	42.678	17.145	-142.550	-106.466
1200	17.000	44.659	19.389	-141.549	-102.066
1400	17.000	47.279	22.789	-140.040	-95.604

*Heat capacity at 298 K estimated.

1068 K, melting point; $\Delta H^\circ = 6.125$

$\text{SF}(\text{g})$
Sulfur monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.401	53.815	0	-12.255	-12.953
400	8.617	56.317	.868	-12.185	-13.202
600	8.813	59.854	2.614	-12.093	-13.733
800	8.902	62.403	4.386	-12.042	-14.289
1000	8.955	64.396	6.172	-12.015	-14.855
1200	8.991	66.032	7.967	-12.007	-15.423
1400	9.020	67.420	9.768	-12.017	-15.992
1600	9.045	68.626	11.575	-12.041	-16.558
1800	9.067	69.693	13.386	-12.082	-17.121
2000	9.087	70.649	15.201	-12.136	-17.678

SF₂(g)
Sulfur difluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	10.733	61.565	0	-86.255	-82.042
400	11.686	64.862	1.145	-86.299	-80.595
600	12.717	69.824	3.599	-86.317	-77.737
800	13.188	73.555	6.195	-86.297	-74.880
1000	13.432	76.526	8.860	-86.266	-72.028
1200	13.572	78.989	11.561	-86.241	-69.184
1400	13.658	81.088	14.285	-86.225	-66.343
1600	13.716	82.916	17.023	-86.223	-63.503
1800	13.756	84.534	19.770	-86.238	-60.662
2000	13.785	85.985	22.524	-86.268	-57.819

*Data except enthalpy of formation at 298 K estimated.

SF₅(g)
Sulfur pentafluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	21.425	72.811	0	-232.455	-209.930
400	24.955	79.646	2.378	-232.441	-202.230
600	28.309	90.505	7.756	-231.985	-187.210
800	29.729	98.869	13.578	-231.304	-172.384
1000	30.440	105.587	19.602	-230.541	-157.742
1200	30.842	111.176	25.734	-229.750	-143.255
1400	31.095	115.951	31.929	-228.956	-128.904
1600	31.271	120.115	38.167	-228.168	-114.663
1800	31.406	123.806	44.435	-227.391	-100.521
2000	31.522	127.121	50.728	-226.627	-86.465

*Data except enthalpy of formation at 298 K estimated.

SF₃(g)
Sulfur trifluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	13.773	66.347	0	-135.755	-125.746
400	15.588	70.666	1.501	-135.835	-122.312
600	17.554	77.411	4.842	-135.782	-115.553
800	18.463	82.601	8.454	-135.601	-108.837
1000	18.936	86.777	12.199	-135.366	-102.172
1200	19.208	90.256	16.016	-135.113	-95.556
1400	19.378	93.230	19.875	-134.859	-88.984
1600	19.491	95.826	23.763	-134.613	-82.448
1800	19.569	98.126	27.669	-134.378	-75.940
2000	19.625	100.191	31.589	-134.157	-69.459

*Data except enthalpy of formation at 298 K estimated.

SF₆(g)
Sulfur hexafluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	23.174	69.651	0	-307.055	-276.366
400	27.813	77.162	2.615	-307.195	-265.851
600	32.521	89.468	8.716	-306.833	-245.235
800	34.609	99.146	15.455	-306.091	-224.808
1000	35.676	106.996	22.494	-305.188	-204.591
1200	36.286	113.559	29.695	-304.217	-184.560
1400	36.664	119.183	36.993	-303.217	-164.698
1600	36.914	124.096	44.353	-302.211	-144.976
1800	37.087	128.455	51.754	-301.212	-125.381
2000	37.213	132.369	59.184	-300.226	-105.898

SF₄(g)
Sulfur tetrafluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	18.546	71.590	0	-197.755	-182.088
400	20.912	77.398	2.019	-197.708	-176.738
600	23.265	86.393	6.472	-197.360	-166.319
800	24.295	93.245	11.240	-196.878	-156.044
1000	24.319	98.729	16.157	-196.347	-145.897
1200	25.117	103.282	21.153	-195.803	-135.857
1400	25.302	107.169	26.196	-195.264	-125.910
1600	25.423	110.556	31.270	-194.735	-116.037
1800	25.508	113.556	36.363	-194.224	-106.231
2000	25.569	116.246	41.471	-193.730	-96.480

SSF₂(g)
Thiothionyl fluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	15.088	69.960	0	-126.610	-116.774
400	16.702	74.640	1.626	-126.579	-113.417
600	18.252	81.753	5.145	-126.369	-106.876
800	18.911	87.106	8.870	-126.086	-100.420
1000	19.241	91.365	12.688	-125.786	-94.039
1200	19.428	94.891	16.557	-125.491	-87.716
1400	19.543	97.895	20.455	-125.214	-81.443
1600	19.618	100.510	24.371	-124.962	-75.208
1800	19.671	102.824	28.300	-124.736	-69.003
2000	19.708	104.899	32.238	-124.536	-62.822

*Enthalpy of formation at 298 K estimated.

$\text{FS}_2\text{F}(\text{g})$
Disulfur difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	15.784	70.260	0	-111.110	-101.364
400	17.202	75.116	1.686	-111.019	-98.047
600	18.525	82.383	5.280	-110.734	-91.619
800	19.077	87.798	9.047	-110.409	-85.296
1000	19.351	92.088	12.893	-110.081	-79.057
1200	19.506	95.631	16.780	-109.768	-72.881
1400	19.601	98.645	20.691	-109.478	-66.757
1600	19.663	101.267	24.618	-109.215	-60.673
1800	19.706	103.586	28.555	-108.981	-54.619
2000	19.738	105.664	32.500	-108.774	-48.590

*Enthalpy of formation at 298 K estimated.

$\text{S}_2\text{F}_{10}(\text{g})$
Disulfur decafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	42.228	94.872	0	-524.110	-463.929
400	50.530	108.535	4.756	-524.081	-443.357
600	58.900	130.851	15.820	-522.862	-403.216
800	62.564	148.363	20.012	-520.952	-363.613
1000	64.347	162.537	40.723	-518.763	-324.528
1200	65.271	174.357	53.691	-516.477	-285.893
1400	65.782	184.459	66.800	-514.169	-247.647
1600	66.078	193.264	79.988	-511.881	-209.727
1800	66.233	201.056	93.220	-509.632	-172.091
2000	66.351	208.041	106.478	-507.432	-134.706

$\text{SbF}_3(\text{c,l,g})$
Antimony trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	21.563	30.410	0	-218.800	-202.958
300	21.602	30.544	.040	-218.792	-202.859
400	23.683	37.043	2.304	-218.294	-197.619
500	25.765	42.551	4.777	-217.654	-192.519
560	27.014	45.541	6.360	-217.196	-189.534
560	35.200	55.255	11.800	-211.756	-189.534
600	35.200	57.684	13.208	-211.108	-187.969
619	35.200	58.781	13.877	-210.802	-187.241
619	18.843	85.416	30.364	-194.315	-187.241
700	19.065	87.747	31.900	-194.347	-186.310
800	19.249	90.306	33.816	-194.410	-185.164
900	19.369	92.581	35.748	-194.504	-183.999
1000	19.439	94.626	37.689	-194.582	-182.326

*Heat capacity at 298 K and data for gas estimated.

560 K, melting point; $\Delta H^\circ = 5.440$

619 K, boiling point; $\Delta H^\circ = 16.487$

$\text{SbF}_3(\text{g})$
Antimony trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	16.313	72.400	0	-194.200	-190.877
300	16.349	72.501	.030	-194.202	-190.856
400	17.685	77.412	1.740	-194.257	-189.730
500	18.374	81.439	3.546	-194.284	-188.594
600	18.791	84.829	5.406	-194.309	-187.458
700	19.065	87.747	7.300	-194.346	-186.310
800	19.249	90.306	9.216	-194.410	-185.164
900	19.369	92.581	11.148	-194.504	-183.999
1000	19.439	94.626	13.089	-194.582	-182.325

*Data except enthalpy of formation at 298 K estimated.

$\text{ScF}_3(\text{c,l})$
Scandium trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	20.000	23.400	0	-385.200	-368.043
400	21.740	29.560	2.142	-384.865	-362.229
600	23.080	38.670	6.647	-384.095	-351.072
800	23.650	45.400	11.326	-383.332	-340.177
1000	23.990	50.720	16.092	-382.633	-329.490
1200	24.250	55.110	20.917	-382.024	-318.877
1400	24.470	58.870	25.790	-381.523	-308.433
1600	24.660	62.150	30.703	-381.152	-298.017
1800	24.840	65.060	35.654	-381.994	-287.517
1825	24.900	65.410	36.275	-385.348	-286.191
1825	21.240	73.610	51.244	-370.379	-286.191
2000	21.240	75.540	54.961	-370.915	-278.069

* Heat capacity at 298 K estimated.

1825 K, melting point; $\Delta H^\circ = 14.969$

$\text{ScF}_3(\text{g})$
Scandium trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	16.190	72.770	0	-295.300	-292.863
400	17.400	77.720	1.720	-295.386	-292.014
600	18.600	85.040	5.330	-295.512	-290.311
800	19.120	90.470	9.110	-295.647	-288.549
1000	19.380	94.760	12.970	-295.855	-286.752
1200	19.520	98.310	16.860	-296.181	-284.874
1400	19.610	101.330	20.770	-296.643	-282.997
1600	19.670	103.950	24.700	-297.254	-281.000
1800	19.710	106.270	28.640	-299.108	-278.809

SeF(g)
Selenium monofluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	7.710	55.780	0	-26.650	-27.383
400	8.180	58.120	.813	-26.735	-27.619
600	8.520	61.520	2.490	-26.885	-28.032
800	8.660	63.990	4.210	-27.028	-28.388
1000	8.740	65.930	5.950	-27.166	-28.713
1200	8.790	67.530	7.703	-27.292	-29.011
1400	8.830	68.890	9.466	-27.406	-29.291
1600	8.870	70.070	11.236	-27.509	-29.552
1800	8.900	71.120	13.012	-27.599	-29.806
2000	8.930	72.060	14.795	-27.675	-30.052

*Data estimated.

SeF₅(g)
Selenium pentafluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	22.800	76.990	0	-241.450	-219.620
400	26.390	84.280	2.535	-241.379	-212.167
600	28.970	95.570	8.119	-240.889	-197.661
800	29.950	104.050	14.024	-240.269	-183.337
1000	30.480	110.800	20.072	-239.600	-169.187
1200	30.830	116.390	26.206	-238.899	-155.166
1400	31.100	121.160	32.400	-238.173	-141.265
1600	31.320	125.330	38.642	-237.421	-127.477
1800	31.510	129.030	44.924	-236.645	-113.777
2000	31.680	132.360	51.244	-235.844	-100.173

*Data estimated.

SeF₂(g)
Selenium difluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	11.400	64.440	0	-91.350	-87.443
400	12.400	67.960	1.221	-91.418	-86.098
600	13.120	73.150	3.787	-91.496	-83.420
800	13.400	76.970	6.443	-91.559	-80.717
1000	13.550	79.980	9.139	-91.616	-78.006
1200	13.640	82.460	11.858	-91.664	-75.278
1400	13.720	84.560	14.594	-91.703	-72.533
1600	13.780	86.400	17.344	-91.730	-69.801
1800	13.830	88.030	20.105	-91.745	-67.062
2000	13.880	89.490	22.876	-91.748	-64.324

*Data estimated.

SeF₆(g)
Selenium hexafluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	26.310	74.920	0	-283.600	-253.931
400	30.880	83.400	2.950	-283.505	-243.801
600	34.150	96.670	9.515	-282.852	-224.082
800	35.410	106.690	16.487	-282.019	-204.614
1000	36.090	114.670	23.643	-281.118	-185.368
1200	36.530	121.290	30.907	-280.176	-166.302
1400	36.870	126.950	38.249	-279.199	-147.404
1600	37.150	131.890	45.651	-278.192	-128.643
1800	37.390	136.280	53.105	-277.154	-110.007
2000	37.610	140.230	60.605	-276.087	-91.495

SeF₄(g)
Selenium tetrafluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	17.000	70.850	0	-210.650	-194.211
400	20.390	76.400	1.931	-210.792	-188.568
600	22.850	85.230	6.301	-210.699	-177.468
800	23.830	91.950	10.980	-210.449	-166.422
1000	24.370	97.330	15.804	-210.128	-155.453
1200	24.750	101.810	20.718	-209.760	-144.551
1400	25.050	105.650	25.699	-209.348	-133.719
1600	25.300	109.010	30.735	-208.898	-122.943
1800	25.530	112.000	35.819	-208.411	-112.217
2000	25.750	114.700	40.948	-207.885	-101.557

SiF(g)
Silicon monofluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	7.803	53.937	0	-4.800	-12.318
400	8.096	56.272	.610	-4.898	-14.874
600	8.492	59.638	2.473	-5.170	-19.807
800	8.699	62.112	4.194	-5.500	-24.636
1000	8.817	64.067	5.947	-5.870	-29.370
1200	8.893	65.682	7.718	-6.269	-34.042
1400	8.946	67.057	9.502	-6.689	-38.634
1600	8.988	68.254	11.296	-7.131	-43.180
1800	9.021	69.315	13.097	-7.597	-46.823
2000	9.050	70.267	14.904	-7.924	-49.836

$\text{SiF}_2(\text{g})$
Silicon difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.638	61.298	0	-140.500	-142.991
400	11.581	64.564	1.134	-140.665	-143.819
600	12.640	69.488	3.570	-140.981	-145.327
800	13.137	73.200	6.154	-141.303	-146.725
1000	13.396	76.162	8.810	-141.646	-148.033
1200	13.545	78.619	11.505	-142.009	-149.286
1400	13.639	80.715	14.224	-142.392	-150.466
1600	13.701	82.540	16.958	-142.798	-151.604
1800	13.744	84.157	19.703	-155.230	-151.844
2000	13.775	85.606	22.455	-155.528	-151.456

$\text{SiF}_3(\text{g})$
Silicon trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.251	67.464	0	-259.400	-256.508
400	15.856	71.891	1.538	-259.552	-255.497
600	17.660	78.708	4.913	-259.746	-253.423
800	18.518	83.920	8.541	-259.879	-251.293
1000	18.969	88.105	12.294	-260.001	-249.123
1200	19.230	91.589	16.116	-260.125	-246.945
1400	19.394	94.566	19.979	-260.262	-244.735
1600	19.502	97.164	23.869	-260.417	-242.520
1800	19.578	99.465	27.778	-272.595	-239.435
2000	19.633	101.531	31.699	-272.638	-235.754

$\text{SiF}_4(\text{g})$
Silicon tetrafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.596	67.554	0	-385.980	-375.893
400	19.871	73.062	1.915	-386.147	-372.420
600	22.488	81.679	6.183	-386.265	-365.522
800	23.765	88.344	10.822	-386.242	-358.610
1000	24.446	93.727	15.650	-386.164	-351.701
1200	24.845	98.223	20.582	-386.067	-344.827
1400	25.095	102.073	25.578	-385.968	-337.958
1600	25.262	105.435	30.615	-385.880	-331.117
1800	25.379	108.418	35.680	-397.812	-323.440
2000	25.463	111.096	40.764	-397.608	-315.192

$\text{SmF}_3(\text{c,l})$
Samarium trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	25.510	27.200	0	-398.900	-380.387
400	25.568	34.705	2.601	-398.232	-374.170
600	25.674	45.092	7.726	-397.341	-362.352
763	25.760	51.272	11.917	-396.884	-352.903
763	32.198	51.884	12.384	-396.417	-352.903
800	30.383	53.364	13.540	-396.127	-350.800
1000	27.182	59.633	19.147	-395.280	-339.580
1200	30.126	64.789	24.812	-395.257	-328.497
1400	35.970	69.845	31.388	-395.721	-317.402
1572	42.262	74.361	38.103	-393.403	-307.909
1572	35.597	82.346	50.653	-380.853	-307.909
1600	35.597	82.974	51.650	-380.573	-306.613
1800	35.597	87.167	58.769	-378.583	-297.493
2000	35.597	90.918	65.888	-376.609	-288.579

*Entropy and heat capacity at 298 K estimated.

763 K, transition point; $\Delta H^\circ = 0.467$

1572 K, melting point; $\Delta H^\circ = 12.550$

$\text{SmF}_3(\text{g})$
Samarium trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.583	80.064	0	-296.600	-293.848
400	19.016	85.447	1.869	-296.665	-292.899
600	20.526	93.485	5.844	-296.924	-290.970
800	21.218	99.496	10.027	-297.340	-288.919
1000	21.563	104.273	14.309	-297.818	-286.759
1200	21.720	108.220	18.640	-299.130	-284.487
1400	21.756	111.572	22.989	-301.820	-281.919
1600	21.711	114.475	27.337	-302.586	-279.027
1800	21.619	117.027	31.670	-303.383	-276.040
2000	21.503	119.299	35.983	-304.215	-272.947

$\text{SnF}(\text{g})$
Tin monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.055	57.721	0	-22.710	-29.050
400	8.421	60.143	1.840	-22.940	-31.180
600	8.939	63.659	2.578	-25.104	-34.874
800	9.364	66.292	4.410	-25.491	-38.071
1000	9.660	68.416	6.315	-25.822	-41.176
1200	9.825	70.193	8.265	-26.120	-44.218
1400	9.896	71.714	10.239	-26.404	-47.211
1600	9.908	73.037	12.220	-26.688	-50.166
1800	9.891	74.203	14.200	-26.978	-53.083
2000	9.862	75.244	16.175	-27.278	-55.970

$\text{SnF}_2(\text{c,l})$
Tin difluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	17.303	22.992	0	-155.000	-143.764
300	17.329	23.099	0.032	-154.994	-143.694
400	18.750	28.279	1.836	-154.626	-139.980
488	20.003	32.136	3.545	-154.250	-136.789
488	23.900	37.277	6.055	-151.740	-136.789
500	23.900	37.848	6.337	-151.640	-136.428
600	23.900	42.205	8.727	-152.454	-133.150
700	23.900	45.889	11.117	-151.596	-130.000
800	23.900	49.081	13.507	-150.748	-126.974
900	23.900	51.896	15.897	-149.909	-124.051
1000	23.900	54.414	18.287	-149.079	-121.224

*Data except enthalpy of formation at 298 K estimated.
488.2 K, melting point; $\Delta H^\circ = 2.510$

$\text{SnF}_2(\text{g})$
Tin difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.874	67.403	0	-115.668	-117.673
400	12.603	71.004	1.250	-115.880	-118.324
600	13.262	76.261	3.847	-118.002	-119.131
800	13.530	80.118	6.530	-118.393	-119.448
1000	13.663	83.153	9.251	-118.783	-119.667
1200	13.736	85.651	11.991	-119.180	-119.806
1400	13.782	87.772	14.743	-119.583	-119.878
1600	13.811	89.614	17.503	-119.992	-119.893
1800	13.832	91.242	20.267	-120.408	-119.855
2000	13.847	92.700	23.035	-120.830	-119.772

$\text{SrF}(\text{g})$
Strontium monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.242	57.315	0	-70.400	-76.540
400	8.529	59.782	.856	-70.606	-78.606
600	8.785	63.297	2.591	-71.130	-82.500
800	8.898	65.841	4.361	-71.854	-86.188
1000	8.963	67.834	6.147	-72.920	-89.631
1200	9.009	69.473	7.945	-75.674	-92.597
1400	9.045	70.864	9.750	-76.447	-95.357
1600	9.077	72.074	11.562	-77.220	-98.005
1800	9.107	73.145	13.381	-110.223	-97.693
2000	9.139	74.106	15.205	-110.316	-96.296

$\text{SrF}_2(\text{c,l})$
Strontium difluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	16.730	19.630	0	-290.700	-278.383
400	17.791	24.699	1.760	-290.394	-274.220
600	19.239	32.216	5.477	-289.752	-266.273
800	19.712	37.837	9.397	-289.191	-258.537
1000	20.048	42.255	13.348	-288.958	-250.883
1200	23.114	46.108	17.584	-290.163	-243.027
1400	33.989	50.346	23.110	-288.112	-235.304
1480	42.089	52.445	26.135	-286.481	-232.330
1480	35.628	52.445	26.135	-286.481	-232.330
1600	30.964	55.044	30.131	-284.580	-228.017
1750	25.133	57.562	34.340	-315.398	-220.905
1750	23.500	61.602	41.410	-308.328	-220.905
1800	23.500	62.264	42.585	-307.858	-218.414
2000	23.500	64.740	47.285	-305.990	-208.576

1480 K, transition point; $\Delta H^\circ = 0$

1750 K, melting point; $\Delta H^\circ = 7.070$

$\text{SrF}_2(\text{g})$
Strontium difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.665	69.694	0	-183.100	-185.709
400	13.153	73.493	1.318	-183.236	-186.580
600	13.551	78.915	3.995	-183.634	-188.174
800	13.703	82.838	6.723	-184.255	-189.602
1000	13.776	85.904	9.471	-185.235	-190.809
1200	13.817	88.420	12.231	-187.916	-191.554
1400	13.841	90.552	14.997	-188.625	-192.105
1600	13.857	92.401	17.767	-189.344	-192.552
1800	13.868	94.034	20.540	-222.303	-190.045
2000	13.876	95.495	23.314	-222.361	-186.457

$\text{TbF}_3(\text{c,l})$
Terbium trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	21.800	28.200	0	-408.000	-389.519
400	23.422	34.851	2.309	-407.564	-383.272
600	25.407	44.756	7.208	-406.491	-371.355
800	26.746	52.259	12.431	-405.333	-359.810
1000	27.802	58.343	17.888	-404.144	-348.575
1200	28.785	63.499	23.546	-402.941	-337.572
1400	29.870	68.015	29.409	-401.736	-326.763
1450	30.177	69.069	30.910	-401.434	-324.091
1450	36.300	78.717	44.900	-387.444	-324.091
1600	36.300	82.290	50.345	-386.701	-317.598
1800	36.300	86.566	57.605	-386.840	-308.863
2000	36.300	90.391	64.865	-384.548	-300.324

*Entropy and heat capacity at 298 K estimated.
1450 K, melting point; $\Delta H^\circ = 13.990$

$\text{TbF}_3(\text{g})$
Terbium trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.090	81.179	0	-301.500	-298.815
400	18.152	86.363	1.799	-301.573	-297.887
600	19.301	93.964	5.556	-301.643	-296.031
800	20.029	99.622	9.494	-301.771	-294.138
1000	20.552	104.151	13.555	-301.977	-292.216
1200	20.907	107.932	17.703	-302.284	-290.235
1400	21.121	111.172	21.908	-302.737	-288.184
1600	21.226	114.001	26.144	-304.401	-286.037
1800	21.252	116.503	30.393	-307.552	-283.461
2000	21.227	118.741	34.642	-308.271	-280.746

$\text{TeF}(\text{g})$
Tellurium monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	7.930	57.660	0	-39.965	-40.711
400	8.330	60.060	.832	-39.972	-40.966
600	8.620	63.500	2.531	-39.994	-41.457
800	8.730	66.000	4.267	-40.051	-41.942
1000	8.790	67.950	6.019	-40.144	-42.401
1200	8.830	69.560	7.781	-40.272	-42.843
1400	8.860	70.920	9.551	-40.433	-43.255
1600	8.890	72.110	11.326	-40.606	-43.658
1800	8.920	73.160	13.107	-40.776	-44.027
2000	8.940	74.100	14.892	-40.939	-44.376

*Data estimated.

$\text{TeF}_2(\text{g})$
Tellurium difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	10.970	65.750	0	-111.165	-107.102
400	12.120	69.160	1.186	-111.210	-105.704
600	12.950	74.270	3.709	-111.225	-102.948
800	13.280	78.040	6.335	-111.247	-100.185
1000	13.450	81.030	9.010	-111.292	-97.422
1200	13.570	83.490	11.713	-111.368	-94.633
1400	13.670	85.590	14.438	-111.471	-91.838
1600	13.740	87.420	17.179	-111.583	-89.029
1800	13.810	89.040	19.935	-111.688	-86.194
2000	13.880	90.500	22.704	-111.781	-83.357

*Data estimated.

$\text{TeF}_4(\text{g})$
Tellurium tetrafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	19.620	77.460	0	-245.765	-230.750
400	22.080	83.630	2.144	-245.635	-225.637
600	23.850	92.990	6.770	-245.181	-215.733
800	24.530	99.950	11.617	-244.691	-205.988
1000	24.900	105.470	16.564	-244.216	-196.371
1200	25.150	110.040	21.571	-243.765	-186.949
1400	25.340	113.930	26.621	-243.338	-177.396
1600	25.500	117.320	31.705	-242.916	-168.001
1800	25.630	120.330	36.818	-242.484	-158.656
2000	25.760	123.040	41.958	-242.036	-149.368

*Data except enthalpy of formation at 298 K estimated.

$\text{TeF}_5(\text{g})$
Tellurium pentafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	24.030	81.450	0	-296.365	-275.318
400	27.130	89.020	2.631	-296.139	-268.157
600	29.340	100.530	8.320	-295.440	-254.314
800	30.200	109.100	14.285	-294.687	-240.719
1000	30.660	115.890	20.374	-293.945	-227.313
1200	30.960	121.510	26.537	-293.226	-214.053
1400	31.190	126.300	32.753	-292.531	-200.915
1600	31.380	130.480	39.010	-291.841	-187.881
1800	31.550	134.180	45.303	-291.138	-174.912
2000	31.700	137.510	51.628	-290.421	-162.030

*Data estimated.

$\text{TeF}_6(\text{g})$
Tellurium hexafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	28.030	80.280	0	-346.365	-317.747
400	31.910	89.160	3.085	-346.077	-308.011
600	34.690	102.730	9.796	-345.172	-289.165
800	35.760	112.870	16.854	-344.182	-270.645
1000	36.330	120.920	24.067	-343.191	-252.381
1200	36.710	127.570	31.373	-342.218	-234.296
1400	37.000	133.260	38.745	-341.264	-216.399
1600	37.240	138.210	46.169	-340.311	-198.618
1800	37.450	142.610	53.638	-339.343	-180.962
2000	37.640	146.570	61.147	-338.356	-163.424

$\text{Te}_2\text{F}_{10}(\text{g})$
Ditellurium decafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	46.970	106.070	0	-626.330	-567.292
400	55.340	121.250	5.279	-625.861	-547.181
600	61.310	145.050	17.058	-624.061	-508.204
800	63.560	163.030	29.574	-621.970	-469.898
1000	64.750	177.360	42.415	-619.823	-432.138
1200	65.500	189.230	55.444	-617.682	-394.788
1400	66.060	199.370	68.603	-615.564	-357.810
1600	66.520	208.220	81.862	-613.439	-321.135
1800	66.910	216.080	95.205	-611.277	-284.721
2000	67.260	223.150	108.622	-609.075	-248.555

*Data estimated.

$\text{ThF}_2(\text{g})$
Thorium difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	12.527	70.533	0	-156.389	-159.171
400	13.064	74.299	1.306	-156.543	-160.098
600	13.506	79.695	3.971	-156.906	-161.801
800	13.677	83.607	6.692	-157.368	-163.365
1000	13.759	86.669	9.436	-157.927	-164.803
1200	13.805	89.182	12.193	-158.575	-166.118
1400	13.832	91.312	14.957	-159.309	-167.317
1600	13.850	93.161	17.725	-160.128	-168.408
1800	13.863	94.793	20.497	-161.783	-169.307
2000	13.872	96.254	23.270	-162.677	-170.097

*Data except enthalpy of formation at 298 K estimated.

$\text{ThF}_3(\text{g})$
Thorium trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	17.519	81.072	0	-283.149	-281.851
400	18.431	86.363	1.836	-283.164	-281.405
600	19.184	94.006	5.611	-283.234	-280.514
800	19.475	99.570	9.481	-283.402	-279.585
1000	19.614	103.932	13.391	-283.671	-278.602
1200	19.692	107.516	17.322	-284.034	-277.557
1400	19.739	110.555	21.266	-284.485	-276.441
1600	19.770	113.193	25.217	-285.025	-275.256
1800	19.791	115.523	29.173	-286.406	-273.916
2000	19.806	117.609	33.133	-287.029	-272.496

*Data except enthalpy of formation at 298 K estimated.

$\text{ThF}_4(\text{c,l})$
Thorium tetrafluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	26.420	33.950	0	-501.443	-478.874
400	28.130	41.980	2.789	-500.897	-471.244
600	29.570	53.700	8.579	-499.769	-456.664
800	30.330	62.320	14.574	-498.667	-442.465
1000	30.900	69.150	20.699	-497.596	-428.538
1200	31.390	74.830	26.929	-496.548	-414.827
1383	31.810	79.320	32.712	-495.604	-402.440
1383	32.000	86.550	42.712	-485.604	-402.440
1400	32.000	86.940	43.256	-485.514	-401.416
1600	32.000	91.210	49.656	-484.510	-389.467
1800	32.000	94.980	56.056	-484.357	-377.561
2000	32.000	98.360	62.456	-483.454	-365.762

1383 K, melting point; $\Delta H^\circ = 10.000$

$\text{ThF}_4(\text{g})$
Thorium tetrafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	22.235	81.667	0	-422.570	-414.228
400	23.598	88.413	2.342	-422.471	-411.391
600	24.753	98.240	7.197	-422.278	-405.897
800	25.207	105.432	12.199	-422.169	-400.456
1000	25.426	111.083	17.264	-422.158	-395.033
1200	25.548	115.731	22.363	-422.241	-389.601
1400	25.623	119.675	27.481	-422.416	-384.147
1600	25.672	123.100	32.610	-422.683	-378.664
1800	25.705	126.126	37.748	-423.792	-373.059
2000	25.730	128.835	42.892	-424.145	-367.403

*Data except enthalpy of formation at 298 K estimated.

$\text{TiF}(\text{g})$
Titanium monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	8.446	56.692	0	-16.000	-23.499
400	9.156	59.279	.898	-16.121	-26.040
600	9.942	63.163	2.820	-16.323	-30.957
800	10.236	66.071	4.843	-16.557	-35.797
1000	10.334	68.368	6.902	-16.869	-40.569
1200	10.373	70.256	8.973	-18.245	-45.239
1400	10.401	71.857	11.050	-18.527	-49.718
1600	10.433	73.248	13.134	-18.890	-54.149
1800	10.469	74.479	15.224	-19.352	-58.530
2000	10.506	75.584	17.321	-23.357	-62.758

*Data estimated.

$\text{TiF}_2(\text{g})$
Titanium difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	12.638	61.081	0	-164.500	-166.086
400	13.486	64.927	1.335	-164.575	-166.614
600	14.213	70.557	4.117	-164.734	-167.603
800	14.504	74.692	6.993	-164.970	-168.522
1000	14.660	77.946	9.910	-165.300	-169.371
1200	14.784	80.630	12.855	-166.690	-170.112
1400	14.923	82.919	15.825	-166.977	-170.662
1600	15.089	84.922	18.826	-167.327	-171.164
1800	15.278	86.710	21.862	-167.753	-171.619
2000	15.479	88.330	24.937	-171.695	-171.927

*Data except enthalpy of formation at 298 K estimated.

$\text{TiF}_3(\text{c,g})$
Titanium trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	21.994	21.000	0	-343.100	-325.514
400	22.300	27.497	2.253	-342.649	-319.575
600	23.536	36.783	6.841	-341.819	-308.222
800	24.746	43.717	11.668	-340.958	-297.146
1000	26.060	49.378	16.747	-340.002	-286.297
1200	27.478	54.253	22.099	-339.874	-275.623
1308	28.290	56.662	25.120	-339.089	-269.855
1308	20.254	97.478	78.520	-285.689	-269.855
1400	20.284	98.851	80.378	-285.749	-268.746
1600	20.328	101.563	84.439	-285.944	-266.305
1800	20.353	103.959	88.508	-286.247	-263.833
2000	20.367	106.104	92.580	-290.107	-261.224

*Data except enthalpy of formation at 298 K estimated.
1308.3 K, sublimation point; $\Delta H^\circ = 53.400$

$\text{TiF}_3(\text{g})$
Titanium trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	15.675	69.622	0	-284.100	-281.010
400	17.513	74.509	1.699	-284.203	-279.934
600	19.190	81.986	5.398	-284.262	-277.787
800	19.808	87.605	9.307	-284.319	-275.617
1000	20.074	92.057	13.298	-284.451	-273.425
1200	20.209	95.730	17.328	-285.645	-271.166
1400	20.284	98.851	21.378	-285.749	-268.746
1600	20.328	101.563	25.439	-285.944	-266.305
1800	20.353	103.959	29.508	-286.247	-263.833
2000	20.367	106.104	33.580	-290.107	-261.224

*Data except enthalpy of formation at 298 K estimated.

$\text{TiF}_4(\text{c,g})$
Titanium tetrafluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	27.310	32.016	0	-394.190	-372.667
400*	30.270	40.483	2.942	-393.441	-365.422
557	32.910	50.958	7.920	-392.026	-354.681
557	23.605	89.078	29.145	-370.801	-354.681
600	23.905	90.853	30.170	-370.788	-353.432
800	24.682	97.850	35.038	-370.742	-347.651
1000	25.075	103.405	40.018	-370.760	-341.875
1200	25.298	107.998	45.057	-371.833	-336.055
1400	25.436	111.909	50.131	-371.811	-330.097
1600	25.527	115.312	55.228	-371.874	-324.133
1800	25.591	118.322	60.340	-372.044	-318.156
2000	25.636	121.021	65.463	-375.768	-312.058

*Data above 300 K estimated.
556.8 K, sublimation point; $\Delta H^\circ = 21.225$

$\text{TiF}_4(\text{g})$
Titanium tetrafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	20.357	75.243	0	-370.820	-362.185
400	22.126	81.492	2.170	-370.843	-359.228
600	23.905	90.853	6.800	-370.788	-353.432
800	24.682	97.850	11.668	-370.742	-347.651
1000	25.075	103.405	16.648	-370.760	-341.875
1200	25.298	107.998	21.687	-371.833	-336.055
1400	25.436	111.909	26.761	-371.811	-330.097
1600	25.527	115.312	31.858	-371.874	-324.133
1800	25.591	118.322	36.970	-372.044	-318.156
2000	25.636	121.021	42.093	-375.768	-312.058

*Data except enthalpy of formation at 298 K estimated.

$\text{TlF}(\text{c,l})$
Thallium monofluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.760	22.870	0	-77.600	-72.623
356	200.000	25.200	.762	-77.428	-71.667
356	12.820	25.420	.842	-77.348	-71.667
400	13.190	26.930	1.410	-77.234	-70.978
595	15.860	32.500	4.140	-77.781	-68.008
595	16.080	38.080	7.460	-74.461	-68.008
600	16.080	38.200	7.535	-74.438	-67.956
800	16.080	42.830	10.750	-73.497	-65.945
1000	16.080	46.420	13.965	-72.578	-64.160
1200	16.080	49.350	17.180	-71.672	-62.566

356.3 K, transition point; $\Delta H^\circ = 0.080$
595.4 K, melting point; $\Delta H^\circ = 3.320$

TlF(g)
Thallium monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.293	58.431	0	-44.420	-50.046
400	8.568	60.911	.860	-44.604	-51.941
600	8.813	64.439	2.602	-46.190	-55.452
800	8.924	66.991	4.377	-46.690	-58.466
1000	8.993	68.990	6.169	-47.194	-61.346
1200	9.045	70.635	7.973	-47.698	-64.136
1400	9.088	72.032	9.786	-48.203	-66.827
1600	9.129	73.248	11.608	-48.706	-69.450
1800	9.168	74.326	13.438	-48.320	-70.795
2000	9.208	75.293	15.275	-48.465	-68.837

$\text{TmF}_3(\text{g})$
Thulium trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	16.937	81.085	0	-290.600	-287.836
400	17.997	86.226	1.784	-290.651	-286.885
600	18.946	93.734	5.494	-290.695	-284.992
800	19.330	99.244	9.327	-290.785	-283.081
1000	19.519	103.580	13.214	-290.989	-281.127
1200	19.624	107.149	17.129	-291.282	-279.133
1400	19.689	110.179	21.061	-291.656	-277.071
1600	19.731	112.811	25.003	-292.114	-274.965
1800	19.760	115.137	28.953	-292.647	-272.793
2000	19.782	117.220	32.907	-297.443	-270.156

$(\text{TlF})_2(\text{g})$
Dimeric thallium fluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.739	85.533	0	-122.800	-124.711
400	19.218	91.116	1.936	-122.953	-125.343
600	19.573	98.989	5.822	-125.723	-126.313
800	19.702	104.640	9.752	-126.343	-126.421
1000	19.763	109.044	13.699	-126.987	-126.356
1200	19.796	112.650	17.655	-127.648	-126.178
1400	19.816	115.703	21.616	-128.322	-125.865
1600	19.829	118.350	25.581	-129.006	-125.460
1800	19.838	120.686	29.548	-207.927	-122.539
2000	19.844	122.777	33.516	-207.925	-113.051

$\text{UF}_3(\text{c})$
Uranium trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	22.730	29.500	0	-360.600	-344.153
300	22.740	29.641	.042	-360.591	-344.051
400	23.470	36.282	2.353	-360.120	-338.609
500	24.200	41.593	4.736	-359.679	-333.283
600	24.930	46.075	7.193	-359.264	-328.043
700	25.660	49.973	9.722	-358.875	-322.871
800	26.390	53.447	12.325	-358.517	-317.753
900	27.120	56.597	15.000	-358.198	-312.676
1000	27.850	59.492	17.749	-358.504	-307.596

*Data except enthalpy of formation at 298 K estimated.

$\text{TmF}_3(\text{c,l})$
Thulium trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	22.700	27.600	0	-395.800	-377.090
400	23.690	34.419	2.366	-395.268	-370.780
600	24.891	44.274	7.235	-394.154	-358.775
800	25.657	51.546	12.294	-393.017	-347.156
1000	26.238	57.335	17.485	-391.918	-335.810
1200	26.800	62.168	22.788	-390.823	-324.697
1326	27.211	64.863	26.190	-390.122	-317.786
1326	23.390	70.323	33.430	-382.882	-317.786
1400	23.390	71.593	35.160	-382.757	-314.151
1431	23.390	72.105	35.885	-382.708	-312.633
1431	33.540	76.927	42.785	-375.808	-312.633
1600	33.540	80.671	48.453	-373.863	-305.291
1800	33.540	84.621	55.161	-371.639	-296.857
2000	33.540	88.155	61.869	-373.681	-288.264

$\text{UF}_4(\text{c,l})$
Uranium tetrafluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	27.730	36.250	0	-459.100	-437.444
400	29.066	44.608	2.900	-458.464	-430.144
600	30.296	56.658	8.852	-457.313	-416.241
800	31.026	65.479	14.988	-456.418	-402.695
1000	31.610	72.466	21.253	-456.439	-389.297
1200	32.137	78.277	27.628	-456.639	-375.788
1309	32.412	81.083	31.147	-456.069	-368.467
1309	39.570	89.662	42.377	-444.839	-368.467
1400	39.570	92.322	45.978	-443.709	-363.198

1309 K, melting point; $\Delta H^\circ = 11.230$

*Entropy and heat capacity at 298 K estimated.

1326 K, transition point; $\Delta H^\circ = 7.240$

1431 K, melting point; $\Delta H^\circ = 6.900$

$UF_4(g)$
Uranium tetrafluoride (ideal gas)

T	C_p°	S°	$H^\circ-H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	21.815	88.376	0	-383.700	-377.585
400	23.304	95.018	2.306	-383.658	-375.502
600	24.598	104.756	7.118	-383.647	-371.434
800	25.114	111.913	12.096	-383.910	-367.334
1000	25.365	117.547	17.146	-385.146	-363.085
1200	25.505	122.185	22.234	-386.633	-358.471
1400	25.591	126.123	27.345	-386.942	-353.752

*Data except enthalpy of formation at 298 K estimated.

$UF_5(g)$
Uranium pentafluoride (ideal gas)

T	C_p°	S°	$H^\circ-H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	26.222	93.055	0	-464.000	-452.058
400	28.222	101.069	2.783	-463.872	-447.996
600	30.022	112.913	8.636	-463.638	-440.117
800	30.756	121.664	14.724	-463.646	-432.286
1000	31.117	128.570	20.915	-464.616	-424.370
1200	31.319	134.262	27.160	-465.835	-416.144
1400	31.443	139.100	33.437	-465.875	-407.860

*Data except enthalpy of formation at 298 K estimated.

$UF_6(g)$
Uranium hexafluoride (ideal gas)

T	C_p°	S°	$H^\circ-H_{298}^\circ$	ΔH_f°	ΔG_f°
298	30.985	90.233	0	-513.250	-493.245
400	33.436	99.717	3.293	-513.004	-486.447
600	35.620	113.760	10.235	-512.497	-473.283
800	36.506	124.145	17.459	-512.224	-460.264
1000	36.941	132.343	24.808	-512.912	-447.232
1200	37.184	139.102	32.223	-513.849	-433.946
1400	37.333	144.846	39.676	-513.611	-420.648
1600	37.431	149.838	47.153	-516.052	-407.054
1800	37.499	154.251	54.646	-516.345	-393.410
2000	37.547	158.204	62.151	-516.656	-379.734

$VF_3(c)$
Vanadium trifluoride

T	C_p°	S°	$H^\circ-H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	21.500	23.200	0	-310.000	-293.190
300	21.550	23.330	.040	-309.992	-293.085
400	23.220	29.790	2.290	-309.508	-287.519
500	23.990	35.070	4.655	-308.986	-282.085
600	24.400	39.480	7.075	-308.460	-276.754
700	24.630	43.260	9.530	-307.941	-271.509
800	24.780	46.560	12.000	-307.441	-266.341
900	24.860	49.490	14.480	-306.961	-261.238
1000	24.920	52.110	16.970	-306.502	-256.182

*Data estimated.

$VF_5(g)$
Vanadium pentafluoride (ideal gas)

T	C_p°	S°	$H^\circ-H_{298}^\circ$	ΔH_f°	ΔG_f°
298	23.560	77.860	0	-343.250	-328.294
400	26.300	85.200	2.551	-343.281	-323.175
600	28.960	96.450	8.117	-343.086	-313.158
800	30.110	104.960	14.039	-342.780	-303.229
1000	30.690	111.740	20.127	-342.473	-293.367
1200	31.010	117.370	26.303	-342.216	-283.571
1400	31.220	122.170	32.523	-342.050	-273.821
1600	31.350	126.340	38.775	-341.986	-264.073
1800	31.440	130.040	45.065	-342.014	-254.324
2000	31.510	133.360	51.347	-342.198	-244.593

$WF(g)$
Tungsten monofluoride (ideal gas)

T	C_p°	S°	$H^\circ-H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	7.755	59.903	0	92.300	83.987
400	8.140	62.240	.811	92.118	81.177
600	8.547	65.629	2.485	91.751	75.781
800	8.743	68.118	4.216	91.369	70.515
1000	8.872	70.083	5.978	90.969	65.354
1200	8.985	71.711	7.764	90.552	60.271
1400	9.094	73.104	9.572	90.114	55.275
1600	9.197	74.325	11.401	89.658	50.326
1800	9.295	75.414	13.251	89.185	45.436
2000	9.389	76.398	15.119	88.693	40.599

*Data estimated.

WF₆(g)
Tungsten hexafluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	28.448	81.504	0	-411.500	-390.145
400	31.652	90.354	3.075	-411.376	-382.862
600	34.660	103.853	9.754	-410.823	-368.720
800	35.925	114.020	16.828	-410.137	-354.788
1000	36.556	122.112	24.083	-409.421	-341.028
1200	36.912	128.811	31.433	-408.717	-327.412
1400	37.131	134.519	38.839	-408.044	-313.901
1600	37.275	139.487	46.280	-407.411	-300.497
1800	37.374	143.883	53.746	-406.818	-287.170
2000	37.446	147.825	61.228	-406.271	-273.909

XeF₂(g)
Xenon difluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	12.933	61.998	0	-25.580	-17.537
300	12.952	62.079	.024	-25.579	-17.488
400	13.678	65.915	1.359	-25.510	-14.800
500	14.075	69.013	2.749	-25.421	-12.132
600	14.312	71.604	4.169	-25.328	-9.485
700	14.460	73.822	5.608	-25.233	-6.851
800	14.560	75.758	7.059	-25.141	-4.231
900	14.630	77.479	8.519	-25.049	-1.624
1000	14.680	79.022	9.985	-24.960	.975

XeF₆(c,l)
Xenon hexafluoride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	40.963	50.282	0	-80.820	-40.398
300	41.166	50.535	.076	-80.795	-40.147
323	25.860	53.596	1.029	-80.466	-37.093
323	77.636	57.852	2.402	-79.093	-37.093
350	109.075	65.533	4.990	-77.269	-33.598

322.63 K, melting point; ΔH° = 1.373

YF₃(c,l)
Yttrium trifluoride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	20.774	21.200	0	-410.700	-392.190
400	23.042	27.685	2.253	-410.275	-385.929
600	24.555	37.374	7.042	-409.267	-373.966
800	25.128	44.526	12.017	-408.257	-362.355
1000	25.461	50.171	17.078	-407.294	-350.993
1200	25.725	54.837	22.197	-406.384	-339.825
1350	25.916	57.878	26.070	-405.732	-331.536
1350	29.230	63.626	33.830	-397.972	-331.536
1400	29.230	64.689	35.292	-397.595	-329.082
1428	29.230	65.268	36.110	-397.387	-327.714
1428	31.950	69.949	42.795	-390.702	-327.714
1600	31.950	73.583	48.291	-388.997	-320.235
1800	31.950	77.346	54.681	-390.989	-311.715

1350 K, transition point; ΔH° = 7.760

1428 K, melting point; ΔH° = 6.685

YbF₃(c,l)
Ytterbium trifluoride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	22.600	26.500	0	-375.200	-357.173
400	23.604	33.292	2.356	-374.678	-351.094
600	24.822	43.115	7.210	-373.718	-339.510
800	25.641	50.372	12.259	-372.682	-328.266
1000	26.440	56.177	17.465	-371.603	-317.288
1200	27.523	61.087	22.854	-372.839	-306.280
1259	27.939	62.418	24.490	-372.512	-303.006
1259	28.580	67.096	30.380	-366.622	-303.006
1400	28.580	70.130	34.410	-365.733	-295.933
1435	25.580	70.836	35.410	-365.514	-294.193
1435	29.080	75.787	42.515	-358.409	-294.193
1600	29.080	78.952	47.313	-387.594	-284.098
1800	29.080	82.377	53.129	-385.501	-271.283

*Entropy and heat capacity at 298 K estimated.

1259 K, transition point; ΔH° = 5.890

1435 K, melting point; ΔH° = 7.105

YbF₃(g)
Ytterbium trifluoride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	16.908	79.677	0	-269.100	-266.927
400	17.976	84.811	1.782	-269.151	-266.176
600	18.935	92.313	5.489	-269.339	-264.650
800	19.324	97.820	9.320	-269.521	-263.063
1000	19.514	102.155	13.205	-269.763	-261.425
1200	19.621	105.723	17.120	-272.473	-259.477
1400	19.687	108.753	21.051	-272.992	-257.264
1600	19.729	111.385	24.993	-303.814	-252.210
1800	19.759	113.710	28.942	-303.588	-245.770
2000	19.780	115.793	32.896	-303.373	-239.359

$\text{ZnF}_2(\text{c}, \text{l})$
Zinc difluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	15.690	17.610	0	-182.700	-170.541
400	17.000	22.419	1.670	-182.442	-166.424
600	18.610	29.639	5.242	-181.810	-158.547
800	19.890	35.171	9.094	-182.868	-150.629
1000	21.120	39.741	13.195	-182.010	-142.663
1090	21.670	41.584	15.120	-181.565	-139.140
1090	21.700	42.272	15.870	-180.815	-139.140
1200	22.410	44.392	18.296	-207.709	-134.496
1220	22.530	44.763	18.745	-207.538	-133.277
1220	24.000	52.583	28.285	-197.998	-133.277
1400	24.000	55.886	32.605	-196.189	-123.857

*Heat capacities above 298 K estimated.

1090 K, transition point; $\Delta H^\circ = 0.750$

1220 K, melting point; $\Delta H^\circ = 9.540$

$\text{ZrF}(\text{g})$
Zirconium monofluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	7.989	58.227	0	19.800	12.440
400	8.364	60.632	.834	19.591	9.957
600	8.809	64.114	2.555	19.136	5.236
800	9.176	66.698	4.353	18.632	.676
1000	9.528	68.784	6.224	18.098	-3.750
1200	9.842	70.550	8.162	16.681	-8.016
1400	10.102	72.087	10.157	16.389	-12.109
1600	10.309	73.450	12.199	16.073	-16.159
1800	10.467	74.674	14.278	15.723	-20.169
2000	10.587	75.783	16.383	15.331	-24.136

*Data estimated.

$\text{ZrF}_2(\text{c}, \text{l})$
Zirconium difluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	15.760	18.000	0	-230.000	-218.145
400	16.700	22.766	1.654	-229.780	-214.128
600	18.200	29.834	5.151	-229.276	-206.407
800	19.270	35.228	8.906	-228.679	-198.873
1000	20.080	39.619	12.844	-228.021	-191.497
1175	20.580	42.898	16.405	-228.312	-185.120
1175	24.000	50.588	25.405	-219.312	-185.120
1200	24.000	51.063	26.005	-219.104	-184.395
1400	24.000	54.763	30.805	-217.488	-178.740
1600	24.000	57.968	35.605	-215.951	-173.311
1800	24.000	60.795	40.405	-214.489	-168.071
2000	24.000	63.323	45.205	-213.101	-162.987

*Data estimated.

1175 K, melting point; $\Delta H^\circ = 9.000$

$\text{ZrF}_2(\text{g})$
Zirconium difluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	11.628	67.715	0	-133.400	-136.367
400	12.437	71.257	1.229	-133.605	-137.350
600	13.176	76.464	3.803	-134.024	-139.133
800	13.481	80.302	6.472	-134.513	-140.767
1000	13.646	83.329	9.186	-135.079	-142.265
1200	13.776	85.828	11.928	-136.581	-143.590
1400	13.918	87.962	14.697	-136.996	-144.727
1600	14.086	89.831	17.497	-137.459	-145.800
1800	14.277	91.501	20.333	-137.961	-146.813
2000	14.479	93.016	23.209	-138.497	-147.769

*Data except enthalpy of formation at 209 K estimated.

$\text{ZrF}_3(\text{c})$
Zirconium trifluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	20.000	21.000	0	-335.000	-316.817
400	21.950	27.182	2.147	-334.678	-310.653
600	24.000	36.515	6.765	-333.870	-298.809
800	25.100	43.580	11.682	-332.966	-287.258
1000	25.750	49.225	16.771	-332.033	-275.907
1200	26.020	53.979	21.953	-331.983	-264.753
1400	26.170	58.001	27.173	-330.845	-253.638

*Data estimated.

$\text{ZrF}_3(\text{g})$
Zirconium trifluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	16.212	73.047	0	-264.200	-261.535
400	17.616	78.023	1.728	-264.298	-260.609
600	19.165	85.495	5.424	-264.411	-258.738
800	19.965	91.130	9.346	-264.503	-256.834
1000	20.390	95.636	13.386	-264.618	-254.904
1200	20.620	99.376	17.489	-265.648	-252.893
1400	20.743	102.565	21.627	-265.591	-250.773
1600	20.803	105.339	25.782	-265.604	-248.656
1800	20.824	107.791	29.945	-265.689	-246.535
2000	20.822	109.985	34.110	-265.851	-244.399

*Data except enthalpy of formation at 298 K estimated.

$\text{ZrF}_4(\text{c}, \text{g})$
Zirconium tetrafluoride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.790	25.000	0	-456.800	-432.588
400	27.237	32.670	2.664	-456.353	-424.383
600	29.529	44.203	8.368	-455.276	-408.625
800	30.931	52.900	14.421	-454.091	-393.253
1000	32.075	59.928	20.724	-452.819	-378.189
1179	33.012	65.285	26.550	-452.497	-364.895
1179	25.374	109.081	78.185	-400.862	-364.895
1200	25.391	109.529	78.718	-400.846	-364.254
1400	25.506	113.453	83.808	-400.735	-358.168
1600	25.582	116.864	88.918	-400.697	-352.089
1800	25.634	119.880	94.039	-400.734	-346.012
2000	25.671	122.583	99.170	-400.845	-339.927

1179 K, sublimation point; $\Delta H^\circ = 51.635$

$\text{ZrF}_4(\text{g})$
Zirconium tetrafluoride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	20.887	76.339	0	-400.000	-391.095
400	22.603	82.740	2.223	-399.994	-388.052
600	24.205	92.259	6.929	-399.915	-382.098
800	24.873	99.326	11.845	-399.867	-376.170
1000	25.205	104.916	16.856	-399.887	-370.245
1200	25.391	109.529	21.918	-400.846	-364.254
1400	25.506	113.453	27.008	-400.735	-358.168
1600	25.582	116.864	32.118	-400.697	-352.089
1800	25.634	119.880	37.239	-400.734	-346.012
2000	25.671	122.583	42.370	-400.845	-339.927

Hydrides

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

Sources of data from general references are listed below, with the reference(s) given immediately after each formula:

AlH(g) (7, 30), AlH₂(g) (15), AlH₃(hex) (15), AlH₃(g) (15), BH(g) (7), BH₂(g) (7), BH₃(g) (7), B₂H₆(g) (7), B₅H₉(l,g) (7), B₁₀H₁₄(c,l,g) (7), BaH(g) (15), BaH₂(c,l) (15), BeH(g) (15), BeH₂(amorph) (15), BeH₂(g) (7), CH(g) (7), CH₂(g) (6), CH₃(g) (7), CH₄(g) (7, 30), C₂H₂(g) (7), C₂H₄(g) (7), CaH(g) (15), CaH₂(c,l) (15), CuH(g) (19), GaH(g) (15), InH(g) (15), KH(c) (7, 33), KH(g) (7, 33), LiH(c,l) (33), LiH(g) (7, 33), MgH(g) (7), MgH₂(c,l) (15), NH(g) (3), NH₂(g) (3), NH₃(g) (3, 30), N₂H₂(g) (7), N₂H₄(l,g) (7), NaH(c) (7, 33), NaH(g) (7, 33), NiH(g) (22), PH(g) (7), PH₂(g) (7), PH₃(g) (7), PbH(g) (7), SiH(g) (3), SiH₂(g) (14), SiH₃(g) (14), SiH₄(g) (5), SrH(g) (15), SrH₂(c,l) (15), TiH₂(c) (7), TiH(g) (15), ZrH(g) (7).

Additional sources:

C₂H₆(g) and C₆H₆(g):

Stull, D. R., E. F. Westrum, Jr., and G. C. Sinke. The Chemical Thermodynamics of Organic Compounds. Wiley, 1969, 865 pp.

LiH(c,l):

Shpil'rain, E. E., D. N. Kagan, and G. A. Krechetova. Thermodynamic Properties of Lithium Hydride. High Temp. (Engl. Transl.), v. 9, 1971, pp. 1200-1202.

AlH(g)
Aluminum monohydride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.020	44.875	0	61.960	55.253
400	7.180	46.958	.722	61.719	52.998
600	7.650	49.956	2.204	61.227	48.744
800	8.068	52.217	3.778	60.696	44.661
1000	8.370	54.051	5.424	57.518	40.906
1200	8.585	55.598	7.120	56.965	37.634
1400	8.742	56.933	8.854	56.430	34.457
1600	8.863	58.109	10.615	55.900	31.352
1800	8.959	59.158	12.397	55.373	28.316
2000	9.039	60.107	14.197	54.844	25.337

AlH₃(g)
Aluminum trihydride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	9.574	49.346	0	49.747	51.011
400	10.895	52.345	1.043	49.121	51.543
600	13.253	57.224	3.465	48.169	52.974
800	15.053	61.297	6.306	47.497	54.684
1000	16.314	64.800	9.450	44.388	56.727
1200	17.180	67.856	12.805	44.032	59.231
1400	17.783	70.552	16.305	43.761	61.787
1600	18.212	72.956	19.906	43.528	64.375
1800	18.526	75.120	23.582	43.310	66.997
2000	18.761	77.085	27.311	43.089	69.640

AlH₂(g)
Aluminum dihydride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.789	50.957	0	59.048	55.180
400	9.088	53.543	.898	58.630	53.924
600	10.197	57.439	2.827	57.885	51.737
800	11.149	60.508	4.965	57.214	49.789
1000	11.849	63.076	7.269	53.979	48.192
1200	12.343	65.283	9.691	53.421	47.089
1400	12.696	67.213	12.197	52.907	46.075
1600	12.957	68.926	14.764	52.412	45.132
1800	13.163	70.465	17.376	51.922	44.250
2000	13.334	71.861	20.026	51.433	43.425

BH(g)
Boron monohydride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	6.975	41.047	0	105.800	98.634
400	7.014	43.101	.712	105.837	96.178
600	7.252	45.984	2.135	105.678	91.372
800	7.599	48.117	3.620	105.395	86.648
1000	7.926	49.848	5.173	105.076	81.999
1200	8.193	51.318	6.786	104.736	77.410
1400	8.404	52.597	8.447	104.364	72.889
1600	8.571	53.731	10.145	103.949	68.411
1800	8.704	54.748	11.873	103.487	64.010
2000	8.814	55.671	13.625	102.974	59.639
2200	8.905	56.516	15.397	102.409	55.332
2400	8.984	57.294	17.186	89.811	51.340

AlH₃(hexagonal)
Aluminum trihydride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	9.610	7.180	0	-2.725	11.111
300	9.669	7.239	.018	-2.737	11.197
400	11.950	10.368	1.111	-3.284	15.930
500	13.324	13.192	2.379	-3.688	20.781

BH₂(g)
Boron dihydride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.133	43.045	0	48.000	44.891
400	8.947	45.553	.871	47.842	43.852
600	10.160	49.422	2.788	47.478	41.934
800	11.136	52.483	4.920	47.138	40.141
1000	11.930	55.057	7.230	46.862	38.425
1200	12.545	57.289	9.680	46.627	36.756
1400	13.012	59.259	12.238	46.401	35.132
1600	13.365	61.021	14.877	46.155	33.529
1800	13.634	62.611	17.578	45.874	31.982
2000	13.842	64.059	20.327	45.548	30.444
2200	14.005	65.386	23.112	45.168	28.952
2400	14.134	66.610	25.927	32.754	27.760

$\text{BH}_3(\text{g})$
Boron trihydride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	8.657	44.880	0	25.500	26.496
400	9.304	47.512	.914	25.031	26.907
600	10.863	51.569	2.926	24.063	28.055
800	12.509	54.922	5.264	23.225	29.520
1000	13.957	57.874	7.916	22.577	31.173
1200	15.122	60.526	10.828	22.073	32.937
1400	16.026	62.928	13.947	21.656	34.784
1600	16.721	65.115	17.225	21.278	36.678
1800	17.258	67.117	20.625	20.903	38.638
2000	17.677	68.958	24.120	20.513	40.618
2200	18.008	70.659	27.690	20.091	42.648
2400	18.272	72.237	31.319	7.648	44.984

*Data except enthalpy of formation at 298 K estimated.

$\text{B}_2\text{H}_6(\text{g})$
Diboron hexahydride, diborane (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.886	55.709	0	9.800	21.944
400	17.747	60.335	1.613	8.648	26.274
600	24.219	68.811	5.838	6.912	35.493
800	29.077	76.480	11.192	5.914	45.195
1000	32.600	83.368	17.379	5.500	55.072
1200	35.123	89.547	24.165	5.454	64.988
1400	36.941	95.106	31.382	5.601	74.907
1600	38.271	100.130	38.909	5.814	84.774
1800	39.262	104.697	46.667	6.024	94.660
2000	40.016	108.875	54.599	6.185	104.477

$\text{B}_5\text{H}_9(\text{l}, \text{g})$
Pentaboron enneahydride, pentaborane

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	36.120	44.056	0	10.240	40.025
335	39.200	48.331	1.355	10.198	43.715
335	25.574	68.600	8.145	16.978	43.715
400	31.120	73.631	9.995	16.249	48.971
600	44.841	89.000	17.669	15.422	65.593
800	54.342	103.289	27.648	16.405	82.219
1000	60.805	116.155	39.204	18.638	98.433
1200	65.245	127.658	51.836	21.633	114.112
1400	68.361	137.964	65.214	25.047	129.265
1600	70.600	147.246	79.122	28.655	143.885
1800	72.250	155.661	93.415	32.325	158.105
2000	73.494	163.341	107.995	35.976	171.856

335 K, boiling point; $\Delta H^\circ = 6.790$

$\text{B}_{10}\text{H}_{14}(\text{c}, \text{l}, \text{g})$
Decaborane

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	52.092	42.200	0	-6.900	49.853
372	67.200	55.896	4.550	-8.163	64.001
372	70.500	70.012	9.800	-2.913	64.001
400	77.200	75.385	11.882	-3.187	69.071
492	82.500	91.909	19.240	-4.048	85.807
492	72.158	112.844	29.540	6.252	85.807
600	84.050	128.362	38.011	4.329	103.456
800	99.711	154.848	56.499	2.321	136.882
1000	110.031	178.284	77.542	1.791	170.607
1200	117.019	199.002	100.291	2.076	204.311
1400	121.885	217.428	124.209	2.660	238.003
1600	125.369	233.943	148.953	3.186	271.501
1800	127.929	248.865	174.296	3.461	305.152
2000	129.854	262.447	200.083	3.361	338.565

371.93 K, melting point; $\Delta H^\circ = 5.250$

492 K, boiling point; $\Delta H^\circ = 10.3$

$\text{BaH}(\text{g})$
Barium monohydride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.226	52.318	0	48.646	42.147
400	7.567	54.488	.753	48.307	39.975
600	8.140	57.672	2.327	47.159	36.031
800	8.500	60.067	3.994	46.201	32.458
1000	8.735	61.991	5.719	45.261	29.132
1200	8.925	63.600	7.485	42.432	26.366
1400	9.123	64.991	9.290	41.546	23.759
1600	9.364	66.224	11.138	40.681	21.278
1800	9.663	67.344	13.039	39.851	18.901
2000	10.018	68.380	15.007	39.068	16.617

$\text{BaH}_2(\text{c}, \text{l})$
Barium dihydride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.994	15.057	0	-45.430	-36.167
400	11.674	18.383	1.154	-45.721	-32.963
600	13.009	23.369	3.623	-46.674	-26.396
800	14.344	27.294	6.358	-47.268	-19.550
871	14.818	28.533	7.392	-47.435	-17.084
871	16.970	30.071	8.732	-46.095	-17.084
1000	16.970	32.414	10.921	-46.085	-12.787
1200	16.970	35.508	14.315	-48.016	-5.752
1400	16.970	38.124	17.709	-48.065	1.295
1473	16.970	38.987	18.948	-48.093	3.870
1473	17.925	43.043	24.923	-42.118	3.870
1600	17.925	44.526	27.199	-42.059	7.831
1800	17.925	46.637	30.784	-41.998	14.063
2000	17.925	48.526	34.369	-41.974	20.290

871 K, transition point; $\Delta H^\circ = 1.340$

1473 K, melting point; $\Delta H^\circ = 5.975$

BeH(g)
Beryllium monohydride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	6.985	42.234	0	82.995	75.732
400	7.060	44.295	.714	82.912	73.260
600	7.395	47.215	2.157	82.610	68.496
800	7.791	49.397	3.676	82.252	63.841
1000	8.124	51.173	5.269	81.876	59.283
1200	8.383	52.678	6.921	81.451	54.798
1400	8.585	53.986	8.618	80.964	50.400
1600	8.748	55.143	10.352	76.905	46.164
1800	8.884	56.182	12.115	76.467	42.330
2000	8.999	57.124	13.904	76.038	38.577

$\text{BeH}_2(\text{amorphous})$
Beryllium dihydride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.134	5.760	0	-4.540	3.724
300	7.160	5.804	.013	-4.547	3.774
400	8.588	8.060	.801	-4.889	6.602
500	10.016	10.130	1.731	-5.159	9.504

$\text{BeH}_2(\text{g})$
Beryllium dihydride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.259	41.350	0	30.000	27.653
400	7.943	43.571	.771	29.621	26.907
600	9.667	47.117	2.552	28.937	25.706
800	11.098	50.105	4.616	28.440	24.706
1000	12.102	52.696	6.943	28.083	23.817
1200	12.788	54.967	9.436	27.769	22.988
1400	13.264	56.977	12.044	27.441	22.223
1600	13.603	58.771	14.733	23.565	21.595
1800	13.849	60.388	17.479	23.319	21.348
2000	14.034	61.858	20.268	23.079	21.157

CH(g)
Methylidyne (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	6.972	43.721	0	142.000	134.026
400	6.984	45.771	.711	142.109	131.284
600	7.112	48.621	2.117	142.122	125.858
800	7.401	50.704	3.566	141.984	120.455
1000	7.783	52.395	5.084	141.794	115.094
1200	8.186	53.850	6.681	141.598	109.773
1400	8.564	55.141	8.357	141.413	104.483
1600	8.893	56.306	10.103	141.245	99.220
1800	9.165	57.370	11.910	141.092	93.976
2000	9.382	58.347	13.766	140.947	88.750

$\text{CH}_2(\text{g})$
Methylene (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.269	46.324	0	92.350	88.252
400	8.638	48.805	.861	92.256	86.866
600	9.370	52.445	2.661	91.963	84.230
800	10.144	55.246	4.612	91.623	81.703
1000	10.892	57.592	6.717	91.305	79.258
1200	11.531	59.636	8.962	91.026	76.878
1400	12.042	61.453	11.321	90.774	74.540
1600	12.438	63.088	13.771	90.538	72.237
1800	12.745	64.572	16.290	90.304	69.962
2000	12.987	65.928	18.864	90.067	67.715
2200	13.179	67.175	21.482	89.822	65.490
2400	13.336	68.328	24.134	89.564	63.294

$\text{CH}_3(\text{g})$
Methyl (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	9.248	46.381	0	34.820	35.357
400	10.048	49.210	.983	34.495	35.592
600	11.541	53.572	3.144	33.863	36.278
800	12.888	57.080	5.589	33.313	37.169
1000	14.090	60.088	8.290	32.877	38.184
1200	15.109	62.750	11.213	32.545	39.280
1400	15.939	65.144	14.321	32.291	40.422
1600	16.602	67.317	17.578	32.090	41.598
1800	17.129	69.304	20.953	31.919	42.798
2000	17.548	71.131	24.422	31.767	44.016
2200	17.885	72.820	27.966	31.620	45.244
2400	18.157	74.389	31.571	31.473	46.491

$\text{CH}_4(\text{g})$
Methane (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.518	44.490	0	-17.880	-12.127
400	9.680	47.144	.923	-18.619	-10.046
600	12.483	51.597	3.138	-19.896	-5.471
800	15.041	55.548	5.897	-20.836	-.512
1000	17.160	59.141	9.125	-21.460	4.644
1200	18.842	62.424	12.732	-21.839	9.907
1400	20.150	65.431	16.637	-22.047	15.215
1600	21.161	68.191	20.772	-22.142	20.544
1800	21.947	70.730	25.086	-22.165	25.884
2000	22.562	73.076	29.540	-22.143	31.223

$C_2H_2(g)$
Acetylene (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.539	48.004	0	54.190	50.000
400	12.065	51.326	1.155	54.142	48.577
600	13.931	56.604	3.771	53.971	45.827
800	15.239	60.798	6.693	53.719	43.149
1000	16.318	64.317	9.852	53.461	40.534
1200	17.221	67.375	13.208	53.231	37.972
1400	17.968	70.087	16.729	53.032	35.444
1600	18.582	72.528	20.387	52.862	32.945
1800	19.085	74.747	24.155	52.708	30.464
2000	19.504	76.780	28.015	52.567	28.001

$C_2H_4(g)$
Ethylene (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.250	52.396	0	12.540	16.345
400	12.679	55.745	1.167	11.797	17.763
600	16.889	61.721	4.143	10.587	21.022
800	20.039	67.033	7.851	9.713	24.640
1000	22.443	71.774	12.109	9.125	28.441
1200	24.290	76.036	16.791	8.759	32.346
1400	25.706	79.892	21.797	8.543	36.294
1600	26.794	83.399	27.051	8.425	40.267
1800	27.636	86.605	32.498	8.366	44.253
2000	28.296	89.552	38.094	8.340	48.244

$C_2H_6(g)$
Ethane (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.580	54.850	0	-20.240	-7.862
300	12.640	54.930	.030	-20.257	-7.780
400	15.680	58.990	1.440	-21.417	-3.450
500	18.660	62.810	3.160	-22.428	1.163
600	21.350	66.460	5.170	-23.272	5.968
700	23.720	69.930	7.420	-23.976	10.894
800	25.830	73.240	9.900	-24.532	15.915
900	27.690	76.390	12.580	-24.959	20.999
1000	29.330	79.390	15.430	-25.277	26.123

$C_6H_6(g)$
Benzene (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.520	64.340	0	19.820	31.005
300	19.650	64.470	.040	19.797	31.074
400	26.740	71.110	2.370	18.581	35.033
500	32.800	77.750	5.360	17.572	39.267
600	37.740	84.180	8.890	16.740	43.686
700	41.750	90.310	12.870	16.070	48.227
800	45.060	96.110	17.220	15.548	52.864
900	47.830	101.580	21.860	15.133	57.539
1000	50.160	106.740	26.770	14.847	62.277

$CaH(g)$
Calcium monohydride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.145	48.215	0	54.830	48.070
400	7.440	50.355	.742	54.592	45.799
600	8.009	53.484	2.290	54.113	41.505
800	8.398	55.846	3.933	53.354	37.408
1000	8.656	57.749	5.640	52.589	33.500
1200	8.842	59.344	7.391	49.796	29.927
1400	8.992	60.719	9.175	49.429	26.645
1600	9.124	61.928	10.986	49.068	23.407
1800	9.245	63.010	12.824	48.713	21.158
2000	9.355	63.990	14.684	48.364	18.900

$CaH_2(c,l)$
Calcium dihydride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	9.799	9.895	0	-42.300	-32.982
400	10.703	12.901	1.044	-42.590	-29.752
600	12.478	17.576	3.362	-42.998	-23.236
800	14.253	21.409	6.035	-43.431	-16.585
1000	16.028	24.780	9.063	-43.590	-9.860
1053	16.498	25.620	9.925	-43.644	-8.069
1053	16.500	27.139	11.525	-42.044	-8.069
1200	16.500	29.295	13.950	-43.978	-3.168
1273	16.500	30.270	15.155	-43.828	-.691
1273	17.925	34.400	20.413	-38.570	-.691
1400	17.925	36.104	22.689	-38.141	3.069
1600	17.925	38.498	26.274	-37.500	8.903
1800	17.925	40.610	29.860	-37.438	15.604
2000	17.925	42.498	33.445	-37.473	25.447

1053 K, transition point; $\Delta H^\circ = 1.600$

1273 K, melting point; $\Delta H^\circ = 5.258$

CuH(g)
Copper monohydride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	6.990	46.931	0	65.700	58.722
400	7.087	48.996	.716	65.457	56.376
600	7.466	51.936	2.169	64.973	51.940
800	7.872	54.141	3.704	64.514	47.666
1000	8.196	55.934	5.312	64.068	43.506
1200	8.437	57.451	6.976	63.594	39.437
1400	8.617	58.766	8.683	59.903	35.548
1600	8.757	59.926	10.421	59.309	32.110
1800	8.867	60.964	12.183	58.719	28.743
2000	8.958	61.903	13.966	58.132	25.445

GaH(g)
Gallium monohydride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.036	47.721	0	51.219	44.553
400	7.221	49.812	.725	49.583	42.750
600	7.721	52.834	2.219	49.095	39.445
800	8.143	55.116	3.808	48.709	36.289
1000	8.445	56.968	5.468	48.385	33.222
1200	8.662	58.527	7.180	48.096	30.217
1400	8.826	59.876	8.929	47.824	27.258
1600	8.960	61.063	10.708	47.561	24.338
1800	9.076	62.125	12.512	47.303	21.452
2000	8.944	63.087	14.338	47.048	18.593

InH(g)
Indium monohydride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.071	49.607	0	51.315	45.297
400	7.300	51.714	.731	51.016	43.285
600	7.837	54.777	2.246	49.646	39.862
800	8.251	57.092	3.857	49.155	36.677
1000	8.534	58.966	5.537	48.729	33.606
1200	8.735	60.540	7.265	48.336	30.620
1400	8.888	61.899	9.028	47.958	27.698
1600	9.013	63.094	10.819	47.587	24.829
1800	9.123	64.162	12.632	47.218	22.005
2000	9.228	65.129	14.468	46.854	19.223

KH(c)
Potassium hydride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	9.060	12.000	0	-13.800	-8.117
300	9.100	12.056	.017	-13.802	-8.081
400	10.550	14.906	1.011	-14.470	-6.050
500	11.600	17.378	2.120	-14.453	-3.945
600	12.410	19.568	3.323	-14.326	-1.853
700	13.051	21.530	4.597	-14.119	.211
800	13.580	23.309	5.929	-13.852	2.239

*Data except enthalpy of formation at 298 K estimated.

KH(g)
Potassium hydride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.418	47.304	0	31.400	26.557
400	7.818	49.541	.776	30.495	25.061
600	8.370	52.826	2.401	29.952	22.470
800	8.678	55.280	4.108	29.527	20.041
1000	8.867	57.238	5.864	29.135	17.715
1200	8.996	58.867	7.651	10.057	18.295
1400	9.095	60.261	9.460	10.122	19.663
1600	9.175	61.481	11.288	10.183	21.022
1800	9.245	62.566	13.130	10.237	22.372
2000	9.308	63.543	14.985	10.282	23.719

LiH(c,l)
Lithium hydride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	6.700	4.790	0	-21.640	-16.343
400	8.500	7.160	.829	-21.796	-14.501
600	11.000	11.130	2.804	-22.652	-10.576
800	13.100	14.560	5.203	-22.349	-6.580
962	15.200	17.160	7.495	-21.754	-3.436
962	16.800	22.640	12.765	-16.484	-3.436
1000	16.500	23.290	13.403	-16.244	-2.925
1200	14.800	26.160	16.546	-15.208	-.365
1400	13.100	28.320	19.345	-14.531	2.052

962 K, melting point; ΔH° = 5.270

LiH(g)
Lithium hydride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.106	40.821	0	33.280	27.835
400	7.364	42.943	.736	33.030	26.012
600	7.921	46.037	2.266	31.730	22.862
800	8.329	48.376	3.894	31.262	19.978
1000	8.601	50.265	5.589	30.861	17.206
1200	8.790	51.851	7.329	30.494	14.509
1400	8.929	53.217	9.101	30.145	11.872
1600	9.038	54.417	10.898	29.805	9.284
1800	9.128	55.487	12.715	-5.395	10.203
2000	9.206	56.452	14.549	-5.367	11.938

NH(g)
Imidogen (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	6.966	43.294	0	90.000	88.567
400	6.973	45.342	.710	90.001	88.078
600	7.041	48.179	2.109	89.993	87.116
800	7.223	50.227	3.534	89.979	86.159
1000	7.471	51.865	5.003	89.966	85.205
1200	7.726	53.250	6.523	89.962	84.254
1400	7.958	54.458	8.092	89.964	83.304
1600	8.158	55.534	9.704	89.971	82.352
1800	8.330	56.505	11.353	89.982	81.399
2000	8.478	57.391	13.034	89.998	80.444

MgH(g)
Magnesium hydride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.070	46.150	0	40.400	33.621
400	7.298	48.257	.731	40.157	31.343
600	7.834	51.319	2.245	39.666	27.043
800	8.248	53.633	3.856	39.157	22.909
1000	8.531	55.506	5.535	36.454	19.080
1200	8.728	57.080	7.262	35.820	15.667
1400	8.873	58.436	9.023	4.996	13.177
1600	8.986	59.629	10.810	5.017	14.343
1800	9.078	60.693	12.616	5.038	15.507
2000	9.157	61.654	14.440	5.057	16.670

NH₂(g)
Nitrogen dihydride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.024	46.510	0	-10.985	-10.090
400	8.221	48.894	.827	-11.118	-9.762
600	8.805	52.332	2.527	-11.314	-9.038
800	9.492	54.958	4.356	-11.390	-8.264
1000	10.181	57.151	6.324	-11.347	-7.486
1200	10.802	59.064	8.423	-11.207	-6.726
1400	11.333	60.770	10.638	-10.991	-5.995
1600	11.781	62.313	12.951	-10.719	-5.299
1800	12.167	63.724	15.347	-10.404	-4.640
2000	12.511	65.024	17.815	-10.053	-4.018
2200	12.826	66.231	20.349	-9.672	-3.433
2400	13.120	67.360	22.944	-9.258	-2.883

MgH₂(c,l)
Magnesium dihydride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.449	7.433	0	-18.100	-8.683
300	8.465	7.485	.016	-18.108	-8.624
400	9.308	10.036	.904	-18.524	-5.400
500	10.151	12.204	1.877	-18.889	-2.078
600	10.994	14.129	2.935	-19.197	1.319
600	17.925	19.706	6.281	-15.851	1.319
700	17.925	22.469	8.073	-15.455	4.149
800	17.925	24.863	9.866	-15.090	6.921
900	17.925	26.974	11.658	-14.760	9.657

600 K, melting point; ΔH° = 3.346

NH₃(g)
Nitrogen trihydride, ammonia (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.521	46.048	0	-11.020	-3.969
400	9.253	48.650	.904	-11.531	-1.480
600	10.825	52.702	2.913	-12.329	3.729
800	12.245	56.015	5.223	-12.866	9.170
1000	13.502	58.885	7.800	-13.200	14.720
1200	14.591	61.446	10.612	-13.375	20.323
1400	15.510	63.766	13.625	-13.431	25.945
1600	16.271	65.889	16.806	-13.398	31.567
1800	16.896	67.842	20.125	-13.301	37.185
2000	17.408	69.650	23.557	-13.156	42.786

cis-N₂H₄(g)
cis-Diimide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.737	52.223	0	50.900	58.280
400	9.784	54.932	.941	50.424	60.877
600	11.882	59.307	3.114	49.782	66.258
800	13.548	62.964	5.664	49.454	71.807
1000	14.830	66.131	8.507	49.334	77.411
1200	15.818	68.926	11.576	49.353	83.027
1400	16.576	71.424	14.819	49.462	88.633
1600	17.161	73.677	18.195	49.629	94.216
1800	17.615	75.726	21.675	49.834	99.779
2000	17.970	77.601	25.235	50.062	105.316

N₂H₄(l,g)
Hydrazine

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	23.623	29.050	0	12.100	35.694
387	25.400	35.415	2.170	12.420	42.676
387	14.143	60.486	11.870	22.120	46.676
400	14.747	60.971	12.062	22.038	43.374
600	18.538	67.726	15.420	21.182	54.256
800	21.081	73.427	19.395	20.871	65.339
1000	23.030	78.348	23.814	20.898	76.458
1200	24.592	82.690	28.582	21.154	87.551
1400	25.842	86.579	33.630	21.566	98.586
1600	26.836	90.097	38.901	22.084	109.551
1800	27.626	93.305	44.350	22.674	120.452
2000	28.258	96.250	49.941	23.312	131.282
2200	28.766	98.968	55.645	23.979	142.044
2400	29.177	101.489	61.441	24.666	152.754

386.9 K, boiling point; ΔH° = 9.700

NaH(c)
Sodium hydride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.698	9.564	0	-13.450	-7.983
300	8.732	9.618	.016	-13.453	-7.948
400*	10.150	12.343	.967	-14.193	-6.046
500	11.270	14.734	2.040	-14.210	-4.005
600	12.120	16.868	3.212	-14.109	-1.972
700	12.840	18.792	4.461	-13.917	.036
800	13.400	20.545	5.775	-13.651	2.013

*Data above 350 K estimated.

NaH(g)
Sodium hydride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	7.241	45.000	0	31.130	26.032
400	7.589	47.176	.755	30.175	24.389
600	8.172	50.372	2.335	29.594	21.629
800	8.537	52.777	4.009	29.163	19.042
1000	8.767	54.708	5.741	28.800	16.555
1200	8.926	56.321	7.511	5.202	14.594
1400	9.044	57.707	9.309	5.257	16.157
1600	9.139	58.921	11.127	5.308	17.709
1800	9.220	60.002	12.963	5.358	19.255
2000	9.292	60.977	14.815	5.406	20.799

NiH(g)
Nickel monohydride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	6.990	50.320	0	94.000	85.778
400	7.070	52.380	.720	93.702	83.020
600	7.430	55.310	2.160	92.951	77.820
800	7.830	57.500	3.690	92.242	72.901
1000	8.150	59.290	5.290	91.618	68.127
1200	8.400	60.800	6.950	90.972	63.500
1400	8.580	62.110	8.640	90.261	58.964
1600	8.730	63.260	10.380	89.493	54.565
1800	8.840	64.300	12.130	84.521	50.405
2000	8.930	65.230	13.910	83.631	46.678

PH(g)
Phosphorus monohydride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	6.970	46.900	0	56.400	49.997
400	7.008	48.953	.711	55.970	47.891
600	7.242	51.832	2.133	52.608	44.215
800	7.586	53.962	3.616	52.437	41.445
1000	7.914	55.691	5.166	52.306	38.713
1200	8.188	57.159	6.777	52.210	36.003
1400	8.417	58.439	8.439	52.140	33.308
1600	8.615	59.576	10.142	52.087	30.621
1800	8.792	60.601	11.883	52.050	27.941
2000	8.954	61.536	13.658	52.027	25.264

*Data estimated.

$\text{PH}_2(\text{g})$
Phosphorus dihydride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	8.312	50.800	0	25.900	22.986
400	8.732	53.300	.867	25.273	22.104
600	9.656	57.013	2.705	21.627	20.950
800	10.557	59.917	4.728	21.292	20.779
1000	11.300	62.356	6.917	21.085	20.677
1200	11.866	64.468	9.236	20.966	20.608
1400	12.286	66.331	11.654	20.901	20.554
1600	12.599	67.993	14.144	20.863	20.506
1800	12.834	69.491	16.688	20.837	20.464
2000	13.014	70.853	19.274	20.815	20.425

*Data estimated.

$\text{PH}_3(\text{g})$
Phosphorus trihydride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.868	50.238	0	1.300	3.206
400	9.907	52.997	.959	.411	4.013
600	12.167	57.468	3.179	-3.552	6.323
800	13.985	61.227	5.801	-3.992	9.690
1000	15.368	64.504	8.744	-4.159	13.135
1200	16.380	67.401	11.924	-4.148	16.594
1400	17.115	69.984	15.277	-4.030	20.042
1600	17.655	72.306	18.757	-3.850	23.469
1800	18.058	74.410	22.330	-3.639	26.872
2000	18.365	76.329	25.974	-3.413	30.252

$\text{PbH}(\text{g})$
Lead monohydride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.045	52.737	0	56.500	50.047
400	7.244	54.833	.727	56.219	47.887
600	7.755	57.867	2.227	55.661	43.837
800	8.170	60.158	3.822	53.955	40.367
1000	8.461	62.014	5.487	53.487	37.024
1200	8.672	63.576	7.201	53.082	33.774
1400	8.843	64.926	8.953	52.712	30.576
1600	8.997	66.117	10.737	52.355	27.416
1800	9.146	67.185	12.551	52.010	24.346
2000	9.294	68.157	14.395	51.675	21.288

$\text{SiH}(\text{g})$
Silicon monohydride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.191	47.306	0	90.000	81.890
400	7.180	49.414	.731	89.862	79.137
600	7.451	52.368	2.190	89.503	73.851
800	7.817	54.562	3.717	89.130	68.691
1000	8.129	56.342	5.313	88.764	63.632
1200	8.369	57.846	6.964	88.402	58.631
1400	8.550	59.150	8.656	88.036	53.701
1600	8.690	60.301	10.381	87.658	48.809
1800	8.801	61.331	12.130	87.259	44.812
2000	8.891	62.264	13.900	86.998	41.437

$\text{SiH}_2(\text{g})$
Silicon dihydride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.485	49.579	0	59.640	54.504
400	9.413	52.193	.908	58.325	53.139
600	11.576	56.428	3.012	57.912	50.648
800	12.956	59.971	5.462	57.778	48.255
1000	13.554	62.937	8.142	57.761	45.884
1200	13.771	65.430	10.878	57.754	43.502
1400	13.842	67.560	13.641	57.708	41.132
1600	13.862	69.410	16.412	57.604	38.756
1800	13.866	71.043	19.185	45.436	37.246
2000	13.866	72.504	21.958	45.368	36.334

$\text{SiH}_3(\text{g})$
Silicon trihydride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	9.302	51.718	0	50.038	49.917
400	10.640	54.637	1.015	49.476	49.962
600	13.068	59.426	3.394	48.639	50.401
800	14.919	63.454	6.203	48.140	51.073
1000	16.213	66.931	9.324	47.869	51.849
1200	17.103	69.971	12.661	47.732	52.651
1400	17.723	72.657	16.148	47.659	53.481
1600	18.164	75.054	19.739	47.604	54.301
1800	18.487	77.213	23.405	47.536	55.978
2000	18.729	79.173	27.128	47.508	58.243

$\text{SiH}_4(\text{g})$
Silicon tetrahydride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.236	48.887	0	8.200	13.575
400	12.302	52.186	1.149	7.419	15.534
600	15.745	57.855	3.968	6.322	19.851
800	18.335	62.759	7.390	5.732	24.464
1000	20.199	67.062	11.254	5.490	29.188
1200	21.516	70.868	15.433	5.464	33.926
1400	22.452	74.259	19.835	5.555	38.666
1600	23.130	77.304	24.397	5.698	43.372
1800	23.631	80.059	29.075	-6.149	48.908
2000	24.009	82.569	33.841	-5.845	55.005

$\text{TiH}_2(\text{c})$
Titanium dihydride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.191	7.101	0	-34.500	-25.130
400	9.400	9.524	.845	-34.989	-21.848
600	12.860	14.035	3.094	-35.446	-15.156
800	15.090	18.065	5.906	-35.444	-8.378
1000	16.380	21.588	9.068	-35.207	-1.635
1200	17.050	24.637	12.415	-35.880	5.087
1400	17.488	27.301	15.873	-35.386	11.875
1600	17.753	29.654	19.398	-34.947	18.595
1800	17.934	31.757	22.968	-34.603	25.265
2000	18.000	33.650	26.564	-37.815	32.003

$\text{SrH}(\text{g})$
Strontium monohydride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.201	50.822	0	52.400	45.626
400	7.531	52.983	.750	52.125	43.355
600	8.107	56.153	2.317	51.552	39.091
800	8.476	58.540	3.978	50.870	35.034
1000	8.714	60.458	5.699	49.900	31.207
1200	8.885	62.063	7.460	47.265	27.833
1400	9.021	63.443	9.251	46.626	24.646
1600	9.140	64.656	11.067	45.990	21.548
1800	9.244	65.738	12.906	13.124	21.396
2000	9.333	66.717	14.764	13.170	22.313

$\text{TlH}(\text{g})$
Thallium monohydride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.111	51.409	0	48.906	42.804
400	7.376	53.534	.737	48.636	40.760
600	7.942	56.635	2.271	46.960	37.004
800	8.354	58.980	3.903	46.468	33.759
1000	8.634	60.876	5.603	46.034	30.638
1200	8.835	62.469	7.351	45.631	27.591
1400	8.993	63.843	9.135	45.243	24.624
1600	9.126	65.053	10.947	44.863	21.707
1800	9.246	66.135	12.784	5.374	20.053
2000	9.355	67.115	14.645	5.357	21.686

$\text{SrH}_2(\text{c}, \text{l})$
Strontium dihydride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.516	12.428	0	-43.000	-33.674
400	11.308	15.629	1.111	-43.267	-30.446
600	12.863	20.508	3.528	-43.690	-23.940
800	14.418	24.422	6.257	-44.008	-17.306
1000	15.973	27.806	9.296	-44.375	-10.566
1128	16.968	29.789	11.405	-46.256	-6.077
1128	16.970	31.314	13.125	-44.536	-6.077
1200	16.970	32.364	14.347	-44.450	-3.624
1323	16.970	34.020	16.434	-44.315	.553
1323	17.925	38.175	21.931	-38.818	.553
1400	17.925	39.189	23.311	-38.668	2.841
1600	17.925	41.583	26.896	-38.307	8.744
1800	17.925	43.694	30.481	-70.218	17.471
2000	17.925	45.583	34.066	-69.256	27.162

$\text{ZrH}(\text{g})$
Zirconium monohydride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	7.096	51.638	0	123.400	115.435
400	7.348	53.756	.735	123.131	112.756
600	7.891	56.841	2.260	122.597	107.683
800	8.284	59.169	3.880	122.065	102.791
1000	8.543	61.048	5.565	121.507	98.037
1200	8.719	62.622	7.292	120.035	93.451
1400	8.845	63.976	9.049	119.653	89.050
1600	8.942	65.163	10.828	119.205	84.708
1800	9.019	66.221	12.625	118.693	80.425
2000	9.084	67.175	14.435	118.110	76.203

*Data estimated.

1128 K, transition point; $\Delta H^\circ = 1.720$

1323 K, melting point; $\Delta H^\circ = 5.497$

Iodides

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

Source of data: reference 25.

AgI(c,l)
Silver iodide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	13.580	27.600	0	-14.780	-15.839
400	14.898	31.749	1.441	-16.560	-16.153
421	15.661	32.528	1.760	-16.573	-16.132
421	13.982	36.020	3.230	-15.103	-16.132
600	13.589	40.873	5.681	-19.786	-15.048
800	13.890	44.801	8.413	-19.272	-13.547
831	14.100	45.332	8.845	-19.191	-13.328
831*	14.000	48.040	11.095	-16.941	-13.328
1000	14.000	50.632	13.461	-16.515	-12.637
1200	14.000	53.185	16.261	-16.086	-11.903

*Data for liquid estimated.

421 K, transition point; ΔH° = 1.470

831 K, melting point; ΔH° = 2.250

AlI(g)
Aluminum moniodide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.635	59.207	0	16.240	4.746
400	8.790	61.769	.888	13.921	.946
600	8.923	65.362	2.662	8.213	-3.787
800	8.987	67.938	4.453	7.703	-7.713
1000	9.030	69.949	6.255	4.490	-11.312
1200	9.064	71.598	8.064	3.873	-14.415
1400	9.095	72.998	9.880	3.260	-17.415
1600	9.123	74.214	11.702	2.651	-20.327
1800	9.150	75.290	13.530	2.045	-23.162
2000	9.177	76.256	15.362	1.439	-25.931

AlI₃(c,l)
Aluminum triiodide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	23.700	38.000	0	-72.400	-69.295
300	23.700	38.146	.044	-72.403	-69.276
400	25.700	45.238	2.514	-78.289	-68.011
464	27.000	49.146	4.200	-93.793	-66.136
464	30.000	57.767	8.200	-89.793	-66.136
500	30.000	60.009	9.280	-89.424	-64.313
600	30.000	65.478	12.280	-88.421	-59.385

464 K, melting point; ΔH° = 4.00

AlI₃(g)
Aluminum triiodide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.423	89.270	0	-46.200	-58.382
400	18.997	94.774	1.909	-52.694	-62.230
600	19.458	102.581	5.763	-68.738	-61.964
800	19.634	108.206	9.674	-68.928	-59.680
1000	19.718	112.598	13.611	-71.814	-57.150
1200	19.764	116.197	17.559	-72.108	-54.191
1400	19.793	119.246	21.515	-72.402	-51.180
1600	19.811	121.890	25.476	-72.699	-48.128
1800	19.824	124.225	29.439	-73.004	-45.041
2000	19.833	126.314	33.405	-73.314	-41.916

(AlI₃)₂
Dimeric aluminum triiodide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	41.098	142.751	0	-117.000	-130.693
400	42.178	155.000	4.248	-129.558	-134.812
600	43.006	172.290	12.782	-160.819	-127.548
800	43.311	184.709	21.418	-160.385	-116.527
1000	43.456	194.391	30.096	-165.354	-105.222
1200	43.536	202.322	38.796	-165.138	-93.217
1400	43.584	209.037	47.508	-164.925	-81.246
1600	43.615	214.859	56.228	-164.722	-69.306
1800	43.637	219.997	64.953	-164.532	-57.392
2000	43.652	224.596	73.682	-164.356	-45.496

AsI₃(c,l)
Arsenic triiodide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	25.280	50.920	0	-13.900	-14.123
300	25.308	50.920	.047	-13.900	-14.124
400	26.830	58.566	2.654	-19.651	-13.998
414	27.037	59.466	3.020	-19.761	-13.804
414	32.900	72.329	8.340	-14.441	-13.804
500	32.900	78.570	11.183	-29.012	-12.310
600	32.900	84.569	14.473	-27.694	-9.096
700	32.900	89.640	17.763	-26.393	-6.099

413.6 K, melting point; ΔH° = 5.32

$\text{AsI}_3(\text{g})$
Arsenic triiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.350	93.620	0	9.300	-3.654
300	19.350	93.740	.036	9.289	-3.734
400	19.570	99.350	1.984	2.879	-7.782
500	19.680	103.730	3.947	-13.048	-8.926
600	19.740	107.320	5.918	-13.049	-8.102
700	19.770	110.370	7.894	-13.062	-7.279
800	19.800	113.010	9.872	-13.088	-6.449
900	19.810	115.340	11.853	-21.396	-5.389
1000	19.820	117.430	13.835	-21.264	-3.619

$\text{BI}(\text{g})$
Boron monoiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	8.021	55.604	0	73.000	60.980
400	8.366	58.013	.836	70.916	56.963
600	8.696	61.478	2.547	65.537	51.663
800	8.844	64.002	4.303	65.330	47.071
1000	8.927	65.985	6.081	65.046	42.539
1200	8.983	67.618	7.872	64.706	38.062
1400	9.026	69.006	9.673	64.315	33.656
1600	9.061	70.214	11.482	63.869	29.298
1800	9.091	71.283	13.297	63.369	25.018
2000	9.119	72.242	15.118	62.817	20.775

*Data estimated.

$\text{BI}_2(\text{g})$
Boron diiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	11.731	73.964	0	58.000	44.644
400	12.447	77.520	1.234	53.716	40.281
600	13.155	82.722	3.805	42.990	36.921
800	13.461	86.554	6.470	42.791	34.929
1000	13.615	89.576	9.179	42.534	32.993
1200	13.702	92.067	11.912	42.228	31.108
1400	13.756	94.183	14.658	41.871	29.286
1600	13.792	96.022	17.413	41.458	27.509
1800	13.816	97.648	20.174	40.988	25.805
2000	13.834	99.105	22.939	40.460	24.134

*Data estimated.

$\text{BI}_3(\text{g})$
Boron triiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	16.919	83.322	0	17.000	4.992
400	17.922	88.447	1.779	10.663	1.177
600	18.878	95.924	5.474	-5.146	1.415
800	19.283	101.418	9.295	-5.089	3.597
1000	19.486	105.745	13.174	-5.081	5.766
1200	19.601	109.309	17.083	-5.119	7.932
1400	19.671	112.336	21.011	-5.204	10.119
1600	19.717	114.966	24.950	-5.347	12.309
1800	19.750	117.291	28.897	-5.548	14.538
2000	19.773	119.373	32.850	-5.807	16.773

$\text{BaI}(\text{g})$
Barium monoiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.896	66.593	0	-10.140	-21.409
400	8.948	69.215	.909	-12.567	-25.120
600	9.002	72.854	2.705	-19.002	-29.511
800	9.039	75.449	4.509	-20.019	-32.871
1000	9.071	77.470	6.320	-21.063	-35.964
1200	9.100	79.126	8.137	-24.017	-38.472
1400	9.129	80.531	9.960	-25.046	-40.800
1600	9.157	81.752	11.789	-26.070	-42.979
1800	9.186	82.832	13.623	-27.093	-45.032
2000	9.214	83.802	15.463	-28.112	-46.972

$\text{BaI}_2(\text{c,l})$
Barium diiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.515	39.470	0	-143.900	-142.944
400*	19.109	44.995	1.916	-147.918	-142.462
600	20.152	52.946	5.845	-158.427	-136.440
800	21.033	58.868	9.966	-158.027	-129.176
984	21.701	63.291	13.900	-157.552	-122.588
984	27.000	69.734	20.240	-151.212	-122.588
1000	27.000	70.169	20.672	-151.081	-122.123
1200	27.000	75.092	26.072	-151.360	-116.112
1400	27.000	79.254	31.472	-149.722	-110.367
1600	27.000	82.860	36.872	-148.089	-104.855
1800	27.000	86.040	42.272	-146.462	-99.550
2000	27.000	88.884	47.672	-144.841	-94.423

*Data 300-984 K estimated.

984 K, melting point: $\Delta H^\circ = 6.34$

$\text{BaI}_2(\text{g})$
Barium diiodide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	13.734	83.180	0	-72.400	-84.476
400	13.811	87.228	1.403	-76.931	-88.369
600	13.866	92.841	4.172	-88.600	-90.550
800	13.885	96.832	6.947	-89.546	-91.066
1000	13.894	99.932	9.725	-90.528	-91.333
1200	13.899	102.466	12.505	-93.427	-91.028
1400	13.902	104.608	15.285	-94.409	-90.549
1600	13.904	106.465	18.065	-95.396	-89.930
1800	13.905	108.103	20.846	-96.388	-89.190
2000	13.906	109.568	23.627	-97.386	-88.336

$\text{BeI}_2(\text{g})$
Beryllium diiodide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	13.131	69.649	0	-15.300	-27.113
400	13.660	73.587	1.366	-19.573	-30.951
600	14.231	79.249	4.163	-30.237	-33.292
800	14.495	83.384	7.039	-30.334	-34.300
1000	14.632	86.634	9.953	-30.484	-35.273
1200	14.711	89.310	12.888	-30.710	-36.218
1400	14.760	91.581	15.835	-31.018	-37.104
1600	14.793	93.555	18.791	-34.910	-37.856
1800	14.816	95.298	21.752	-35.190	-38.223
2000	14.832	96.860	24.717	-35.472	-38.528

$\text{BeI}(\text{g})$
Beryllium monoiodide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.001	56.688	0	40.600	28.513
400	8.353	59.093	.834	38.393	24.492
600	8.694	62.555	2.544	32.849	19.259
800	8.850	65.080	4.300	32.532	14.771
1000	8.939	67.065	6.080	32.153	10.375
1200	9.000	68.700	7.874	31.694	6.056
1400	9.046	70.091	9.679	31.154	1.833
1600	9.085	71.302	11.492	27.033	-2.223
1800	9.119	72.374	13.312	26.528	-5.867
2000	9.151	73.336	15.139	26.028	-9.422

$\text{BiI}_3(\text{c,l})$
Bismuth triiodide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	25.300	53.700	0	-36.000	-35.554
300	24.025	42.449	.044	-90.590	-75.241
400	24.500	60.950	2.510	-41.916	-35.183
500	25.500	66.510	5.000	-57.361	-32.036
600	27.300	71.320	7.640	-59.475	-26.756
682	29.000	74.910	9.940	-58.845	-22.332
682	36.000	89.620	19.290	-49.495	-22.332
700	36.000	89.570	19.950	-49.206	-21.605
800	36.000	94.380	23.550	-47.635	-17.767
900	36.000	98.620	27.150	-46.059	-14.134
1000	36.000	102.410	30.750	-44.475	-10.662

*Heat capacity at 298 K estimated.
681.8 K, melting point; $\Delta \text{H}^\circ = 9.350$

$\text{BeI}_2(\text{c,l,g})$
Beryllium diiodide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	16.482	28.800	0	-45.100	-44.734
400	18.372	33.926	1.781	-48.958	-44.472
600	20.122	41.773	5.664	-58.536	-39.106
753	20.541	46.395	8.778	-57.687	-34.254
753	27.000	53.035	13.778	-52.687	-34.254
759	27.000	53.264	13.951	-52.611	-34.097
759	14.451	82.629	36.251	-30.311	-34.097
800	14.495	83.384	36.839	-30.334	-34.300
1000	14.632	86.634	39.753	-30.484	-35.273
1200	14.711	89.310	42.688	-30.710	-36.218
1400	14.760	91.581	45.635	-31.018	-37.104
1600	14.793	93.555	48.591	-34.910	-37.856
1800	14.816	95.298	51.552	-35.190	-38.223
2000	14.832	96.860	54.517	-35.472	-38.528

*Data estimated except temperature of fusion.
753 K, melting point; $\Delta \text{H}^\circ = 5.00$
759.4 K, boiling point to monomer; $\Delta \text{H}^\circ = 22.3$

$\text{BiI}_3(\text{g})$
Bismuth triiodide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	19.620	97.580	0	-3.900	-16.536
400	19.730	103.364	2.005	-10.321	-20.553
600	19.810	111.382	5.960	-29.055	-20.373
800	19.830	117.084	9.924	-29.161	-17.456
1000*	19.840	121.510	13.892	-29.233	-14.520
1200	19.850	125.129	17.862	-29.290	-11.571
1400	19.860	128.190	21.833	-29.351	-8.615

*Begins to decompose appreciably above 900 K.

$\text{CI}_4(\text{g})$
Carbon tetraiodide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	22.906	93.601	0	62.840	51.894
400	23.996	100.501	2.394	54.594	48.508
600	24.938	110.441	7.304	33.980	52.008
800	25.312	117.674	12.333	34.526	57.933
1000	25.494	123.344	17.416	34.997	63.728
1200	25.596	128.002	22.526	35.413	69.434
1400	25.658	131.952	27.652	35.788	75.076

$\text{CaI}(\text{g})$
Calcium monoiodide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.758	62.426	0	-1.210	-12.721
400	8.854	65.015	.890	-3.537	-16.523
600	8.932	68.623	2.677	-9.293	-21.256
800	8.970	71.198	4.468	-10.100	-25.131
1000	8.995	73.202	6.264	-10.966	-28.801
1200	9.015	74.844	8.065	-13.886	-32.113
1400	9.033	76.235	9.870	-14.392	-35.109
1600	9.051	77.442	11.679	-14.896	-38.040
1800	9.069	78.509	13.491	-51.941	-39.966
2000	9.091	79.466	15.307	-52.043	-38.631

$\text{CaI}_2(\text{c,l})$
Calcium diiodide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	18.441	34.724	0	-128.300	-127.413
400*	18.920	40.211	1.903	-132.220	-126.964
600	18.870	48.063	5.782	-142.083	-121.159
800	20.810	53.908	9.850	-141.513	-114.274
1000	21.750	58.653	14.106	-140.824	-107.552
1052	22.000	59.762	15.243	-140.680	-105.825
1052	24.700	69.268	25.243	-130.680	-105.825
1200	24.700	72.519	28.899	-131.660	-102.235
1400	24.700	76.326	33.839	-129.941	-97.464
1600	24.700	79.624	38.779	-128.228	-92.948
1800	24.700	82.534	43.719	-163.061	-87.706
2000	24.700	85.136	48.659	-160.959	-79.445

*Data 300-1052 K estimated.

1052 K, melting point; $\Delta \text{H}^\circ = 10.00$

$\text{CaI}_2(\text{g})$
Calcium diiodide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	14.492	78.263	0	-61.700	-73.794
400	14.665	82.550	1.486	-66.037	-77.716
600	14.794	88.525	4.434	-76.831	-80.184
800	14.842	92.789	7.399	-77.364	-81.230
1000	14.864	96.103	10.369	-77.961	-82.139
1200	14.876	98.815	13.344	-80.615	-82.745
1400	14.883	101.108	16.320	-80.860	-83.078
1600	14.888	103.096	19.297	-81.110	-83.385
1800	14.891	104.850	22.275	-117.905	-82.719
2000	14.894	106.419	25.253	-117.765	-78.817

$\text{CdI}_2(\text{c,l})$
Cadmium diiodide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	19.110	38.500	0	-48.600	-48.112
300*	19.122	38.618	.035	-48.600	-48.108
400	19.761	44.206	1.979	-52.463	-47.809
500	20.403	48.685	3.988	-62.636	-45.682
600	21.045	52.462	6.060	-63.634	-42.319
661	21.438	54.524	7.360	-63.318	-40.163
661	24.400	62.011	12.310	-58.368	-40.163
700	24.400	63.402	13.257	-58.046	-39.103
800	24.400	66.660	15.697	-57.217	-36.451
900	24.400	69.534	18.137	-56.391	-33.903
1000	24.400	72.105	20.577	-55.566	-31.446

*Data 300-600 K estimated.

661.2 K, melting point; $\Delta \text{H}^\circ = 4.950$

$\text{CeI}_3(\text{c,l})$
Cerium triiodide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	24.000	54.300	0	-155.300	-153.947
400	24.800	61.468	2.486	-161.280	-153.250
600	26.200	71.794	7.589	-176.219	-144.434
800	27.500	79.511	12.960	-175.115	-134.000
1000	28.800	85.784	18.587	-174.642	-123.863
1033	29.000	86.721	19.540	-174.434	-122.191
1033	36.500	98.725	31.940	-162.034	-122.191
1200	36.500	104.195	38.035	-161.023	-115.771

1033 K, melting point; $\Delta \text{H}^\circ = 12.40$

$\text{CeI}_3(\text{g})$
Cerium triiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.496	102.111	0	-88.900	-101.802
400	19.708	107.872	1.997	-95.369	-105.901
600	20.114	115.936	5.978	-111.431	-106.130
800	20.533	121.782	10.044	-111.632	-104.333
1000	20.816	126.397	14.182	-112.647	-102.482
1200	20.939	130.205	18.359	-114.299	-100.259
1400	20.950	133.435	22.550	-114.642	-97.889
1600	20.898	136.230	26.735	-114.999	-95.477
1800	20.818	138.687	30.907	-115.379	-93.018
2000	20.730	140.876	35.062	-115.784	-90.510

$\text{CuI}(\text{g})$
Copper monoiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.727	61.088	0	34.000	22.287
400	8.845	63.671	.896	31.693	18.413
600	8.945	67.280	2.676	26.027	13.516
800	8.996	69.861	4.471	25.633	9.405
1000	9.033	71.872	6.274	25.192	5.399
1200	9.063	73.522	8.083	24.686	1.485
1400	9.090	74.921	9.899	20.945	-2.239
1600	9.115	76.136	11.719	20.291	-5.506
1800	9.140	77.211	13.545	19.641	-8.692
2000	9.164	78.176	15.375	18.991	-11.807

$\text{CsI}(\text{c,l})$
Cesium iodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.570	29.410	0	-82.840	-81.397
400	12.814	33.141	1.294	-85.420	-80.649
600	13.583	38.459	3.922	-90.491	-76.638
800	15.150	42.561	6.781	-90.011	-72.085
900	16.265	44.408	8.350	-89.633	-69.865
900	16.750	51.208	14.470	-83.513	-69.865
1000	16.750	52.972	16.145	-99.112	-67.573
1200	16.750	56.026	19.495	-97.663	-61.400
1400	16.750	58.608	22.845	-96.218	-55.470

900 K, melting point; $\Delta H^\circ = 6.12$

$\text{CuI}(\text{c,l})$
Copper monoiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.920	23.087	0	-16.200	-16.583
400	13.668	26.990	1.355	-18.048	-16.656
600	18.400	32.951	4.320	-22.529	-14.443
642	30.787	34.515	5.293	-22.011	-13.892
642	33.100	35.667	6.033	-21.271	-13.892
680	33.100	37.570	7.291	-20.427	-13.479
680	16.400	38.502	7.924	-19.794	-13.479
800	16.400	41.167	9.892	-19.147	-12.419
868	16.400	42.505	11.007	-18.788	-11.862
868	15.903	44.688	12.903	-16.892	-11.862
1000	15.165	46.887	14.952	-16.330	-11.139
1200	14.263	49.569	17.890	-15.707	-10.164
1400	13.621	51.716	20.674	-18.481	-9.177
1600	13.241	53.507	23.356	-18.272	-7.862

642 K, transition point; $\Delta H^\circ = 0.740$

680 K, transition point; $\Delta H^\circ = 0.633$

868 K, melting point; $\Delta H^\circ = 1.896$

$(\text{CuI})_3(\text{g})$
Trimeric copper monoiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	31.020	111.000	0	-4.000	-17.593
400	31.260	120.152	3.172	-10.437	-21.934
600	31.560	132.891	9.458	-26.488	-22.653
800	31.700	141.993	15.786	-26.729	-21.340
1000	31.730	149.071	22.130	-27.116	-19.951
1200	31.730	154.856	28.476	-27.715	-18.465

$\text{DyI}_3(\text{g})$
Dysprosium triiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.473	103.341	0	-79.400	-92.460
400	19.647	109.092	1.993	-85.885	-96.613
600	19.798	117.090	5.940	-101.908	-96.945
800	19.939	122.804	9.912	-102.018	-95.272
1000	20.115	127.271	13.918	-102.187	-93.566
1200	20.291	130.955	17.958	-102.476	-91.820
1400	20.437	134.094	22.032	-102.971	-90.011
1600	20.542	136.830	26.131	-103.745	-88.111
1800	20.606	139.254	30.246	-108.261	-85.823
2000	20.638	141.427	34.371	-109.290	-83.288

$\text{ErI}_3(\text{g})$
Erbium triiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.465	103.131	0	-81.200	-94.320
400	19.642	108.879	1.993	-87.689	-98.487
600	19.769	116.873	5.936	-103.743	-98.855
800	19.814	122.567	9.895	-103.907	-97.204
1000	19.835	126.990	13.860	-104.147	-95.494
1200	19.846	130.608	17.828	-104.486	-93.738
1400	19.853	133.668	21.798	-104.943	-91.905
1600	19.857	136.319	25.769	-105.542	-90.003
1800	19.860	138.658	29.741	-111.055	-88.012
2000	19.863	140.750	33.714	-111.691	-85.405

$\text{FeI}_2(\text{c,l})$
Iron diiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	20.000	40.000	0	-25.000	-26.706
400	20.060	45.886	2.040	-28.793	-27.165
600	20.178	54.042	6.064	-38.603	-23.194
650	20.207	55.659	7.075	-38.430	-21.916
650	20.920	55.967	7.275	-38.230	-21.916
800*	26.500	60.874	10.834	-37.293	-18.239
860	28.709	62.879	12.500	-36.730	-16.829
860	27.000	75.321	23.200	-26.030	-16.829
1000	27.000	79.394	26.980	-25.054	-15.413
1200	27.000	84.317	32.380	-24.023	-13.579

*Heat capacities above 773 K and enthalpy of fusion estimated.

650 K, transition point; $\Delta H^\circ = 0.200$

860 K, melting point; $\Delta H^\circ = 10.7$

1336 K, boiling point to equilibrium mixture; $\Delta H^\circ = 25$

$\text{FeI}_2(\text{g})$
Iron diiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	14.545	83.530	0	21.000	6.316
400	14.698	87.828	1.490	16.657	1.508
600	14.819	93.815	4.444	5.777	-2.678
800	14.911	98.090	7.416	5.289	-5.430
1000	15.046	101.430	10.411	4.377	-8.018
1200	15.222	104.189	13.438	3.035	-10.368
1400	15.411	106.550	16.501	2.616	-12.568
1600	15.588	108.619	19.601	2.147	-14.704
1800	15.738	110.464	22.734	1.320	-16.761
2000	15.856	112.129	25.894	-2.853	-18.383

*Data except enthalpy of formation at 298 K estimated.

$(\text{FeI}_2)_2(\text{g})$
Dimeric iron diiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	31.377	129.865	0	2.000	-16.279
400	31.561	139.115	3.206	-6.460	-22.141
600	31.699	151.942	9.535	-27.799	-23.297
800	31.797	161.074	15.884	-28.370	-21.724
1000	31.939	168.184	22.256	-29.812	-19.926
1200	32.129	174.023	28.663	-32.143	-17.723
1400	32.343	178.992	35.110	-32.660	-15.278
1600	32.554	183.325	41.600	-33.308	-12.750
1800	32.744	187.170	48.130	-34.698	-10.096
2000	32.900	190.628	54.695	-42.799	-6.599

*Data except enthalpy of formation at 298 K estimated.

$\text{GdI}_3(\text{c,l})$
Gadolinium triiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.600	54.100	0	-142.000	-140.874
400	24.473	61.172	2.453	-148.094	-140.238
600	25.122	71.243	7.425	-163.104	-131.485
800	25.376	78.509	12.478	-162.184	-121.082
1000	25.516	84.188	17.568	-161.321	-110.917
1013	25.524	84.518	17.900	-161.267	-110.262
1013	30.550	84.735	18.120	-161.047	-110.262
1200	30.550	89.910	23.833	-159.379	-101.029
1204	30.550	90.012	23.955	-159.345	-100.835
1204	37.250	100.730	36.860	-146.440	-100.835

*Entropy and heat capacity at 298 K estimated.

1013 K, transition point; $\Delta H^\circ = 0.220$

1204 K, melting point; $\Delta H^\circ = 12.905$

$\text{GdI}_3(\text{g})$
Gadolinium triiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.478	102.176	0	-75.700	-88.908
400	19.649	107.927	1.994	-82.253	-93.099
600	19.772	115.922	5.938	-98.290	-93.479
800	19.815	121.617	9.898	-98.463	-91.849
1000	19.836	126.041	13.863	-98.726	-90.174
1200	19.847	129.659	17.831	-99.081	-88.430
1400	19.853	132.719	21.801	-99.548	-86.609
1600	19.858	135.370	25.773	-103.344	-84.670
1800	19.861	137.709	29.744	-103.898	-82.298
2000	19.863	139.802	33.717	-104.460	-79.878

$\text{GeI}_4(\text{g})$
Germanium tetraiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.890	102.490	0	-13.600	-25.390
400	25.260	109.860	2.560	-22.017	-29.035
600	25.610	120.180	7.650	-42.947	-25.929
800	25.690	127.560	12.780	-42.638	-20.307
1000	25.630	133.290	17.920	-42.384	-14.754
1200	25.480	137.950	23.030	-42.241	-9.241

$\text{HI}(\text{g})$
Hydrogen iodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	6.969	49.350	0	6.300	.377
400	7.010	51.402	.711	4.060	-1.531
600	7.253	54.284	2.134	-1.425	-2.618
800	7.600	56.418	3.620	-1.542	-2.995
1000	7.920	58.149	5.172	-1.609	-3.351
1200	8.177	59.616	6.783	-1.637	-3.695
1400	8.376	60.893	8.439	-1.643	-4.038
1600	8.531	62.022	10.131	-1.637	-4.381
1800	8.654	63.034	11.850	-1.626	-4.724
2000	8.753	63.951	13.591	-1.615	-5.068
2200	8.835	64.789	15.350	-1.605	-5.415
2400	8.904	65.561	17.124	-1.599	-5.761
2600	8.963	66.276	18.911	-1.596	-6.108
2800	9.016	66.942	20.709	-1.597	-6.454
3000	9.062	67.566	22.517	-1.603	-6.802

$\text{HfI}_4(\text{c})$
Hafnium tetraiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	34.500	64.500	0.000	-118.000	-117.575
300	34.510	64.710	0.065	-117.994	-117.569
400	35.250	74.740	3.550	-125.478	-117.196
500	36.000	82.690	7.115	-145.591	-113.223
600	36.750	89.320	10.750	-144.411	-106.867
700	37.500	95.040	14.465	-143.173	-100.700
800	38.240	100.100	18.250	-141.888	-94.725

*Data estimated.

$\text{HfI}_4(\text{g})$
Hafnium tetraiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	25.120	105.940	0	-87.000	-98.930
300	25.130	106.090	.046	-87.013	-99.002
400	25.430	113.370	2.577	-95.451	-102.621
500	25.570	119.060	5.127	-116.579	-102.396
600	25.650	123.730	7.689	-116.472	-99.574
700	25.700	127.690	10.257	-116.381	-96.763
800	25.730	131.120	12.828	-116.310	-93.963
900	25.750	134.150	15.402	-116.259	-91.174
1000	25.770	136.870	17.978	-116.227	-88.397

*Enthalpy of formation at 298 K estimated.

$\text{HgI}(\text{g})$
Mercury monoiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	9.055	67.068	0	31.900	21.450
400	9.139	69.741	.927	29.556	18.014
600	9.272	73.473	2.768	23.889	13.989
800	9.393	76.157	4.635	9.667	14.536
1000	9.511	78.265	6.525	9.658	15.755
1200	9.627	80.010	8.439	9.670	16.972
1400	9.743	81.503	10.376	9.704	18.188
1600	9.858	82.811	12.336	9.756	19.396
1800	9.973	83.979	14.319	9.830	20.596
2000	10.088	85.036	16.326	9.923	21.789

$\text{Hg}_2\text{I}_2(\text{c,l})$
Dimeric mercury iodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	25.300	57.670	0	-28.462	-26.563
300	25.323	57.827	.047	-28.463	-26.551
400	26.390	65.266	2.635	-32.369	-25.767
500	27.170	71.243	5.315	-42.511	-23.157
563	27.530	74.470	7.050	-42.159	-20.179
563	32.600	86.015	13.550	-35.659	-20.179
600	32.600	88.090	14.755	-35.266	-19.751

*Entropy at 298 K estimated.

563 K, melting point; $\Delta H^\circ = 6.50$

630 K, decomposition pressure = 1 atm

$\text{HgI}_2(\text{c,l,g})$
Mercury diiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	18.582	43.338	0	-25.200	-24.437
400	19.600	48.941	1.944	-29.125	-24.027
402	19.600	49.038	1.984	-29.137	-24.000
402	20.105	50.531	2.584	-28.537	-24.000
530	20.105	56.088	5.157	-38.545	-20.937
530	24.400	64.643	9.691	-34.011	-20.937
600	24.400	67.670	11.399	-33.386	-19.251
627	24.400	68.744	12.058	-33.144	-18.618
627	14.833	91.297	26.199	-19.003	-18.618
800	14.861	94.911	28.768	-33.006	-14.701
1000	14.877	98.229	31.742	-32.835	-10.145
1200	14.885	100.943	34.718	-32.669	-5.625
1400	14.890	103.238	37.696	-32.505	-1.128
1600	14.894	105.226	40.674	-32.348	3.343
1800	14.896	106.981	43.653	-32.195	7.794
2000	14.898	108.550	46.633	-32.048	12.232

*Entropy at 298 K estimated.

402 K, transition point; $\Delta H^\circ = 0.600$ 530 K, melting point; $\Delta H^\circ = 4.534$ 627 K, boiling point; $\Delta H^\circ = 14.141$

$\text{HgI}_2(\text{g})$
Mercury diiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.608	80.331	0	-3.855	-14.121
400	14.736	84.644	1.495	-8.229	-17.412
600	14.828	90.640	4.454	-10.986	-10.633
800	14.861	94.911	7.423	-33.006	-14.701
1000	14.877	98.229	10.397	-32.835	-10.145
1200	14.885	100.943	13.373	-32.669	-5.625
1400	14.890	103.238	16.351	-32.505	-1.128
1600	14.894	105.226	19.329	-32.348	3.343
1800	14.896	106.981	22.308	-32.195	7.794
2000	14.898	108.550	25.288	-32.048	12.232

$\text{Hol}_3(\text{g})$
Holmium triiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.468	103.341	0	-82.900	-95.951
400	19.644	109.090	1.993	-89.371	-100.102
600	19.771	117.084	5.937	-105.396	-100.436
800	19.828	122.780	9.897	-105.497	-98.765
1000	19.893	127.211	13.869	-105.693	-97.062
1200	19.984	130.845	17.856	-106.045	-95.305
1400	20.097	133.934	21.864	-106.613	-93.471
1600	20.217	136.626	25.895	-107.460	-91.548
1800	20.330	139.013	29.950	-112.279	-89.335
2000	20.429	141.161	34.026	-113.061	-86.757

$\text{InI}(\text{g})$
Indium monoiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.826	63.860	0	1.800	-8.981
400	8.877	66.460	.902	-5.572	-12.530
600	8.913	70.070	2.682	-7.186	-16.417
800	8.926	72.630	4.466	-7.699	-19.412
1000	8.932	74.630	6.252	-8.209	-22.288
1200	8.935	76.260	8.039	-8.720	-25.058
1400	8.937	77.630	9.826	-9.234	-27.729
1600	8.938	78.830	11.613	-9.750	-30.347
1800	8.939	79.880	13.401	-10.269	-32.886
2000	8.940	80.820	15.189	-10.790	-35.368

$\text{InI}_2(\text{g})$
Indium diiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.639	84.050	0	-5.600	-18.263
400	13.757	88.090	1.396	-10.076	-22.366
600	13.842	93.680	4.158	-21.915	-24.761
800	13.872	97.670	6.929	-22.342	-25.648
1000	13.886	100.770	9.705	-22.766	-26.428
1200	13.893	103.370	12.483	-23.194	-27.202
1400	13.898	105.440	15.262	-23.626	-27.734
1600	13.901	107.300	18.042	-24.063	-28.297
1800	13.903	108.930	20.822	-24.506	-28.788
2000	13.904	110.400	23.601	-24.956	-29.252

$\text{InI}_3(\text{g})$
Indium triiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.396	95.580	0	-28.800	-40.763
400	19.602	101.310	1.987	-35.283	-44.541
600	19.751	109.300	5.925	-52.153	-43.819
800	19.804	114.990	9.882	-52.294	-41.017
1000	19.828	119.410	13.845	-52.436	-38.181
1200	19.841	123.020	17.812	-52.583	-35.309
1400	19.849	126.080	21.781	-52.736	-32.417
1600	19.854	128.730	25.752	-52.895	-29.501
1800	19.858	131.070	29.724	-53.063	-26.571
2000	19.861	133.170	33.696	-53.239	-23.633

KI(c,l)
Potassium iodide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	12.600	25.410	0	-78.370	-77.199
400	12.991	29.168	1.304	-80.991	-76.605
600	13.730	34.574	3.975	-85.997	-72.800
800	14.533	38.632	6.800	-85.499	-68.471
954	15.213	41.248	9.090	-85.006	-65.237
954	16.310	47.265	14.830	-79.266	-65.237
1000	16.310	48.033	15.580	-79.057	-64.566
1200	16.310	51.007	18.842	-96.837	-58.925
1400	16.310	53.521	22.104	-95.479	-52.713

954 K, melting point; ΔH° = 5.740

KI(g)
Potassium iodide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.872	61.704	0	-30.000	-39.651
400	8.948	64.323	.908	-33.017	-42.693
600	9.027	67.968	2.706	-38.896	-45.735
800	9.081	70.572	4.517	-39.412	-47.936
1000	9.127	72.604	6.338	-39.929	-50.008
1200	9.169	74.271	8.168	-59.141	-49.146
1400	9.211	75.688	10.006	-59.207	-47.475
1600	9.251	76.921	11.852	-59.269	-45.795
1800	9.292	78.013	13.706	-59.328	-44.109
2000	9.332	78.994	15.569	-59.384	-42.414

(KI)₂(g)
Dimeric potassium iodide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	19.660	94.558	0	-100.900	-111.599
400	19.753	100.351	2.008	-106.742	-114.776
600	19.819	108.375	5.966	-118.137	-115.280
800	19.842	114.080	9.933	-118.826	-114.222
1000	19.853	118.509	13.902	-119.532	-112.992
1200	19.858	122.129	17.873	-157.645	-105.960
1400	19.862	125.191	21.846	-157.479	-97.356
1600	19.864	127.843	25.818	-157.324	-88.778
1800	19.866	130.183	29.791	-157.176	-80.222
2000	19.867	132.276	33.764	-157.042	-71.678

*Data except enthalpy of formation at 298 K estimated.

LaI₃(c,l)
Lanthanum triiodide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	23.700	51.200	0	-159.400	-158.196
400	24.830	58.343	2.479	-165.379	-157.551
600	25.699	68.607	7.547	-180.337	-148.840
800	26.656	76.106	12.765	-179.204	-138.509
1000	29.650	82.320	18.345	-177.851	-128.478
1051	30.968	83.827	19.890	-177.407	-125.971
1051	36.300	96.405	33.110	-164.187	-125.971
1200	36.300	101.218	38.519	-164.333	-120.645

*Entropy and heat capacity at 298 K estimated.

1051 K, melting point; ΔH° = 13.220

LaI₃(g)
Lanthanum triiodide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	19.493	98.624	0	-92.700	-105.636
400	19.658	104.379	1.995	-99.163	-109.749
600	19.776	112.377	5.941	-115.242	-110.008
800	19.818	118.072	9.901	-115.368	-108.246
1000	19.837	122.497	13.866	-115.630	-106.435
1200	19.848	126.115	17.835	-118.317	-104.505
1400	19.854	129.175	21.805	-118.718	-102.176
1600	19.858	131.826	25.776	-119.128	-99.776
1800	19.861	134.165	29.748	-119.546	-97.343
2000	19.863	136.258	33.721	-119.971	-94.841

LiI(c,l)
Lithium iodide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	12.200	20.740	0	-64.630	-64.602
400	12.850	24.421	1.278	-66.582	-64.520
600	13.909	29.829	3.952	-72.246	-61.662
742	15.010	32.888	6.000	-71.828	-59.200
742	15.100	37.605	9.500	-68.328	-59.200
800	15.100	38.742	10.376	-68.115	-58.495
1000	15.100	42.111	13.396	-67.380	-56.174
1200	15.100	44.864	16.416	-66.644	-54.003
1400	15.100	47.192	19.436	-65.905	-51.954

742 K, melting point; ΔH° = 3.50

LiI(g)
Lithium iodide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.263	55.478	0	-19.380	-29.709
400	8.556	57.951	.858	-21.752	-33.102
600	8.824	61.480	2.600	-28.348	-36.755
800	8.950	64.037	4.379	-28.861	-39.478
1000	9.029	66.043	6.177	-29.349	-42.075
1200	9.087	67.695	7.989	-29.821	-44.577
1400	9.136	69.099	9.811	-30.281	-46.999
1600	9.180	70.322	11.643	-30.726	-49.356
1800	9.221	71.406	13.483	-66.028	-48.196
2000	9.260	72.379	15.331	-66.095	-46.209

(LiI)₂(g)
Dimeric lithium iodide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.175	78.997	0	-87.000	-98.130
400	18.877	84.449	1.891	-91.569	-101.689
600	19.412	92.225	5.730	-104.407	-102.779
800	19.610	97.840	9.635	-105.086	-102.132
1000	19.703	102.227	13.568	-105.724	-101.318
1200	19.754	105.824	17.514	-106.346	-100.380
1400	19.785	108.872	21.468	-106.955	-99.336
1600	19.805	111.515	25.427	-107.551	-98.205
1800	19.819	113.849	29.390	-177.871	-90.074
2000	19.829	115.937	33.354	-177.738	-80.324

MgI(g)
Magnesium monoiodide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.751	65.042	0	5.900	-7.026
400	8.942	67.643	.902	3.583	-11.314
600	9.146	71.311	2.713	-2.118	-17.009
800	9.283	73.962	4.556	-2.591	-21.906
1000	9.409	76.046	6.425	-5.295	-26.493
1200	9.508	77.770	8.316	-5.942	-30.680
1400	9.612	79.243	10.228	-36.775	-33.934
1600	9.714	80.534	12.160	-36.750	-33.532
1800	9.815	81.684	14.113	-36.706	-33.133
2000	9.915	82.723	16.086	-36.647	-32.737

MgI₂(c,l,g)
Magnesium diiodide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	17.880	31.000	0	-87.700	-86.338
400	18.740	36.384	1.868	-91.649	-85.722
600	19.840	44.203	5.733	-101.504	-79.578
800	20.620	50.022	9.781	-100.672	-72.396
907	20.970	52.625	12.000	-100.225	-68.638
907	24.000	60.343	19.000	-93.225	-68.638
1000	24.000	62.605	21.232	-94.698	-65.978
1200	24.000	67.061	26.032	-93.344	-60.369
1255	24.000	68.136	27.352	-92.986	-58.852
1255	14.860	96.939	63.500	-56.838	-58.852
1400	14.869	98.566	65.652	-87.379	-58.269
1600	14.877	100.552	68.627	-87.225	-54.121
1800	14.883	102.305	71.603	-87.075	-49.993
2000	14.887	103.873	74.580	-86.931	-45.879

*Data except enthalpy of formation at 298 K and temperature of fusion estimated.

907 K, melting point; ΔH° = 7.00

1255 K, boiling point to monomer; ΔH° = 36.148

MgI₂(g)
Magnesium diiodide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	14.250	75.854	0	-38.300	-50.311
400	14.512	80.083	1.466	-42.651	-54.203
600	14.720	86.015	4.393	-53.444	-56.605
800	14.798	90.262	7.346	-53.707	-57.623
1000	14.836	93.568	10.310	-56.220	-58.383
1200	14.856	96.275	13.280	-56.696	-58.778
1400	14.869	98.566	16.252	-87.379	-58.269
1600	14.877	100.552	19.227	-87.225	-54.121
1800	14.883	102.305	22.203	-87.075	-49.993
2000	14.887	103.873	25.180	-86.931	-45.879

*Data except enthalpy of formation at 298 K estimated.

MoI(g)
Molybdenum monoiodide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	8.834	66.650	0	119.200	105.509
400	8.911	69.259	.904	116.908	100.954
600	8.983	72.887	2.694	111.258	94.718
800	9.026	75.478	4.496	110.874	89.263
1000	9.060	77.495	6.304	110.449	83.907
1200	9.090	79.150	8.119	109.974	78.643
1400	9.123	80.554	9.940	109.438	73.463
1600	9.164	81.774	11.769	108.839	68.365
1800	9.225	82.857	13.607	108.165	63.345
2000	9.323	83.834	15.461	107.409	58.403

*Data estimated.

MoI₂(c)
Molybdenum diiodide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	19.767	35.770	0	-24.840	-25.186
400	20.071	41.621	2.029	-28.605	-25.183
600	20.667	49.872	6.103	-38.178	-20.357
800	21.263	55.899	10.296	-37.071	-14.581
1000	21.859	60.708	14.608	-35.897	-9.094
1200	22.455	64.746	19.039	-34.664	-3.848

*Data except enthalpy of formation at 298 K estimated.
1305 K, decomposition pressure = 1 atm.

MoI₂(g)
Molybdenum diiodide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	16.902	81.066	0	61.600	47.749
400	17.030	86.055	1.729	57.535	43.183
600	16.874	92.945	5.127	47.286	39.263
800	16.490	97.748	8.464	47.537	36.548
1000	16.128	101.387	11.725	47.660	33.784
1200	15.847	104.302	14.921	47.658	31.007
1400	15.643	106.728	18.069	47.539	28.241
1600	15.497	108.807	21.182	47.310	25.499
1800	15.397	110.626	24.271	46.971	22.792
2000	15.334	112.245	27.343	46.513	20.127

*Data estimated.

MoI₃(g)
Molybdenum triiodide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	19.482	96.420	0	43.700	29.409
400	19.653	102.173	1.994	37.302	24.823
600	19.804	110.172	5.941	21.395	23.587
800	19.960	115.890	9.917	21.385	24.321
1000	20.158	120.365	13.928	21.353	25.057
1200	20.359	124.058	17.980	21.299	25.803
1400	20.532	127.210	22.070	21.212	26.561
1600	20.672	129.961	26.191	21.077	27.335
1800	20.789	132.403	30.337	20.879	28.126
2000	20.895	134.598	34.506	20.598	28.948

*Data estimated.

MoI₄(g)
Molybdenum tetraiodide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	25.064	108.198	0	29.800	16.135
400	25.395	115.617	2.572	21.382	11.846
600	25.635	125.969	7.680	.428	13.695
800	25.721	133.357	12.817	.679	18.081
1000	25.761	139.101	17.965	.880	22.405
1200	25.783	143.800	23.120	1.021	26.696
1400	25.797	147.776	28.278	1.091	30.970
1600	25.807	151.221	33.439	1.083	35.240
1800	25.818	154.262	38.601	.984	39.511
2000	25.834	156.983	43.766	.780	43.802

*Data estimated.

NaI(c,l)
Sodium iodide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	12.450	23.550	0	-68.780	-67.997
400	12.878	27.270	1.290	-71.444	-67.597
600	13.660	32.635	3.942	-76.461	-64.057
800	14.936	36.719	6.787	-75.918	-59.996
934	16.432	39.136	8.880	-75.355	-57.373
934	16.040	45.212	14.555	-69.680	-57.373
1000	16.040	46.308	15.614	-69.375	-56.514
1200	16.040	49.232	18.822	-91.712	-53.571
1400	16.040	51.705	22.030	-90.408	-47.316

934 K, melting point; ΔH° = 5.675

NaI(g)
Sodium iodide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.762	59.496	0	-20.260	-30.194
400	8.882	62.089	.899	-23.315	-33.396
600	8.994	65.715	2.688	-29.196	-36.639
800	9.059	68.312	4.493	-29.691	-39.045
1000	9.109	70.339	6.310	-30.159	-41.328
1200	9.154	72.004	8.137	-53.877	-43.063
1400	9.196	73.418	9.972	-53.946	-41.252
1600	9.237	74.649	11.815	-54.010	-39.436
1800	9.277	75.739	13.667	-54.069	-37.610
2000	9.316	76.718	15.526	-54.123	-35.777

$\text{NdI}_3(\text{c,l})$
Neodymium triiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.600	55.100	0	-152.800	-151.716
400	25.008	62.247	2.480	-158.797	-151.107
600	26.921	72.767	7.683	-173.668	-142.471
800	28.533	80.736	13.230	-172.452	-132.252
847	28.897	82.375	14.580	-172.154	-129.898
847	27.980	86.307	17.910	-168.824	-129.898
1000	27.980	90.953	22.191	-168.074	-122.935
1060	27.980	92.584	23.870	-167.826	-120.235
1060	37.200	101.942	33.790	-157.906	-120.235
1200	37.200	106.557	38.998	-156.828	-115.334

*Entropy and heat capacity at 298 K estimated.
847 K, transition point; $\Delta H^\circ = 3.330$
1060 K, melting point; $\Delta H^\circ = 9.920$

$\text{NdI}_3(\text{g})$
Neodymium triiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.498	102.900	0	-87.600	-100.767
400	19.740	108.665	1.999	-94.078	-104.955
600	20.218	116.757	5.993	-110.158	-105.355
800	20.693	122.641	10.086	-110.396	-103.720
1000	21.053	127.300	14.263	-110.802	-102.010
1200	21.273	131.160	18.498	-112.128	-100.158
1400	21.371	134.448	22.764	-114.417	-97.976
1600	21.380	137.303	27.040	-114.985	-95.596
1800	21.333	139.819	31.312	-115.567	-93.138
2000	21.254	142.062	35.571	-116.170	-90.608

$\text{NiI}(\text{g})$
Nickel monoiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.754	64.558	0	59.000	46.019
400	9.001	67.166	.904	56.642	41.716
600	9.385	70.894	2.746	50.785	36.030
800	9.581	73.625	4.646	50.250	31.204
1000	9.642	75.771	6.569	49.758	26.494
1200	9.648	77.530	8.499	49.206	21.900
1400	9.656	79.017	10.429	48.576	17.398
1600	9.698	80.309	12.363	47.859	12.992
1800	9.787	81.456	14.311	42.961	8.852
2000	9.924	82.494	16.281	42.152	5.106

$\text{NiI}_2(\text{c})$
Nickel diiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.500	33.150	0	-18.700	-18.179
300	18.513	33.265	.034	-18.702	-18.176
400	19.077	38.672	1.915	-22.645	-17.853
500	19.438	42.972	3.843	-32.945	-15.680
600*	19.618	46.534	5.797	-32.670	-12.256

*Vaporizes with decomposition above 600 K.

$\text{PbI}(\text{g})$
Lead monoiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.880	66.917	0	25.750	14.555
400	8.934	69.535	.907	23.404	10.862
600	8.987	73.168	2.700	17.632	6.355
800	9.020	75.758	4.501	15.935	3.064
1000	9.050	77.774	6.308	15.420	-.097
1200	9.083	79.427	8.121	14.936	-3.150
1400	9.127	80.831	9.942	14.476	-6.138
1600	9.186	82.053	11.773	14.025	-9.073
1800	9.261	83.139	13.617	13.584	-11.908
2000	9.349	84.119	15.478	13.158	-14.718

$\text{PbI}_2(\text{c,l})$
Lead diiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.540	41.787	0	-41.920	-41.484
300	18.550	41.902	.034	-41.922	-41.482
400	18.847	47.286	1.907	-45.864	-41.186
600	20.008	55.090	5.764	-55.780	-35.658
683	21.006	57.742	7.463	-56.577	-32.739
683	25.950	65.941	13.063	-50.977	-32.739
800	25.950	70.044	16.099	-49.842	-29.704
900	25.950	73.100	18.694	-48.863	-27.244
1000	25.950	75.834	21.289	-47.879	-24.898
1100	25.950	78.308	23.884	-46.890	-22.656

683 K, melting point; $\Delta H^\circ = 5.60$
1105 K, boiling point to $\text{PbI}_2(\text{g})$; $\Delta H^\circ = 28.34$

$\text{PbI}_2(\text{g})$
Lead diiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	13.770	85.908	0	-0.760	-13.479
400	13.831	89.964	1.406	-5.205	-17.598
600	13.875	95.582	4.178	-16.206	-20.379
800	13.890	99.576	6.954	-17.827	-21.314
1000	13.897	102.677	9.733	-18.275	-22.137
1200	13.901	105.211	12.513	-18.700	-22.865
1400	13.904	107.354	15.294	-19.111	-23.535
1600	13.905	109.211	18.074	-19.526	-24.161
1800	13.906	110.849	20.856	-19.945	-24.690
2000	13.907	112.314	23.637	-20.371	-25.195

*Data except enthalpy of formation at 298 K estimated.

$\text{PbI}_4(\text{g})$
Lead tetraiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	25.409	111.411	0	-53.649	-65.696
400	25.595	118.908	2.599	-62.097	-69.427
600	25.726	129.316	7.733	-83.151	-66.460
800	25.773	136.724	12.884	-84.197	-60.525
1000	25.794	142.478	18.041	-84.076	-54.624
1200	25.806	147.182	23.201	-83.937	-48.743
1400	25.813	151.160	28.363	-83.788	-42.897
1600	25.818	154.608	33.526	-83.647	-37.087
1800	25.821	157.649	38.690	-83.517	-31.250
2000	25.823	160.369	43.855	-83.398	-25.448

*Data estimated.

$\text{PrI}_3(\text{c,l})$
Praseodymium triiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.800	54.700	0	-156.400	-155.026
400	25.200	61.914	2.504	-162.369	-154.321
600	27.100	72.511	7.743	-177.176	-145.527
800	28.600	80.508	13.310	-175.911	-135.162
1000	30.000	87.040	19.170	-174.574	-125.121
1011	30.100	87.368	19.500	-174.500	-124.578
1011	34.000	99.930	32.200	-161.800	-124.578
1200	34.000	105.757	38.626	-160.481	-117.715

*Data estimated except enthalpy of formation at 298 K and temperature and enthalpy of fusion. 1011 K, melting point; $\Delta H^\circ = 12.70$

$\text{PrI}_3(\text{g})$
Praseodymium triiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.494	102.791	0	-90.600	-103.565
400	19.713	108.552	1.997	-97.076	-107.684
600	20.134	116.622	5.980	-113.139	-107.956
800	20.599	122.478	10.054	-113.368	-106.194
1000	21.003	127.120	14.216	-113.728	-104.355
1200	21.303	130.977	18.448	-114.859	-102.357
1400	21.489	134.276	22.729	-117.006	-99.960
1600	21.576	137.153	27.037	-117.493	-97.496
1800	21.586	139.695	31.355	-117.979	-94.966
2000	21.543	141.968	35.668	-118.478	-92.368

$\text{PuI}_3(\text{c,l})$
Plutonium triiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	26.730	51.200	0	-138.600	-137.450
400	27.300	59.125	2.748	-145.328	-136.827
600	28.210	70.351	8.292	-160.402	-127.775
800	29.200	78.602	14.032	-159.559	-117.056
1000	30.180	85.223	19.970	-158.817	-106.537
1050	30.420	86.701	21.485	-158.487	-103.933
1050	34.000	98.130	33.485	-146.487	-103.933
1200	34.000	102.670	38.585	-144.946	-97.959
1400	34.000	107.911	45.385	-142.898	-90.288

*Data except enthalpy of formation at 298 K estimated. 1050 K, melting point; $\Delta H^\circ = 12.0$

$\text{SbI}_3(\text{c,l,g})$
Antimony triiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.440	52.320	0	-24.000	-23.941
300	23.500	52.465	.040	-24.007	-23.943
400	25.400	59.490	2.490	-29.927	-23.690
444	26.400	62.193	3.630	-30.332	-22.979
444	34.400	74.468	9.080	-24.882	-22.979
500	34.400	78.554	11.010	-39.311	-21.393
600	34.400	84.826	14.450	-37.856	-17.952
667	34.400	88.469	16.755	-36.893	-15.779
667	19.803	112.634	32.873	-20.775	-15.779
700	19.810	113.590	33.527	-20.787	-15.530
800	19.820	116.240	35.509	-20.842	-14.782
900	19.830	118.570	37.492	-20.936	-14.013
1000	19.840	120.660	39.476	-25.808	-12.736

*Heat capacity at 298 K estimated. 444 K, melting point; $\Delta H^\circ = 5.450$ 667 K, boiling point; $\Delta H^\circ = 16.118$

$\text{SbI}_3(\text{g})$
Antimony triiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.540	96.770	0	1.600	-11.594
300	19.540	96.890	.036	1.589	-11.674
400	19.680	102.540	1.998	-4.819	-15.802
500	19.750	106.940	3.970	-20.751	-17.026
600	19.790	110.540	5.947	-20.760	-16.283
700	19.810	113.590	7.927	-20.787	-15.530
800	19.820	116.240	9.909	-20.842	-14.782
900	19.830	118.570	11.892	-20.936	-14.013
1000	19.840	120.660	13.876	-25.808	-12.736

$\text{SiI}(\text{g})$
Silicon monoiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	9.330	60.646	0	74.959	62.357
400	9.617	63.437	.968	72.813	58.151
600	9.603	67.345	2.896	67.416	52.505
800	9.477	70.090	4.803	67.227	47.561
1000	9.387	72.194	6.689	66.960	42.684
1200	9.335	73.901	8.561	66.643	37.848
1400	9.307	75.337	10.425	66.290	33.082
1600	9.296	76.579	12.285	65.905	28.350
1800	9.296	77.674	14.144	53.490	24.515
2000	9.303	78.654	16.004	53.211	21.305

$\text{SiI}_2(\text{g})$
Silicon diiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	13.055	76.688	0	22.100	8.853
400	13.407	80.580	1.350	17.738	4.539
600	13.677	86.078	4.063	6.918	1.319
800	13.777	90.028	6.810	6.669	-.508
1000	13.825	93.108	9.571	6.373	-2.260
1200	13.851	95.631	12.339	6.044	-3.965
1400	13.866	97.767	15.111	5.688	-5.600
1600	13.877	99.620	17.885	5.304	-7.202
1800	13.884	101.254	20.661	-7.110	-7.904
2000	13.889	102.718	23.438	-7.392	-7.984

*Data except enthalpy of formation at 298 K estimated.

$\text{SiI}_3(\text{g})$
Silicon triiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	18.449	90.391	0	8.440	-4.754
400	19.029	95.904	1.912	2.042	-8.966
600	19.480	103.722	5.772	-13.839	-9.471
800	19.648	109.352	9.687	-13.819	-8.017
1000	19.727	113.746	13.625	-13.843	-6.557
1200	19.771	117.347	17.575	-13.898	-5.104
1400	19.798	120.397	21.532	-13.979	-3.628
1600	19.815	123.042	25.494	-14.089	-2.155
1800	19.827	125.376	29.458	-26.232	.181
2000	19.835	127.466	33.424	-26.244	3.110

*Data estimated.

$\text{SiI}_4(\text{c,l,g})$
Silicon tetraiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	25.821	61.700	0	-45.300	-45.802
394	27.820	69.140	2.561	-53.369	-45.755
394	39.135	81.080	7.261	-48.669	-45.755
400	39.198	81.706	7.510	-48.698	-45.707
576	40.933	96.283	14.553	-67.028	-39.394
576	25.283	115.811	25.797	-55.784	-39.394
600	25.333	116.854	26.410	-55.746	-38.706
800	25.547	124.176	31.501	-55.451	-33.069
1000	25.648	129.888	36.621	-55.197	-27.495
1200	25.704	134.570	41.757	-54.974	-21.986
1400	25.738	138.535	46.902	-54.778	-16.498
1600	25.760	141.973	52.052	-54.613	-11.053
1800	25.776	145.009	57.205	-66.483	-4.784
2000	25.786	147.725	62.362	-66.224	2.054

393.65 K, melting point; $\Delta H^\circ = 4.70$

575.8 K, boiling point; $\Delta H^\circ = 11.244$

$\text{SiI}_4(\text{g})$
Silicon tetraiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.037	99.506	0	-26.400	-38.174
400	24.764	106.684	2.490	-34.818	-41.818
600	25.333	116.854	7.510	-55.746	-38.706
800	25.547	124.176	12.601	-55.451	-33.069
1000	25.648	129.888	17.721	-55.197	-27.495
1200	25.704	134.570	22.857	-54.974	-21.986
1400	25.738	138.535	28.002	-54.778	-16.498
1600	25.760	141.973	33.152	-54.613	-11.053
1800	25.776	145.009	38.305	-66.483	-4.784
2000	25.786	147.725	43.462	-66.224	2.054

$\text{SnI}_2(\text{c,l})$
Tin diiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.750	40.270	0	-34.390	-34.472
300*	18.760	40.386	.035	-34.391	-34.472
400	19.550	45.893	1.950	-38.315	-34.354
500	20.330	50.338	3.945	-48.549	-32.392
593	21.100	53.869	5.870	-49.784	-29.132
593	23.900	61.120	10.170	-45.484	-29.132
600	23.900	61.400	10.337	-45.428	-28.939
700	23.900	65.084	12.727	-44.621	-26.254
800	23.900	68.276	15.117	-43.812	-23.686
900	23.900	71.091	17.507	-43.006	-21.219
1000	23.900	73.609	19.897	-42.201	-18.841

*Heat capacities above 298 K estimated.

593 K, melting point; $\Delta H^\circ = 4.30$

980 K, boiling point; $\Delta H^\circ(\text{at } 298 \text{ K}) = 30.76$

$\text{SnI}_4(\text{c,l,g})$
Tin tetraiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	31.540	67.570	0	-51.460	-51.406
300*	31.570	67.770	.060	-51.460	-51.405
400	32.740	77.020	3.280	-59.251	-51.100
418	32.680	78.470	3.870	-59.480	-50.730
418	40.100	89.470	8.470	-54.880	-50.730
500	40.100	96.660	11.760	-74.518	-48.086
600	40.100	103.970	15.770	-74.676	-42.625
628	40.100	105.800	16.890	-74.251	-41.144
628	25.670	125.650	29.355	-61.786	-41.144
700	25.710	128.430	31.205	-61.723	-38.774
800	25.740	131.870	33.780	-61.630	-35.501
900	25.760	134.900	36.355	-61.543	-32.239
1000	25.770	137.620	38.930	-61.458	-28.994

*Data 300-418 K extrapolated.

418 K, melting point; $\Delta H^\circ = 4.60$

628 K, boiling point; $\Delta H^\circ = 12.465$

$\text{SnI}_4(\text{g})$
Tin tetraiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	25.170	106.660	0	-30.520	-42.120
300	25.180	106.820	.045	-30.535	-42.195
400	25.460	114.100	2.580	-39.011	-45.692
500	25.590	119.800	5.135	-60.203	-45.341
600	25.660	124.470	7.695	-61.811	-42.060
700	25.710	128.430	10.265	-61.723	-38.774
800	25.740	131.870	12.840	-61.630	-35.501
900	25.760	134.900	15.415	-61.543	-32.239
1000	25.770	137.620	17.990	-61.458	-28.994

$\text{SrI}(\text{g})$
Strontium monoiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.875	65.033	0	7.288	-4.237
400	8.940	67.652	.908	4.927	-8.040
600	9.005	71.290	2.703	-.927	-12.743
800	9.048	73.887	4.508	-1.660	-16.578
1000	9.085	75.910	6.322	-2.728	-20.166
1200	9.118	77.569	8.142	-5.480	-23.277
1400	9.151	78.977	9.969	-6.243	-26.182
1600	9.184	80.202	11.802	-7.004	-29.980
1800	9.221	81.285	13.643	-39.992	-28.816
2000	9.263	82.259	15.491	-40.065	-27.571

$\text{SrI}_2(\text{c,l})$
Strontium diiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	18.630	38.031	0	-134.200	-133.536
400	19.300	43.600	1.932	-138.135	-133.161
600	20.620	51.675	5.924	-147.999	-127.494
800	21.930	57.786	10.179	-147.183	-120.781
811	22.000	58.086	10.420	-147.139	-120.419
811	26.300	63.881	15.120	-142.439	-120.419
1000	26.300	69.391	20.091	-141.057	-115.418
1200	26.300	74.186	25.351	-141.277	-110.153
1400	26.300	78.240	30.611	-139.518	-105.103
1600	26.300	81.752	35.871	-137.765	-100.306
1800	26.300	84.849	41.131	-168.250	-92.864
2000	26.300	87.620	46.391	-165.831	-84.617

*Heat capacities extrapolated 270-811 K.

811 K, melting point; $\Delta H^\circ = 4.70$

$\text{SrI}_2(\text{g})$
Strontium diiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	14.674	81.128	0	-65.700	-77.885
400	14.774	85.456	1.500	-70.067	-81.835
600	14.845	91.463	4.464	-80.959	-84.327
800	14.871	95.738	7.436	-81.426	-85.385
1000	14.883	99.057	10.411	-82.237	-86.264
1200	14.889	101.771	13.388	-84.740	-86.718
1400	14.893	104.067	16.366	-85.263	-87.006
1600	14.895	106.056	19.345	-85.791	-87.218
1800	14.897	107.810	22.325	-118.556	-84.500
2000	14.898	109.380	25.304	-118.418	-80.724

*Data except enthalpy of formation at 298 K estimated.

$\text{TbI}_3(\text{c,l})$
Terbium triiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	23.400	54.900	0	-145.000	-143.731
300	23.249	55.045	.043	-145.006	-143.724
400	24.825	61.985	2.459	-151.033	-143.054
600	25.885	72.325	7.566	-165.924	-134.277
800	26.144	79.790	12.757	-164.934	-123.873
1000	28.906	85.841	18.190	-163.855	-113.733
1080	31.519	88.157	20.600	-163.230	-109.740
1080	29.730	88.324	20.780	-163.050	-109.740
1100	29.730	88.870	21.375	-162.906	-108.754
1200	29.730	91.456	24.348	-162.210	-103.867
1228	29.730	92.142	25.180	-162.024	-102.509
1228	37.600	103.323	38.910	-148.294	-102.509

*Data at 298 K estimated.

1080 K, transition point; $\Delta H^\circ = 0.180$

1228 K, melting point; $\Delta H^\circ = 13.730$

$\text{TbI}_3(\text{g})$
Terbium triiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.479	102.994	0	-79.600	-92.670
400	19.695	108.750	1.996	-96.096	-96.823
600	20.068	116.805	5.971	-102.119	-97.160
800	20.479	122.634	10.026	-102.264	-95.479
1000	20.845	127.245	14.160	-102.485	-93.768
1200	21.113	131.071	18.357	-102.801	-91.996
1400	21.274	134.339	22.598	-103.257	-90.151
1600	21.343	137.185	26.861	-104.922	-88.208
1800	21.344	139.699	31.130	-108.073	-85.842
2000	21.302	141.946	35.395	-108.788	-83.334

$\text{ThI}_4(\text{c,l})$
Thorium tetraiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	30.270	61.000	0	-160.566	-158.397
400	31.320	70.060	3.142	-168.493	-157.351
600	32.450	82.990	9.530	-188.329	-145.395
800	33.250	92.440	16.102	-186.830	-131.308
839	33.390	94.030	17.402	-186.531	-128.608
839	42.000	107.730	28.902	-175.031	-128.608
1000	42.000	115.110	35.664	-172.438	-119.940
1200	42.000	122.760	44.064	-169.298	-109.729
1400	42.000	129.240	52.464	-166.243	-100.048

*Data except enthalpy of formation at 298 K estimated.
839 K, melting point; $\Delta H^\circ = 11.50$

$\text{TiI}(\text{g})$
Titanium monoiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	9.192	64.225	0	65.500	52.672
400	9.671	66.996	.962	63.237	48.411
600	10.239	71.040	2.961	57.722	42.712
800	10.451	74.021	5.033	57.491	37.745
1000	10.517	76.361	7.131	57.189	32.845
1200	10.545	78.281	9.238	55.830	28.046
1400	10.573	79.909	11.349	55.569	23.434
1600	10.611	81.323	13.468	55.232	18.867
1800	10.656	82.575	15.594	54.800	14.345
2000	10.705	83.700	17.730	50.829	9.975

*Data estimated.

$\text{TiI}_2(\text{c,g})$
Titanium diiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	20.609	29.300	0	-63.600	-61.877
400	20.786	35.381	2.108	-67.315	-61.175
600	21.134	43.875	6.300	-76.845	-55.004
800	21.482	50.002	10.562	-75.785	-47.877
1000	21.830	54.833	14.893	-74.759	-41.017
1200	22.178	58.844	19.294	-74.732	-34.329
1358	22.453	61.606	22.820	-73.796	-29.065
1358	15.104	99.745	74.620	-21.996	-29.065
1400	15.037	100.199	75.247	-22.062	-29.280
1600	15.177	102.216	78.268	-22.410	-30.288
1800	15.348	104.013	81.320	-22.833	-31.250
2000	15.535	105.640	84.408	-26.771	-32.063

*Data except enthalpy of formation at 298 K estimated.
1358.2 K, sublimation point; $\Delta H^\circ = 51.80$

$\text{TiI}_2(\text{g})$
Titanium diiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	14.476	77.335	0	-4.700	-17.299
400	14.659	81.618	1.485	-9.038	-21.392
600	14.793	87.593	4.433	-19.812	-24.202
800	14.843	91.856	7.397	-20.050	-25.625
1000	14.860	95.172	10.369	-20.383	-26.980
1200	14.939	97.889	13.350	-21.776	-28.227
1400	15.037	100.199	16.347	-22.062	-29.280
1600	15.177	102.216	19.368	-22.410	-30.288
1800	15.348	104.013	22.420	-22.833	-31.250
2000	15.535	105.640	25.508	-26.771	-32.063

*Data except enthalpy of formation at 298 K estimated.

$\text{TiI}_3(\text{c}, \text{g})$
Titanium triiodide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	27.910	45.500	0	-80.880	-79.849
400	28.090	53.726	2.852	-86.449	-79.326
600	28.430	65.180	8.504	-100.727	-71.116
800	28.780	73.408	14.225	-99.107	-61.485
1000	29.130	79.868	20.016	-97.526	-52.261
1092	29.290	82.438	22.704	-96.909	-48.135
1092	20.613	117.705	61.216	-58.297	-48.135
1200	20.599	119.647	63.443	-59.381	-47.080
1400	20.574	122.820	67.560	-59.458	-45.023
1600	20.551	125.566	71.672	-59.628	-42.951
1800	20.530	127.986	75.781	-59.910	-40.853
2000	20.512	130.148	79.885	-63.752	-38.618

*Data except enthalpy of formation at 298 K estimated.
1092 K, sublimation point; $\Delta \text{H}^\circ = 38.512$

$\text{TiI}_3(\text{g})$
Titanium triiodide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	19.311	91.294	0	-35.900	-48.523
400	20.082	97.092	2.011	-42.310	-52.534
600	20.569	105.353	6.089	-58.162	-52.655
800	20.641	111.284	10.213	-58.140	-50.818
1000	20.625	115.889	14.340	-58.222	-48.979
1200	20.599	119.647	18.463	-59.381	-47.080
1400	20.574	122.820	22.580	-59.458	-45.023
1600	20.551	125.566	26.692	-59.628	-42.951
1800	20.530	127.986	30.801	-59.911	-40.853
2000	20.512	130.148	34.905	-63.752	-38.618

*Data estimated.

$\text{TiI}_4(\text{c}, \text{l}, \text{g})$
Titanium tetraiodide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	30.030	58.830	0	-89.800	-88.606
379	34.066	66.439	2.570	-89.954	-88.261
379	45.900	72.389	4.825	-87.699	-88.261
400	45.900	74.864	5.789	-95.030	-88.042
428	45.900	77.970	7.075	-95.001	-87.553
428	37.500	87.877	11.315	-90.761	-87.553
600	37.500	100.545	17.765	-109.191	-80.248
651	37.500	103.622	19.690	-108.538	-77.793
651*	25.628	123.290	32.500	-95.728	-77.793
800	25.698	128.571	36.317	-95.641	-73.711
1000	25.747	134.311	41.462	-95.610	-68.231
1200	25.773	139.008	46.615	-96.647	-62.717
1400	25.789	142.982	51.771	-96.595	-57.066
1600	25.799	146.426	56.930	-96.632	-51.416
1800	25.806	149.465	62.090	-96.780	-45.759
2000	25.811	152.185	67.252	-100.483	-39.981

*Data for gas estimated.

379 K, transition point; $\Delta \text{H}^\circ = 2.255$

428 K, melting point; $\Delta \text{H}^\circ = 4.240$

651.3 K, boiling point; $\Delta \text{H}^\circ = 12.810$

$\text{TiI}_4(\text{g})$
Titanium tetraiodide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	24.917	103.479	0	-66.270	-78.388
400	25.309	110.864	2.560	-74.729	-82.141
600	25.595	121.191	7.657	-95.769	-79.213
800	25.698	128.571	12.787	-95.641	-73.711
1000	25.747	134.311	17.932	-95.610	-68.231
1200	25.773	139.008	23.085	-96.647	-62.717
1400	25.789	142.982	28.241	-96.595	-57.066
1600	25.799	146.426	33.400	-96.632	-51.416
1800	25.806	149.465	38.560	-96.780	-45.759
2000	25.811	152.185	43.722	-100.483	-39.981

*Data except enthalpy of formation at 298 K estimated.

TlI(c,l)
Thallium iodide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	12.740	30.520	0	-29.600	-29.988
400	12.890	34.260	1.295	-31.556	-30.052
451	13.060	35.820	1.957	-31.723	-29.848
451	12.800	36.300	2.175	-31.505	-29.848
600	14.480	40.190	4.210	-37.360	-27.721
715	15.770	42.830	5.945	-36.956	-25.906
715	17.200	47.750	9.460	-33.441	-25.906
800	17.200	49.680	10.925	-32.965	-25.038
1000	17.200	53.520	14.365	-31.849	-23.182
1200	17.200	56.660	17.805	-30.737	-21.563

451 K, transition point; ΔH° = 0.218

714.8 K, melting point; ΔH° = 3.515

TmI₃(g)
Thulium triiodide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	19.464	102.697	0	-78.800	-91.731
400	19.641	108.445	1.993	-85.261	-95.842
600	19.768	116.438	5.936	-101.244	-96.112
800	19.813	122.132	9.895	-101.343	-94.388
1000	19.834	126.556	13.860	-101.556	-92.619
1200	19.846	130.173	17.828	-101.854	-90.812
1400	19.853	133.233	21.798	-102.230	-88.932
1600	19.857	135.884	25.769	-102.685	-87.010
1800	19.860	138.223	29.741	-103.217	-85.025
2000	19.863	140.316	33.713	-108.007	-82.573

UI₃(c)
Uranium triiodide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	26.830	53.000	0	-110.100	-109.910
300	26.840	53.170	.050	-110.098	-109.909
400	27.420	60.970	2.763	-115.829	-109.652
500	28.000	67.150	5.534	-131.071	-106.666
600	28.580	72.300	8.363	-130.385	-101.848
700	29.160	76.750	11.250	-110.098	-109.909
800	29.740	80.680	14.195	-129.074	-92.534

*Data except enthalpy of formation and entropy at 298 K estimated.

UI₄(c,l)
Uranium tetraiodide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	30.200	63.000	0	-122.400	-121.054
300	30.270	63.190	.056	-122.404	-121.045
400	32.800	72.290	3.226	-130.264	-120.295
500	34.100	79.760	6.577	-150.685	-115.867
600	34.920	86.060	10.031	-149.822	-108.989
700	35.500	91.480	13.553	-148.966	-102.245
779	35.880	95.300	16.373	-148.314	-97.009
779	39.600	107.110	25.573	-139.114	-97.009
800	39.600	108.160	26.404	-138.870	-95.876

*Entropy and heat capacity at 298 K estimated.

779 K, melting point; ΔH° = 9.20

ZrI(g)
Zirconium monoiodide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	8.823	65.868	0	96.300	83.578
400	8.924	68.477	.904	93.955	79.363
600	9.025	72.116	2.700	88.185	73.833
800	9.089	74.722	4.512	87.649	69.128
1000	9.142	76.756	6.335	87.038	64.568
1200	9.190	78.427	8.168	85.496	60.188
1400	9.237	79.847	10.011	85.040	56.006
1600	9.282	81.083	11.863	84.524	51.894
1800	9.327	82.179	13.724	83.951	47.847
2000	9.371	83.164	15.594	83.319	43.869

*Data except enthalpy of formation at 298 K estimated.

ZrI₂(c,l,g)
Zirconium diiodide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	22.500	35.900	0	-66.400	-66.049
400	22.710	42.660	2.346	-69.901	-65.849
600	23.090	51.951	6.928	-79.093	-60.793
700	23.290	55.525	9.247	-78.386	-57.798
700	23.290	64.095	15.247	-72.386	-57.798
800	25.370	67.320	17.663	-71.606	-55.766
1000	29.540	73.429	23.155	-69.452	-52.038
1200	33.700	79.183	29.479	-67.411	-48.764
1295	35.680	81.834	32.785	-65.626	-47.353
1295	13.898	102.703	59.817	-38.594	-47.353
1400	13.900	103.783	61.272	-38.828	-48.050
1600	13.903	105.639	64.053	-39.328	-49.333
1800	13.904	107.277	66.833	-39.899	-50.553
2000	13.906	108.742	69.614	-40.539	-51.703

*Data except enthalpy of formation at 298 K estimated.

700 K, melting point; ΔH° = 6.00

1295.3 K, boiling point; ΔH° = 27.032

$\text{ZrI}_2(\text{g})$
Zirconium diiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	13.681	82.380	0	-20.400	-33.907
400	13.781	86.416	1.399	-24.848	-38.296
600	13.852	92.020	4.164	-35.857	-41.598
800	13.878	96.009	6.937	-36.332	-43.443
1000	13.890	99.107	9.714	-36.893	-45.157
1200	13.896	101.640	12.493	-38.397	-46.699
1400	13.900	103.783	15.272	-38.828	-48.050
1600	13.903	105.639	18.053	-39.328	-49.333
1800	13.904	107.277	20.833	-39.899	-50.553
2000	13.906	108.742	23.614	-40.539	-51.703

*Data except enthalpy of formation at 298 K estimated.

$\text{ZrI}_3(\text{c})$
Zirconium triiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	24.813	48.897	0	-93.600	-92.986
300	24.832	49.051	.046	-93.601	-92.981
400	25.300	56.267	2.556	-99.409	-92.557
500	25.400	61.923	5.091	-114.898	-89.363
600	25.500	66.564	7.636	-114.390	-84.306
700	25.550	70.499	10.189	-113.899	-79.331
800	25.600	73.914	12.746	-113.428	-74.425
900	25.650	76.932	15.309	-112.976	-69.576

*Data except enthalpy of formation at 298 K estimated.

$\text{ZrI}_3(\text{g})$
Zirconium triiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	19.317	95.047	0	-30.800	-43.945
400	19.557	100.762	1.981	-37.264	-48.130
600	19.730	108.731	5.914	-53.313	-48.528
800	19.792	114.417	9.867	-53.507	-46.906
1000	19.821	118.837	13.828	-53.789	-45.225
1200	19.837	122.452	17.794	-55.014	-43.428
1400	19.846	125.511	21.763	-55.166	-41.485
1600	19.852	128.161	25.733	-55.390	-39.515
1800	19.857	130.500	29.703	-55.688	-37.517
2000	19.860	132.592	33.675	-56.056	-35.478

*Data except enthalpy of formation at 298 K estimated.

$\text{ZrI}_4(\text{c}, \text{g})$
Zirconium tetraiodide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	29.900	59.800	0	-116.800	-115.299
400	30.630	68.700	3.087	-124.756	-114.476
600	31.610	81.320	9.316	-144.716	-102.933
703	32.050	86.340	12.583	-144.026	-95.840
703	25.674	128.495	42.201	-114.408	-95.840
800	25.710	131.831	44.703	-114.377	-93.268
1000	25.754	137.573	49.850	-114.377	-87.992
1200	25.778	142.271	55.003	-115.323	-82.658
1400	25.793	146.246	60.161	-115.196	-77.222
1600	25.802	149.691	65.320	-115.145	-71.803
1800	25.809	152.731	70.481	-115.168	-66.388
2000	25.813	155.450	75.644	-115.265	-60.961

*Heat capacity at 298 K estimated.

702.6 K, sublimation point; $\Delta H^\circ = 29.618$

$\text{ZrI}_4(\text{g})$
Zirconium tetraiodide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.997	106.703	0	-84.900	-97.383
400	25.355	114.107	2.567	-93.376	-101.259
600	25.616	124.447	7.669	-114.463	-98.556
800	25.710	131.831	12.803	-114.377	-93.268
1000	25.754	137.573	17.950	-114.377	-87.992
1200	25.778	142.271	23.103	-115.323	-82.658
1400	25.793	146.246	28.261	-115.196	-77.222
1600	25.802	149.691	33.420	-115.145	-71.803
1800	25.809	152.731	38.581	-115.168	-66.388
2000	25.813	155.450	43.744	-115.265	-60.961

Nitrides

Units: T is in K; Cp° and S° are in cal/mol·K; H° - H₂₉₈°, ΔHf° and ΔGf° are in kcal/mol.

Sources of data from general references are listed below, with the reference(s) given immediately after each formula:

AlN(c) (7), AlN(g) (33), BN(hex) (30), BN(g) (7, 30), Ba₃N₂(c) (1, 26), BeN(g) (7), Be₃N₂(α) (26), CN(g) (7, 27), C₂N₂(g) (7, 27), C₄N₂(g) (7), Ca₃N₂(c) (26), CeN(c) (1), Co₃N(c) (1), CrN(c) (7), CrN(g) (7), Cr₂N(c) (7), Fe₂N(c) (17), Fe₄N(c) (17, 31), GaN(c) (30), InN(c) (1), LaN(c) (20, 29), LiN(g) (7), MgN(g) (7), Mg₃N₂(c) (26), Mn₄N(c) (31), Mn₅N₂(c) (1), MoN_{0.5}(c) (2), NaN₃(c) (33), NbN(c) (32), Nb₂N(c) (28, 32), PN(g) (7, 30), P₃N₅(c) (7, 30), ScN(c) (1), SiN(g) (7), Si₂N(g) (7), Si₃N₄(a) (7, 30), Sr₃N₂(c) (1, 26), TaN(c) (1, 32), ThN(c) (20, 33), Th₃N₄(c) (20, 33), TiN(c) (7), UN(c) (33), YN(c) (1), Zn₃N₂(c) (17, 30), ZrN(c) (7), ZrN(g) (7).

Additional sources:

AlN(c):

Mah, A. D., E. G. King, W. W. Weller, and A. U. Christensen. Thermodynamic Properties of Aluminum Nitride. BuMines RI 5716, 1961, 8 pp.

BN(hex):

McDonald, R. A., and D. R. Stull. The Heat Content and Heat Capacity of Boron Nitride From 298 to 1689° K. J. Phys. Chem., v. 65, 1961, p. 1918.

Prophet, H., and D. R. Stull. Heat Capacities of Boron Nitride and Aluminum Oxide Using an Arc-Image Furnace. J. Chem. and Eng. Data, v. 8, 1963, pp. 78-81.

Sirota, N. N., N. A. Kofman, and Zh. K. Petrova. Temperaturnaya Zavisimost Teploemkosti i Nekotorykh Drugikh Termodinamicheskikh Velichin Grafitodobnoi Modifikatsii Nitrida Bora v Oblasti 5-350° K (Temperature Dependence of the Heat Capacity and Some Other Thermodynamic Values of Boron Nitride in the 5-350° K Range). Vestsi Akad. Navuk B. SSR, Ser. Fiz. Mat. Navuk, No. 6, 1975, pp. 75-78.

Be₃N₂(a):

Douglas, I. B., and W. H. Payne. Measured Enthalpy and Derived Thermodynamic Properties of Alpha Beryllium Nitride, Be₃N₂, From 273 to 1200 K. J. Res. NBS, v. 73A, 1969, pp. 471-477.

Furukawa, G. T., and M. L. Reilly. Heat Capacity and Thermodynamic Properties of α-Beryllium Nitride, Be₃N₂, From 20 to 315 K. J. Res. NBS, v. 74A, 1970, pp. 617-629.

Ca₃N₂(c):

Rossini, F. D., D. D. Wagman, W. H. Evans, S. Levine, and I. Jaffe. Selected Values of Chemical Thermodynamic Properties. NBS Circ. 500, 1952, 1268 pp.

Sato, S. (Heat of Formation and Specific Heat of Calcium Nitride.) Bull. Inst. Phys. and Chem. Res., Tokyo, v. 18, 1939, pp. 548-557.

ErN(c):

Brown, R. C., and N. J. Clark. Knudsen Cell Vaporization of Rare Earth Nitrides: Enthalpy of Vaporization of $\text{HoN}_{0.98}$. High Temp. Sci., v. 7, 1975, pp. 131-141.

_____. Knudsen Cell Vaporization of Rare Earth Nitrides: Enthalpy of Vaporization of SmN and YbN. High Temp. Sci., v. 10, 1978, pp. 71-84.

 $\text{Fe}_2\text{N(c)}$:

Rossini, F. D., D. D. Wagman, W. H. Evans, S. Levine, and I. Jaffe. Selected Values of Chemical Thermodynamic Properties. NBS Circ. 500, 1952, 1268 pp.

GaN(c):

Koshchenko, V. I., A. F. Demidenko, L. D. Sabanova, V. E. Yachmenev, Yu. M. Gran, and A. F. Radchenko. Temperature Dependence of the Thermodynamic Properties of Gallium Nitride at 5-300 K. Inorg. Mater. (Engl. Transl.), v. 15, 1979, pp. 1329-1330.

Thurmond, C. D., and R. A. Logan. The Equilibrium Pressure of N_2 Over GaN. J. Electrochem. Soc., v. 119, 1972, pp. 622-626.

HfN(c):

Litvinenko, V. F., A. S. Bolgar, O. P. Kulik, and O. T. Khorpyakov. High-Temperature Enthalpy and Specific Heat of Hafnium Mononitride. Russ. J. Phys. Chem. (Engl. Transl.), v. 53, 1979, pp. 178-179.

Spencer, P. J. Thermochemical Properties. Ch. in Hafnium: Physico-Chemical Properties of Its Compounds and Alloys, ed. by K. L. Komarek. At. Energy Rev. Spec. Issue No. 8, 1981, pp. 9-56.

 $\text{Li}_3\text{N(c)}$:

Osborne, D. W., and H. E. Flotow. Lithium Nitride (Li_3N): Heat Capacity From 5 to 350 K and Thermochemical Properties to 1086 K. J. Chem. Thermodyn., v. 10, 1978, pp. 675-682.

 $\text{Mg}_3\text{N}_2(\text{c})$:

Douglas, T. B., and A. C. Victor. High-Temperature Heat Contents. Ch. in Preliminary Report on the Thermodynamic Properties of Selected Light-Element Compounds. NBS Rep. 6645, 1960, pp. 19-31.

 $\text{Mn}_4\text{N(c)}$:

Garcia, J., J. Bartolome, D. Gonzalez, R. Navarro, and D. Fruchart. Thermophysical Properties of the Intermetallic Mn_3Mn Perovskites. I. Heat Capacity of the Manganese Nitride Mn_4N . J. Chem. Thermodyn., v. 15, 1983, pp. 465-473.

 $\text{MoN}_{0.5}(\text{c})$:

Mah, A. D. Heats of Combustion and Formation of Molybdenum Subnitride and Chromium Subnitride. BuMines RI 5529, 1960, 7 pp.

 $\text{NaN}_3(\text{c})$:

Carling, W. C., and E. F. Westrum, Jr. Thermophysics of Alkali and Related Azides. I. Heat Capacity of NaN_3 From 5 to 350 K. J. Chem. Thermodyn., v. 8, 1976, pp. 565-573.

Fritzer, H. P., and K. Tokar. Die wahren Molwarmen von Natriumazid (The True Molar Heats of Sodium Azide). Monatsh. Chem., v. 97, 1966, pp. 703-709.

NbN(c):

Paukov, I. E., P. G. Strelkov, V. A. Palitsyn, and E. M. Moroz. Low-Temperature Heat Capacity, Absolute Entropy and Enthalpy of Niobium Nitride Under Standard Conditions. Russ. J. Phys. Chem. (Engl. Transl.), v. 43, 1969, pp. 1461-1462.

PuN(c):

Johnson, G. K., E. H. Van Deventer, O. L. Kruger, and W. N. Hibbard. The Enthalpies of Formation of Plutonium Dioxide and Plutonium Mononitride. J. Chem. Thermodyn., v. 1, 1969, pp. 89-98.

Oetting, F. L. The Chemical Thermodynamic Properties of Nuclear Materials. III. Plutonium Mononitride. J. Chem. Thermodyn., v. 10, 1978, pp. 941-948.

SmN(c):

Brown, R. C., and N. J. Clark. Knudsen Cell Vaporization of Rare Earth Nitrides: Enthalpy of Vaporization of $\text{HoN}_{0.98}$. High Temp. Sci., v. 7, 1975, pp. 131-141.

_____. Knudsen Cell Vaporization of Rare Earth Nitrides: Enthalpy of Vaporization of SmN and YbN. High Temp. Sci., v. 10, 1978, pp. 71-84.

Ta₂N(c):

Fegley, B., Jr. (MA Inst. Tech., Cambridge, MA). Private communication, 1981; available upon request from L. B. Pankratz, BuMines, Albany, OR.

UN(c):

Oetting, F. L., and J. M. Leitnaker. The Chemical Thermodynamic Properties of Nuclear Materials. I. Uranium Mononitride. J. Chem. Thermodyn., v. 4, 1975, pp. 199-211.

$\text{VN}_{0.465}$ (c) and VN(c):

Pankratz, L. B., J. M. Stuve, H. O. Poppleton, and A. D. Mah. Enthalpy and Free Energy of Formation of Vanadium Subnitride ($\text{VN}_{0.465}$), 298° to 1,800° K. BuMines RI 7585, 1971, 13 pp.

YbN(c):

Brown, R. C., and N. J. Clark. Knudsen Cell Vaporization of Rare Earth Nitrides: Enthalpy of Vaporization of $\text{HoN}_{0.98}$. High Temp. Sci., v. 7, 1975, pp. 131-141.

_____. Knudsen Cell Vaporization of Rare Earth Nitrides: Enthalpy of Vaporization of SmN and YbN. High Temp. Sci., v. 10, 1978, pp. 71-84.

AlN(c)
Aluminum nitride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.203	4.800	0	-75.600	-68.188
400	8.709	7.138	.814	-75.750	-65.630
600	10.437	11.037	2.749	-75.798	-60.549
800	11.278	14.170	4.931	-75.752	-55.473
1000	11.655	16.733	7.230	-78.330	-50.220
1200	11.811	18.873	9.578	-78.294	-44.601
1400	11.898	20.701	11.949	-78.257	-38.989
1600	11.994	22.296	14.338	-78.218	-33.383
1800	12.109	23.715	16.749	-78.171	-27.780
2000	12.184	24.995	19.179	-78.115	-22.183

AlN(g)
Aluminum nitride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.736	54.599	0	125.000	117.565
400	8.131	56.932	.809	124.845	115.048
600	8.558	60.321	2.484	124.537	110.216
800	8.763	62.814	4.218	124.135	105.499
1000	8.878	64.783	5.983	121.023	101.083
1200	8.954	66.409	7.767	120.495	97.145
1400	9.010	67.793	9.564	119.958	93.297
1600	9.055	69.000	11.370	119.413	89.522
1800	9.093	70.068	13.185	118.865	85.821
2000	9.127	71.028	15.007	118.314	82.179

BN(hexagonal)
Boron mononitride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	4.715	3.607	0	-60.800	-54.632
400	6.314	5.231	.567	-60.910	-52.507
600	8.369	8.212	2.051	-61.016	-48.278
800	9.717	10.817	3.869	-60.997	-44.027
1000	10.608	13.089	5.908	-60.882	-39.797
1200	11.157	15.076	8.089	-60.718	-35.600
1400	11.455	16.821	10.354	-60.551	-31.423
1600	11.582	18.360	12.660	-60.418	-27.279
1800	11.613	19.726	14.980	-60.342	-23.129
2000	11.626	20.950	17.304	-60.327	-19.007
2200	11.694	22.061	19.634	-60.371	-14.873

BN(g)
Boron mononitride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.039	50.728	0	154.750	146.869
400	7.237	52.822	.726	154.799	144.166
600	7.735	55.851	2.224	154.707	138.862
800	8.126	58.133	3.812	154.496	133.613
1000	8.390	59.976	5.466	154.226	128.424
1200	8.570	61.523	7.163	153.906	123.287
1400	8.701	62.854	8.890	153.535	118.217
1600	8.805	64.023	10.641	153.113	113.191
1800	8.895	65.066	12.411	152.639	108.240
2000	8.978	66.007	14.199	152.118	103.325

Ba₃N₂(c)
Tribarium dinitride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	28.007	36.400	0	-86.800	-70.663
300	28.050	36.573	.052	-86.797	-70.561
400	30.400	44.965	2.974	-86.750	-65.170
500	32.750	52.001	6.132	-87.019	-59.755
600	35.100	58.180	9.524	-87.685	-54.231
700	37.450	63.767	13.152	-87.529	-48.669
800	39.800	68.921	17.014	-87.428	-43.122
900	42.150	73.744	21.112	-87.026	-37.605

*Data except enthalpy of formation at 298 K estimated.

BeN(g)
Beryllium mononitride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	7.192	49.872	0	102.000	94.631
400	7.514	52.029	.749	101.951	92.119
600	8.069	55.188	2.311	101.759	87.242
800	8.414	57.561	3.962	101.502	82.436
1000	8.624	59.463	5.667	101.185	77.706
1200	8.760	61.048	7.407	100.786	73.041
1400	8.856	62.406	9.169	100.298	68.463
1600	8.927	63.594	10.947	96.222	64.043
1800	8.984	64.649	12.739	95.761	60.033
2000	9.031	65.598	14.540	95.299	56.104
2200	9.071	66.460	16.351	94.838	52.206
2400	9.106	67.251	18.168	94.378	48.344

*Data estimated.

$\text{Be}_3\text{N}_2(\alpha)$
 α -Triberyllium dinitride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	15.490	8.226	0	-140.600	-127.376
400	20.139	13.478	1.832	-140.807	-122.823
600	25.569	22.829	6.481	-140.712	-113.828
800	28.041	30.561	11.868	-140.314	-104.932
1000	29.536	36.989	17.635	-139.846	-96.137
1200	30.707	42.480	23.662	-139.442	-87.452
1400	31.552	47.279	29.891	-139.147	-78.787
1600	32.179	51.535	36.267	-149.499	-69.901

$\text{CN}(\text{g})$
Carbon mononitride, cyano (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	6.968	48.406	0	109.000	101.800
400	7.029	50.460	.712	109.109	99.322
600	7.326	53.360	2.145	109.140	94.414
800	7.689	55.518	3.647	109.024	89.520
1000	7.996	57.268	5.216	108.832	84.663
1200	8.235	58.748	6.840	108.600	79.851
1400	8.431	60.033	8.508	108.343	75.080
1600	8.612	61.170	10.212	108.072	70.348
1800	8.794	62.195	11.952	107.798	65.647
2000	8.989	63.131	13.730	107.531	60.979

$\text{C}_2\text{N}_2(\text{g})$
Dicarbon dinitride, cyanogen (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	13.563	57.711	0	73.870	71.128
400	14.771	61.878	1.447	74.111	70.153
600	16.305	68.178	4.565	74.425	68.098
800	17.415	73.028	7.942	74.566	65.964
1000	18.237	77.007	11.512	74.614	63.805
1200	18.833	80.388	15.222	74.612	61.644
1400	19.264	83.325	19.034	74.574	59.485
1600	19.579	85.919	22.920	74.511	57.335
1800	19.815	88.240	26.861	74.423	55.192
2000	19.993	90.337	30.842	74.313	53.061

$\text{C}_4\text{N}_2(\text{g})$
Tetracarbon dinitride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	20.528	69.314	0	127.500	122.117
400	22.664	75.666	2.207	128.005	120.199
600	25.370	85.407	7.030	128.636	116.140
800	27.259	92.979	12.303	128.907	111.927
1000	28.617	99.216	17.898	128.992	107.664
1200	29.582	104.524	23.724	128.982	103.402
1400	30.272	109.139	29.713	128.903	99.142
1600	30.773	113.215	35.820	128.777	94.903
1800	31.145	116.863	42.014	128.604	90.676
2000	31.426	120.159	48.272	128.391	86.475
2200	31.642	123.165	54.580	128.140	82.290
2400	31.813	125.926	60.926	127.847	78.136

$\text{Ca}_3\text{N}_2(\text{c})$
Tricalcium dinitride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	26.500	25.000	0	-103.000	-87.917
300	26.564	25.164	.049	-102.997	-87.820
400	29.400	33.224	2.857	-102.734	-82.796
500	31.548	40.022	5.908	-102.315	-77.863
600	33.436	45.943	9.159	-101.829	-73.010
700	35.201	51.231	12.591	-101.320	-68.263
800	36.900	56.043	16.197	-101.355	-63.487
900	38.560	60.485	19.970	-100.771	-58.744

$\text{CeN}(\text{c})$
Cerium nitride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	9.646	10.600	0	-78.000	-69.209
400	10.679	13.598	1.042	-77.985	-66.205
600	11.609	18.128	3.282	-77.873	-60.338
800	12.150	21.546	5.661	-77.796	-54.506
1000	12.577	24.304	8.135	-78.529	-48.689
1200	12.960	26.632	10.689	-79.874	-42.559
1400	13.322	28.657	13.318	-79.863	-36.338
1600	13.672	30.459	16.017	-79.799	-30.130
1800	14.017	32.089	18.786	-79.677	-23.929
2000	14.357	33.583	21.624	-79.496	-17.741

*Data except enthalpy of formation at 298 K estimated.

$\text{Co}_3\text{N}(\text{c})$
Tricobalt nitride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	21.972	23.600	0	2.000	8.209
300	22.000	23.736	.041	2.001	8.251
400	23.500	30.270	2.316	2.086	10.306
500	25.000	35.676	4.741	2.195	12.363
600	26.500	40.366	7.316	2.337	14.383

*Data estimated.

$\text{CrN}(\text{c})$
Chromium mononitride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	12.590	9.013	0	-28.000	-22.180
400	11.730	12.376	1.165	-27.781	-20.228
600	12.050	17.192	3.543	-27.391	-16.537
800	12.360	20.702	5.984	-27.084	-12.966
1000	12.660	23.495	8.488	-26.829	-9.470
1200	13.000	25.835	11.056	-26.665	-6.010
1400	13.310	27.862	13.687	-26.630	-2.586
1600	13.630	29.660	16.381	-26.707	.865
1800	13.950	31.284	19.139	-26.902	4.321
2000	14.300	32.772	21.964	-27.194	7.804
2200	14.580	34.147	24.850	-31.420	11.447
2400	14.930	35.431	27.801	-31.218	15.340

$\text{CrN}(\text{g})$
Chromium mononitride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	7.350	55.076	0	120.700	112.787
400	7.726	57.290	.768	120.522	110.110
600	8.250	60.532	2.371	120.137	104.987
800	8.532	62.948	4.052	119.684	100.005
1000	8.692	64.871	5.776	119.159	95.142
1200	8.792	66.465	7.525	118.504	90.403
1400	8.859	67.826	9.290	117.673	85.768
1600	8.909	69.012	11.067	116.679	81.287
1800	8.950	70.064	12.853	115.512	76.931
2000	8.987	71.009	14.647	114.189	72.712
2200	9.025	71.867	16.448	108.878	68.761
2400	9.067	72.654	18.257	107.938	65.161

*Data except enthalpy of formation at 298 K estimated.

$\text{Cr}_2\text{N}(\text{c})$
Dichromium nitride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	15.790	15.500	0	-30.000	-24.429
400	17.550	20.408	1.706	-29.831	-22.551
600	19.000	27.814	5.368	-29.437	-18.992
800	20.310	33.460	9.300	-29.038	-15.567
1000	21.630	38.134	13.494	-28.575	-12.255
1200	22.940	42.194	17.951	-28.132	-9.024
1400	24.260	45.829	22.671	-27.788	-5.895
1600	25.580	49.155	27.655	-27.512	-2.765
1800	26.890	52.244	32.904	-27.325	.316
2000	28.080	55.136	38.395	-27.212	3.378
2200	29.300	57.868	44.131	-34.837	6.686
2400	30.420	60.466	50.103	-33.494	10.412

*Entropy at 298 K estimated.

$\text{ErN}(\text{c})$
Erbium nitride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	11.700	18.500	0	-85.500	-78.978
400	11.840	21.960	1.200	-85.343	-76.771
600	12.110	26.810	3.590	-85.036	-72.561
800	12.380	30.330	6.040	-84.743	-68.448
1000	12.650	33.120	8.550	-84.492	-64.388
1200	12.920	35.450	11.100	-84.319	-60.394
1400	13.190	37.460	13.710	-84.221	-56.408
1600	13.460	39.240	16.380	-84.213	-52.433
1800	13.730	40.840	19.100	-89.073	-48.447
2000	14.000	42.300	21.870	-89.009	-43.928

*Data except enthalpy of formation at 298 K estimated.

$\text{Fe}_2\text{N}(\text{c})$
Diiron nitride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	16.700	24.200	0	-0.900	2.596
300	16.740	24.300	.030	-.899	2.618
400	17.350	29.200	1.740	-.789	3.778
500	17.960	33.140	3.500	-.744	4.905
600	18.560	36.460	5.330	-.745	6.044
700	19.170	39.370	7.210	-.819	7.172
800	19.780	41.970	9.160	-.970	8.324
900	20.390	44.340	11.170	-1.263	9.499
1000	21.000	46.520	13.240	-1.853	10.721

*Data except enthalpy of formation and entropy at 298 K estimated.

Fe₄N(c)
Tetrairon nitride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	29.300	37.000	0	-2.500	1.067
300	29.300	37.180	.050	-2.500	1.086
400	30.100	45.720	3.020	-2.383	2.259
500	30.900	52.520	6.080	-2.403	3.430
600	31.700	58.230	9.210	-2.577	4.609
700	32.600	63.190	12.420	-2.911	5.823
800	33.400	67.590	15.720	-3.442	7.106
900	34.200	71.560	19.100	-4.289	8.482
1000	35.000	75.210	22.560	-5.761	9.963

*Data except enthalpy of formation and entropy at 298 K estimated.

GaN(c)
Gallium nitride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.341	8.724	0	-26.400	-19.269
400*	10.071	11.465	.954	-27.808	-16.388
600	11.600	15.874	3.139	-27.614	-10.707
800	12.554	19.348	5.559	-27.200	-5.129
1000	13.333	22.235	8.149	-26.647	.327
1200	14.036	24.729	10.887	-25.973	5.660
1400	14.697	26.943	13.761	-25.185	10.871
1600	15.330	28.947	16.764	-24.285	15.962

*Data above 298 K estimated.

HfN(c)
Hafnium nitride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	9.420	11.500	0	-89.300	-82.802
400	10.380	14.419	1.010	-89.281	-80.589
600	11.320	18.827	3.200	-89.102	-76.265
800	11.930	22.172	5.520	-88.894	-72.024
1000	12.450	24.890	7.960	-88.670	-67.836
1200	12.920	27.202	10.500	-88.446	-63.683
1400	13.380	29.228	13.130	-88.227	-59.571
1600	13.820	31.044	15.850	-88.008	-55.499
1800	14.270	32.698	18.660	-87.784	-51.438
2000	14.700	34.224	21.560	-87.554	-47.421
2200	15.140	35.646	24.540	-88.663	-43.286

HoN(c)
Holmium nitride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	11.800	19.000	0	-80.500	-73.996
400	11.940	22.490	1.210	-80.315	-71.803
600	12.210	27.380	3.620	-79.959	-67.627
800	12.480	30.930	6.090	-79.586	-63.571
1000	12.750	33.740	8.620	-79.277	-59.593
1200	13.020	36.090	11.190	-79.116	-55.683
1400	13.290	38.120	13.820	-79.146	-51.781
1600	13.560	39.910	16.510	-79.427	-47.855
1800	13.830	41.520	19.250	-83.656	-43.714
2000	14.100	43.000	22.040	-83.822	-39.300

*Data except enthalpy of formation at 298 K estimated.

InN(c)
Indium nitride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	9.965	10.400	0	-33.000	-25.157
400	10.260	13.370	1.030	-33.001	-22.480
600	10.840	17.639	3.140	-33.785	-16.905
800	11.420	20.837	5.366	-33.692	-11.290
1000	12.000	23.448	7.708	-33.508	-5.709
1200	12.580	25.687	10.166	-33.234	-.173
1400	13.160	27.670	12.740	-32.866	5.310

*Data except enthalpy of formation at 298 K estimated.

LaN(c)
Lanthanum nitride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	9.646	10.600	0	-72.500	-64.782
400	10.679	13.598	1.042	-72.477	-62.149
600	11.609	18.128	3.282	-72.348	-57.015
800	12.150	21.546	5.661	-72.090	-51.944
1000	12.577	24.304	8.135	-71.896	-46.926
1200	12.960	26.632	10.689	-74.068	-41.889
1400	13.322	28.657	13.318	-73.895	-36.544
1600	13.672	30.459	16.017	-73.669	-31.216
1800	14.017	32.089	18.786	-73.385	-25.935

*Data except enthalpy of formation at 298 K estimated.

LiN(g)
Lithium mononitride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	7.848	49.744	0	80.000	74.065
400	8.241	52.110	.821	79.834	72.063
600	8.655	55.541	2.516	78.690	68.501
800	8.858	58.062	4.269	78.316	65.160
1000	8.980	60.052	6.054	77.953	61.914
1200	9.067	61.698	7.859	77.588	58.739
1400	9.135	63.100	9.679	77.221	55.628
1600	9.193	64.324	11.512	76.857	52.568
1800	9.246	65.410	13.356	41.631	53.018
2000	9.295	66.387	15.211	41.634	54.284
2200	9.341	67.275	17.074	41.636	55.547
2400	9.386	68.090	18.947	41.636	56.813

*Data estimated.

$\text{Li}_3\text{N(c)}$
Trilithium nitride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.985	14.959	0	-39.330	-30.747
300	18.050	15.072	0.033	-39.337	-30.695
400	20.817	20.674	1.987	-39.594	-27.771
500	23.169	25.574	4.187	-42.000	-24.567
600	25.437	30.000	6.619	-42.063	-21.069
700	27.624	34.087	9.272	-41.874	-17.585
800	29.728	37.914	12.141	-41.452	-14.141
900	31.750	41.532	15.215	-40.831	-10.762
1000	33.688	44.979	18.488	-40.015	-7.463

1086 K, melting point; ΔH° unknown

MgN(g)
Magnesium mononitride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	7.823	53.713	0	69.000	62.137
400	8.208	56.070	.818	68.842	59.818
600	8.607	59.484	2.505	68.516	55.375
800	8.794	61.989	4.247	68.107	51.051
1000	8.901	63.964	6.017	65.442	47.022
1200	8.971	65.593	7.805	64.806	43.391
1400	9.023	66.980	9.605	33.956	40.692
1600	9.066	68.188	11.414	33.939	41.654
1800	9.103	69.258	13.230	33.916	42.619
2000	9.136	70.219	15.054	33.890	43.588

*Data estimated.

$\text{Mg}_3\text{N}_2(\text{c})$
Trimagnesium dinitride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.980	21.000	0	-110.100	-95.729
400	25.730	28.440	2.582	-110.091	-90.820
600	27.190	39.150	7.874	-110.130	-81.177
800	28.650	47.170	13.458	-110.264	-71.514
823	28.820	47.980	14.119	-110.286	-70.396
823	29.600	48.250	14.339	-110.066	-70.396
1000	29.600	54.020	19.578	-116.682	-61.324
1061	29.600	55.770	21.384	-116.809	-57.950
1061	29.540	56.020	21.644	-116.549	-57.950
1200	29.540	59.650	25.750	-116.988	-50.250
1400	29.540	64.210	31.658	-208.214	-36.633
1600	29.540	68.150	37.566	-206.953	-12.204
1800	29.540	71.630	43.474	-205.715	12.065
2000	29.540	74.740	49.382	-204.500	36.204

823 K, transition point; $\Delta H^\circ = 0.220$ kcal/mol.1061 K, transition point; $\Delta H^\circ = 0.260$ kcal/mol.

$\text{Mn}_4\text{N(c)}$
Tetramanganese mononitride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	29.830	34.160	0	-30.750	-24.988
300	29.910	34.350	.056	-30.749	-24.954
400	33.440	43.480	3.239	-30.522	-23.054
500	35.140	51.150	6.681	-30.224	-21.212
600	35.730	57.620	10.230	-29.999	-19.437

$\text{Mn}_5\text{N}_2(\text{c})$
Pentamanganese dinitride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	41.999	44.800	0	-48.800	-37.107
300	42.070	45.060	.078	-48.795	-37.034
400	45.910	57.689	4.477	-48.353	-33.181
500	49.750	68.346	9.260	-47.763	-29.443
600	53.590	77.756	14.427	-47.019	-25.852
700	57.430	86.305	19.978	-46.105	-22.409
800	61.270	94.224	25.913	-45.003	-19.104

$\text{MoN}_{1.5}(\text{c})$
Molybdenum nitride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	7.630	7.550	0	-9.750	-3.136
400	8.690	9.960	.835	-9.868	-0.859
600	9.890	13.730	2.705	-9.938	3.669
800	10.710	16.690	4.770	-9.894	8.205
1000	11.350	19.150	6.980	-9.780	12.720
1200	11.880	21.270	9.300	-9.636	17.200
1400	12.310	23.140	11.720	-9.478	21.653

$\text{NaN}_3(\text{c})$
Sodium azide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	18.310	23.150	0	5.190	22.424
300	18.340	23.260	.034	5.193	22.532
400	20.330	28.830	1.972	4.741	28.334
500	21.530	33.510	4.072	5.046	34.201
600	22.250	37.500	6.262	5.445	38.885

$\text{NbN}(\text{c})$
Niobium nitride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	9.320	8.250	0	-56.200	-49.243
400*	10.710	11.201	1.025	-56.141	-46.874
600	12.210	15.861	3.335	-55.777	-42.306
800	13.110	19.506	5.875	-55.249	-37.895
1000	13.740	22.502	8.560	-54.647	-33.625
1200	14.220	25.051	11.360	-53.998	-29.462
1400	14.600	27.273	14.240	-53.335	-25.428
1600	14.920	29.244	17.195	-52.675	-21.478
1643	14.970	29.640	17.835	-52.538	-20.644
1643	15.000	30.249	18.835	-51.538	-20.644
1800	15.000	31.618	21.190	-51.052	-17.712
2000	15.000	33.198	24.190	-50.508	-14.043

*Data above 298 K estimated.

1643 K, transition point; $\Delta \text{H}^\circ = 1.000 \text{ kcal/mol}$.

$\text{Nb}_2\text{N}(\text{c})$
Diniobium nitride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	16.130	19.000	0	-59.900	-53.554
400	16.547	23.798	1.664	-59.813	-51.401
600	17.364	30.662	5.056	-59.605	-47.233
800	18.182	35.769	8.610	-59.340	-43.156
1000	19.000	39.914	12.328	-59.021	-39.141
1200	19.418	43.415	16.170	-58.687	-35.164
1400	19.837	46.440	20.095	-58.380	-31.267
1600	20.255	49.116	24.105	-58.127	-27.397
1800	20.674	51.526	28.197	-57.934	-23.565
2000	21.092	53.726	32.374	-57.812	-19.763

*Data except enthalpy of formation at 298 K estimated.

$\text{PN}(\text{g})$
Phosphorus nitride (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	7.096	50.437	0	26.260	20.973
400	7.355	52.556	.735	25.853	19.247
600	7.885	55.643	2.261	22.586	16.287
800	8.249	57.965	3.878	22.518	14.200
1000	8.476	59.832	5.552	22.458	12.128
1200	8.623	61.392	7.263	22.399	10.066
1400	8.723	62.729	8.998	22.337	8.016
1600	8.794	63.899	10.750	22.273	5.973
1800	8.848	64.938	12.515	22.206	3.941
2000	8.889	65.872	14.288	22.136	1.915

$\text{P}_3\text{N}_5(\text{c})$
Triphosphorus pentanitride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	35.600	44.000	0	-71.400	-41.619
300	35.800	44.221	.066	-71.399	-41.437
400	46.000	56.017	4.191	-71.345	-31.377
500	52.000	66.963	9.108	-70.073	-21.519
600	56.000	76.813	14.516	-76.815	-11.230
700	59.000	85.684	20.274	-74.291	-4.494
800	61.000	93.698	26.279	-71.577	9.866

PuN(c)
Plutonium mononitride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	11.855	15.490	0	-71.510	-65.304
400	12.230	19.026	1.227	-72.320	-63.177
600	12.967	24.124	3.746	-72.504	-58.592
800	13.704	27.956	6.413	-72.769	-53.947
1000	14.441	31.093	9.228	-73.204	-49.213
1200	15.179	33.791	12.190	-73.056	-44.427
1400	15.916	36.186	15.299	-72.783	-39.675
1600	16.653	38.360	18.556	-72.379	-34.972

ScN(c)
Scandium nitride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	8.863	7.100	0	-75.000	-67.825
400	10.095	9.900	.974	-75.013	-65.369
600	11.119	14.218	3.111	-74.869	-60.573
800	11.646	17.495	5.391	-74.674	-55.831
1000	12.030	20.136	7.760	-74.513	-51.155
1200	12.357	22.359	10.199	-74.418	-46.460
1400	12.658	24.287	12.701	-74.412	-41.835
1600	12.944	25.996	15.262	-74.511	-37.174
1800	13.222	27.536	17.878	-75.804	-32.381
2000	13.495	28.944	20.550	-79.471	-27.198

*Data except enthalpy of formation at 298 K estimated.

SiN(g)
Silicon nitride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	7.210	51.792	0	89.000	81.723
400	7.541	53.957	.751	88.880	79.253
600	8.086	57.125	2.318	88.621	74.496
800	8.421	59.501	3.971	88.343	69.829
1000	8.657	61.407	5.680	88.037	65.244
1200	8.880	63.005	7.433	87.715	60.706
1400	9.123	64.392	9.233	87.392	56.234
1600	9.384	65.627	11.084	87.079	51.792
1800	9.645	66.747	12.987	74.780	48.235
2000	9.888	67.776	14.941	74.659	45.287

Si₂N(g)
Disilicon nitride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	11.922	61.275	0	95.000	86.237
400	12.803	64.910	1.262	94.875	83.259
600	13.755	70.307	3.931	94.600	77.509
800	14.202	74.333	6.732	94.274	71.863
1000	14.435	77.530	9.598	93.877	66.321
1200	14.571	80.175	12.499	93.422	60.833
1400	14.656	82.428	15.423	92.916	55.450
1600	14.712	84.389	18.360	92.358	50.107
1800	14.751	86.124	21.306	67.745	46.534
2000	14.780	87.680	24.260	67.404	44.185

*Data except enthalpy of formation at 298 K estimated.

Si₃N₄(α)
α-Trisilicon tetranitride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	23.789	27.000	0	-177.700	-154.432
400	26.450	34.367	2.560	-178.108	-146.424
600	31.000	45.989	8.324	-178.530	-130.469
800	34.850	55.450	14.920	-178.462	-114.441
1000	37.800	63.556	22.196	-177.998	-98.458
1200	40.270	70.677	30.014	-177.199	-82.647
1400	42.046	77.026	38.256	-176.142	-66.956
1600	43.152	82.720	46.788	-174.933	-51.480
1800	43.846	87.846	55.493	-209.681	-33.616
2000	44.320	92.492	64.313	-207.943	-14.163

SmN(c)
Samarium nitride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	11.700	17.600	0	-77.000	-70.466
400	11.840	21.060	1.200	-76.914	-68.250
600	12.110	25.910	3.590	-77.015	-63.916
800	12.380	29.430	6.040	-77.335	-59.496
1000	12.650	32.220	8.550	-77.725	-54.981
1200	12.920	34.550	11.100	-78.946	-50.389
1400	13.190	36.560	13.710	-81.499	-45.510
1600	13.460	38.340	16.380	-82.062	-40.330
1800	13.730	39.940	19.100	-82.587	-35.085
2000	14.000	41.400	21.870	-83.073	-29.772

*Data except enthalpy of formation at 298 K estimated.

$\text{Sr}_3\text{N}_2(\text{c})$
Tristrontium dinitride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	30.988	32.200	0	-93.500	-78.273
400	31.650	41.399	3.190	-93.033	-73.145
600	32.950	54.478	9.650	-92.312	-63.370
800	34.250	64.135	16.370	-91.979	-53.788
1000	35.550	71.917	23.350	-92.464	-44.128
1200	36.850	78.514	30.590	-97.804	-33.604

*Data except enthalpy of formation at 298 K estimated.

$\text{TaN}(\text{c})$
Tantalum nitride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	10.007	10.200	0	-60.100	-53.360
400	11.583	13.393	1.111	-59.971	-51.073
600	12.761	18.355	3.566	-59.479	-46.723
800	13.258	22.102	6.174	-58.884	-42.559
1000	13.558	25.095	8.857	-58.270	-38.550
1200	13.780	27.587	11.592	-57.655	-34.662
1400	13.966	29.726	14.367	-57.050	-30.879
1600	14.132	31.602	17.177	-56.462	-27.182
1800	14.287	33.275	20.019	-55.890	-23.555
2000	14.435	34.788	22.891	-55.340	-19.993

*Data except enthalpy of formation at 298 K estimated.

$\text{Ta}_2\text{N}(\text{c})$
Ditantalum nitride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	16.205	20.590	0	-64.900	-58.300
400	16.978	25.464	1.691	-64.818	-56.058
600	18.280	32.599	5.219	-64.508	-51.736
800	19.504	38.026	8.998	-64.020	-47.547
1000	20.706	42.508	13.019	-63.370	-43.502
1200	21.898	46.388	17.280	-62.555	-39.600
1400	23.087	49.853	21.778	-61.581	-35.850
1600	24.274	53.014	26.515	-60.455	-32.250
1800	25.459	55.941	31.488	-59.177	-28.798
2000	26.644	58.685	36.698	-57.757	-25.502
2200	27.827	61.280	42.145	-56.203	-22.349
2400	29.011	63.752	47.829	-54.529	-19.343

*Entropy and heat capacity at 298 K estimated.

$\text{ThN}(\text{c})$
Thorium mononitride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.740	13.400	0	-93.500	-86.868
400	11.540	16.680	1.138	-93.394	-84.618
600	12.390	21.540	3.539	-93.095	-80.294
800	12.990	25.190	6.079	-92.763	-76.077
1000	13.510	28.140	8.729	-92.432	-71.940
1200	14.000	30.640	11.480	-92.103	-67.865
1400	14.470	32.840	14.327	-91.775	-63.858
1600	14.940	34.800	17.269	-91.444	-59.888
1800	15.410	36.590	20.304	-91.861	-55.888
2000	15.870	38.240	23.432	-91.425	-51.921

$\text{Th}_3\text{N}_4(\text{c})$
Trithorium tetranitride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	35.200	48.000	0	-314.300	-289.905
400	38.500	58.860	3.773	-313.978	-281.613
600	41.590	75.130	11.819	-312.946	-265.644
800	43.490	87.370	20.336	-311.788	-250.050
1000	45.040	97.240	29.192	-310.656	-234.746
1200	46.450	105.580	38.342	-309.566	-219.670
1400	47.790	112.840	47.767	-308.514	-204.763
1600	49.110	119.310	57.457	-307.488	-190.019
1800	50.400	125.170	67.408	-308.740	-175.153
2000	51.680	130.550	77.616	-307.465	-160.389

$\text{TiN}(\text{c})$
Titanium mononitride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.862	7.226	0	-80.800	-73.949
400	10.471	10.079	.993	-80.789	-71.605
600	11.645	14.597	3.229	-80.568	-67.059
800	12.098	18.014	5.606	-80.328	-62.588
1000	12.463	20.753	8.063	-80.134	-58.173
1200	12.839	23.058	10.592	-80.957	-53.762
1400	13.237	25.067	13.200	-80.627	-49.255
1600	13.654	26.861	15.888	-80.314	-44.795
1800	14.084	28.494	18.662	-80.027	-40.373
2000	14.526	30.001	21.523	-83.209	-35.885

UN(c)
Uranium mononitride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.370	14.920	0	-69.500	-63.547
400	12.130	18.380	1.200	-69.353	-61.538
600	13.000	23.480	3.721	-69.073	-57.695
800	13.660	27.310	6.388	-68.962	-53.924
1000	14.240	30.420	9.179	-69.722	-50.110
1200	14.800	33.060	12.084	-70.632	-46.031
1400	15.350	35.390	15.099	-70.263	-41.968
1600	15.900	37.470	18.224	-72.462	-37.620
1800*	16.440	39.380	21.458	-72.399	-33.278
2000	16.970	41.140	24.799	-72.240	-28.940
2200	17.510	42.780	28.247	-71.981	-24.615
2400	18.040	44.330	31.803	-71.621	-20.331
2600	18.580	45.790	35.462	-71.163	-16.065
2800	19.110	47.190	39.231	-70.600	-11.857
3000	19.640	48.520	43.107	-69.933	-7.665

*Data above 1700 K extrapolated.

VN_{0.65}(c)
Vanadium nitride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	6.902	6.379	0	-31.800	-28.467
400	7.810	8.549	.755	-31.834	-27.321
600	8.898	11.942	2.436	-31.768	-25.073
800	9.570	14.599	4.287	-31.600	-22.864
1000	10.107	16.794	6.255	-31.393	-20.706
1200	10.630	18.682	8.329	-31.165	-18.587
1400	11.154	20.361	10.507	-30.932	-16.511
1600	11.629	21.882	12.787	-30.704	-14.467
1800	11.991	23.274	15.151	-30.503	-12.449

VN(c)
Vanadium mononitride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	9.080	8.910	0	-51.880	-45.652
400	10.280	11.796	1.003	-51.856	-43.526
600	11.550	16.225	3.196	-51.657	-39.396
800	12.350	19.666	5.592	-51.337	-35.356
1000	12.890	22.483	8.118	-50.982	-31.403
1200	13.280	24.868	10.737	-50.634	-27.518
1400	13.600	26.941	13.426	-50.327	-23.691
1600	13.840	28.774	16.172	-50.079	-19.906

VN(g)
Vanadium mononitride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	7.444	55.753	0	125.000	117.262
400	7.921	58.009	.783	124.804	114.649
600	8.556	61.355	2.438	124.465	109.648
800	8.865	63.864	4.184	124.135	104.757
1000	9.022	65.861	5.974	123.754	99.955
1200	9.110	67.515	7.788	123.297	95.237
1400	9.166	68.923	9.616	122.743	90.604
1600	9.208	70.150	11.454	122.083	86.055
1800	9.251	71.237	13.299	121.314	81.597
2000	9.302	72.214	15.154	120.424	77.231
2200	9.367	73.104	17.021	119.929	72.983
2400	9.448	73.922	18.902	112.733	69.315

*Data except enthalpy of formation at 298 K estimated.

YN(c)
Yttrium mononitride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	9.393	9.000	0	-71.500	-64.194
400	10.426	11.924	1.016	-71.492	-61.698
600	11.344	16.349	3.205	-71.341	-56.825
800	11.867	19.689	5.529	-71.152	-52.016
1000	12.275	22.382	7.944	-70.976	-47.254
1200	12.639	24.652	10.436	-70.821	-42.530
1400	12.981	26.627	12.998	-70.689	-37.818
1600	13.312	28.382	15.627	-70.580	-33.140
1800	13.636	29.968	18.322	-74.382	-28.424
2000	13.956	31.422	21.082	-74.537	-23.320

*Data except enthalpy of formation at 298 K estimated.

YbN(c)
Ytterbium nitride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	14.000	16.000	0	-86.900	-80.584
400	14.140	20.134	1.430	-86.484	-78.494
600	14.410	25.920	4.290	-85.775	-74.650
800	14.680	30.100	7.200	-85.049	-71.050
1000	14.950	33.410	10.160	-84.356	-67.642
1200	15.220	36.160	13.180	-86.089	-64.108
1400	15.490	38.520	16.250	-85.593	-60.468
1600	15.760	40.610	19.370	-115.355	-54.155
1800	16.030	42.480	22.550	-114.014	-46.579
2000	16.300	44.180	25.780	-112.634	-39.159

*Data except enthalpy of formation at 298 K estimated.

$\text{Zn}_3\text{N}_2(\text{c})$
Iridine dinitride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	26.130	26.000	0	-5.400	9.394
300	26.170	26.160	.050	-5.396	9.489
400	28.250	33.980	2.770	-5.227	14.426
500	30.330	40.500	5.700	-4.920	19.310
600	32.410	46.220	8.830	-4.501	24.107
700	34.490	51.370	12.180	-9.228	28.890

*Data except enthalpy of formation at 298 K estimated.

$\text{ZrN}(\text{c})$
Zirconium mononitride

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	9.670	9.288	0	-87.200	-80.367
400	10.697	12.285	1.041	-87.165	-78.037
600	11.630	16.826	3.287	-86.986	-73.510
800	12.175	20.251	5.671	-86.785	-69.048
1000	12.608	23.015	8.150	-86.602	-64.635
1200	12.997	25.349	10.711	-87.302	-60.205
1400	13.364	27.380	13.348	-86.870	-55.722
1600	13.721	29.188	16.056	-86.449	-51.303
1800	14.071	30.824	18.835	-86.033	-46.935
2000	14.417	32.325	21.684	-85.621	-42.614

$\text{ZrN}(\text{g})$
Zirconium mononitride (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	7.567	55.780	0	134.000	126.971
400	7.965	58.062	.792	133.786	124.603
600	8.434	61.392	2.438	133.365	120.102
800	8.664	63.853	4.150	132.894	115.749
1000	8.791	65.802	5.897	132.345	111.525
1200	8.871	67.412	7.663	130.850	107.471
1400	8.926	68.784	9.443	130.425	103.607
1600	8.968	69.978	11.233	129.928	99.810
1800	9.001	71.037	13.030	129.362	96.076
2000	9.029	71.986	14.833	128.728	92.413

*Data estimated.

Oxides

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

Source of data: reference 24.

$\text{Ag}_2\text{O}(\text{c})$
Disilver monoxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	15.662	29.000	0	-7.420	-2.697
300	15.693	29.098	.844	-7.420	-2.667
400	17.386	33.883	1.696	-7.332	-1.095
450	18.031	35.969	2.582	-7.246	-.319
500*	18.637	37.900	3.499	-7.140	-.455

*Decomposes near 500 K.

$\text{Ag}_2\text{O}_2(\text{c})$
Disilver dioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	21.000	28.000	0	-5.800	6.527
300	21.040	28.130	.039	-5.796	6.605
400	22.710	34.460	2.240	-5.529	10.695
500	23.640	39.630	4.560	-5.186	14.714

*Data above 298 K estimated.

$\text{AlO}(\text{g})$
Aluminum monoxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	7.381	52.169	0	16.400	10.171
400	7.765	54.392	.772	16.201	8.075
600	8.290	57.651	2.382	15.793	4.098
800	8.604	60.081	4.074	15.296	.272
1000	8.892	62.031	5.823	12.115	-3.232
1200	9.241	63.682	7.635	11.565	-6.248
1400	9.650	65.137	9.523	11.076	-9.179
1600	10.073	66.453	11.495	10.656	-12.044
1800	10.463	67.663	13.550	10.308	-14.860
2000	10.783	68.782	15.676	10.020	-17.638

$(\text{AlO})_2(\text{g})$
Dimeric aluminum monoxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	15.250	66.043	0	-104.000	-105.039
400	16.786	70.759	1.638	-104.303	-105.347
600	18.276	77.892	5.167	-104.810	-105.755
800	18.919	83.249	8.894	-105.461	-105.980
1000	19.244	87.510	12.714	-111.502	-105.644
1200	19.429	91.036	16.583	-112.356	-104.390
1400	19.543	94.040	20.481	-113.214	-102.995
1600	19.619	96.655	24.398	-114.080	-101.478
1800	19.671	98.969	28.327	-114.957	-99.850
2000	19.709	101.044	32.265	-115.848	-98.124

$\text{AlO}_2(\text{g})$
Aluminum dioxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	11.684	58.608	0	-44.900	-45.743
400	12.701	62.195	1.246	-44.986	-46.016
600	13.740	67.571	3.905	-45.088	-46.506
800	14.204	71.596	6.705	-45.265	-46.958
1000	14.441	74.793	9.572	-48.149	-47.163
1200	14.576	77.439	12.474	-48.452	-46.938
1400	14.661	79.693	15.399	-48.765	-46.661
1600	14.717	81.654	18.337	-49.092	-46.338
1800	14.757	83.390	21.284	-49.433	-45.973
2000	14.788	84.947	24.239	-49.789	-45.571

$\text{Al}_2\text{O}(\text{g})$
Dialuminum monoxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	12.513	61.414	0	-31.200	-38.165
400	13.190	65.192	1.311	-31.469	-40.503
600	13.952	70.704	4.035	-32.038	-44.899
800	14.318	74.773	6.866	-32.797	-49.079
1000	14.512	77.991	9.751	-38.952	-52.670
1200	14.625	80.648	12.666	-39.917	-55.322
1400	14.696	82.908	15.598	-40.881	-57.814
1600	14.743	84.874	18.542	-41.846	-60.170
1800	14.776	86.612	21.494	-42.815	-62.401
2000	14.800	88.170	24.452	-43.790	-64.523

$\text{Al}_2\text{O}_3(\alpha, \text{l})$
 α -Dialuminum trioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	18.885	12.170	0.000	-400.500	-378.172
400	22.965	18.343	2.150	-400.652	-370.512
600	26.899	28.517	7.194	-400.388	-355.478
800	28.713	36.531	12.774	-399.974	-340.574
1000	29.821	43.065	18.634	-404.795	-325.397
1200	30.653	48.578	24.684	-404.312	-309.560
1400	31.329	53.356	30.885	-403.727	-293.813
1600	31.874	57.576	37.208	-403.060	-278.157
1800	32.297	61.356	43.627	-402.332	-262.585
2000	32.623	64.776	50.120	-401.565	-247.099
2200	32.918	67.899	56.674	-400.769	-231.691
2327	33.135	69.752	60.870	-400.247	-221.941
2327	46.000	81.217	87.550	-373.567	-221.941
2400	46.000	82.638	90.908	-372.327	-217.202

2317 K, melting point; $\Delta \text{H}^\circ = 26.68$

$\text{Al}_2\text{O}_3(\text{c})$
Dialuminum trioxide, gamma phase

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	19.773	12.500	0	-396.000	-373.770
400	24.044	18.964	2.251	-396.051	-366.159
600	28.163	29.615	7.532	-395.549	-351.299
800	30.063	38.005	13.374	-394.874	-336.654
1000	31.223	44.846	19.510	-399.419	-321.802
1200	32.094	50.618	25.845	-398.651	-306.347

$\text{As}_2\text{O}_3(\text{c})$
Diarsenic trioxide (cubic)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	23.155	25.672	0.000	-157.020	-137.669
300	23.225	25.815	.043	-157.019	-137.549
350	24.896	29.626	1.248	-156.940	-134.309
400*	26.269	32.943	2.528	-156.799	-131.086
450	27.501	36.109	3.872	-156.607	-127.881
500	28.654	39.066	5.276	-156.373	-124.701
550	29.713	41.848	6.736	-156.099	-121.548
551	29.732	41.902	6.766	-156.093	-121.485

*Data estimated above 360 K.

551 K, melting point,

$\text{As}_2\text{O}_3(\text{c})$
Diarsenic trioxide (monoclinic)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	23.178	27.087	0	-156.500	-137.571
300	23.245	27.231	.043	-156.499	-137.454
350	24.829	30.938	1.246	-156.422	-134.286
400*	26.092	34.339	2.521	-156.286	-131.131
450	27.181	37.476	3.853	-156.106	-127.995
500	28.184	40.392	5.237	-155.892	-124.883
550	29.118	43.123	6.670	-155.645	-121.795
585	29.700	44.937	7.700	-155.454	-119.646

*Data estimated above 360 K.

585 K, melting point

$\text{As}_2\text{O}_5(\text{c})$
Diarsenic pentoxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	27.853	25.200	0	-221.050	-186.947
300*	27.955	25.373	.052	-221.053	-186.736
400	32.671	34.095	3.095	-220.984	-175.296
500	36.320	41.792	6.551	-220.582	-163.913
600	39.317	48.687	10.337	-219.938	-152.637

*Data above 298 K are estimated.

$\text{As}_4\text{O}_6(\text{g})$
Tetrarsenic hexoxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	41.490	97.810	0	-285.910	-261.062
300	41.610	98.070	.077	-285.916	-260.909
400	46.560	110.790	4.509	-286.014	-252.550
500	49.390	121.510	9.318	-285.850	-244.195
600	51.110	130.670	14.350	-285.591	-235.884
700	52.230	138.640	19.521	-285.314	-227.623
800	52.980	145.670	24.783	-285.058	-219.405
900	53.510	151.940	30.109	-317.902	-210.308
1000	53.900	157.600	35.481	-316.983	-198.405

$\text{BO}(\text{g})$
Boron monoxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	6.978	48.604	0	6.000	-0.765
400	7.068	50.665	.715	6.032	-3.985
600	7.427	53.594	2.162	5.853	-7.614
800	7.810	55.785	3.687	5.527	-12.053
1000	8.108	57.561	5.280	5.142	-16.404
1200	8.324	59.060	6.924	4.719	-20.680
1400	8.480	60.355	8.606	4.259	-24.872
1600	8.595	61.495	10.314	3.753	-29.008
1800	8.682	62.513	12.042	3.198	-33.058
2000	8.749	63.431	13.785	2.590	-37.065

$\text{BO}_2(\text{g})$
Boron dioxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	10.343	54.900	0	-71.800	-73.137
400	11.351	58.085	1.106	-71.739	-73.605
600	12.730	62.974	3.527	-71.686	-74.552
800	13.501	66.752	6.158	-71.695	-75.505
1000	13.942	69.817	8.906	-71.745	-76.452
1200	14.209	72.384	11.723	-71.838	-77.389
1400	14.381	74.588	14.583	-71.980	-78.301
1600	14.497	76.517	17.472	-72.179	-79.200
1800	14.579	78.229	20.380	-72.439	-80.048
2000	14.639	79.768	23.302	-72.764	-80.888

$\text{B}_2\text{O}(\text{g})$
Diboron monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	9.180	54.405	0	23.000	14.925
400	9.903	57.205	.972	22.966	12.166
600	11.121	61.462	3.080	22.567	6.839
800	11.966	64.786	5.395	21.967	1.690
1000	12.514	67.519	7.847	21.284	-3.300
1200	12.873	69.835	10.388	20.536	-8.158
1400	13.115	71.838	12.988	19.711	-12.869
1600	13.284	73.601	15.629	18.797	-17.477
1800	13.405	75.173	18.298	17.785	-21.927
2000	13.495	76.590	20.989	16.672	-26.302

$\text{B}_2\text{O}_3(\text{c}, \text{l})$
Diboron trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.980	12.900	0	-304.370	-285.459
400	18.631	17.839	1.721	-304.377	-278.995
600	23.453	26.385	5.969	-304.122	-266.346
723	25.502	30.952	8.985	-303.829	-258.625
723	31.800	38.891	14.725	-298.089	-258.625
800	31.800	42.109	17.173	-297.410	-254.458
1000	31.800	49.205	23.533	-295.826	-243.906
1200	31.800	55.003	29.893	-294.443	-233.664
1400	31.800	59.905	36.253	-293.227	-223.626
1600	31.800	64.151	42.613	-292.169	-213.773
1800	31.800	67.897	48.973	-291.260	-204.003

723 K, melting point; $\Delta H^\circ = 5.740$

$\text{B}_2\text{O}_3(\text{amorphous})$
Diboron trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.980	18.650	0	-299.840	-282.643
300	15.060	18.740	.028	-299.841	-282.533
400	18.630	23.590	1.721	-299.847	-276.765
500	21.340	28.050	3.725	-299.754	-270.998
600	31.800	32.980	6.451	-299.111	-265.291
700	31.800	37.880	9.631	-298.133	-259.729

$\text{BaO}(\text{c})$
Barium monoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.340	16.830	0.000	-130.980	-124.245
400	11.939	20.253	1.188	-130.891	-121.962
600	12.711	25.251	3.658	-131.188	-117.459
800	13.249	28.986	6.257	-131.298	-112.874
1000	13.653	31.987	8.949	-131.377	-108.257
1200	13.974	34.506	11.713	-133.320	-103.256
1400*	14.254	36.681	14.536	-133.298	-98.246
1600	14.532	38.603	17.414	-133.233	-93.243
1800	14.844	40.332	20.351	-133.121	-88.251

*Data extrapolated above 1300 K.

$\text{BaO}(\text{g})$
Barium monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.863	56.249	0	-29.600	-34.617
400	8.232	58.615	.821	-29.879	-36.294
600	8.601	62.034	2.510	-30.955	-39.296
800	8.766	64.534	4.248	-31.927	-41.942
1000	8.855	66.500	6.011	-32.935	-44.328
1200	8.910	68.120	7.788	-35.865	-46.138
1400	8.950	69.497	9.575	-36.879	-47.770
1600	8.985	70.694	11.368	-37.899	-49.255
1800	9.025	71.754	13.169	-38.923	-50.612
2000	9.086	72.708	14.979	-39.950	-51.857

$\text{BeO}(\text{c})$
Beryllium monoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	6.110	3.290	0.000	-145.600	-138.599
400	8.033	5.378	0.729	-145.676	-136.193
600	10.148	9.087	2.572	-145.622	-131.455
800	11.185	12.165	4.717	-145.438	-126.762
1000	11.711	14.724	7.012	-145.218	-122.117
1200	12.036	16.889	9.389	-145.030	-117.520
1400	12.335	18.767	11.825	-144.888	-112.940
1600	12.686	20.436	14.326	-148.281	-108.291
1800	13.097	21.954	16.904	-147.996	-103.325
2000	13.537	23.356	19.567	-147.638	-98.364
2200	13.954	24.666	22.317	-147.203	-93.458
2373	14.260	25.734	24.758	-146.774	-89.255
2373	16.000	26.303	26.108	-145.424	-89.255
2400*	16.000	26.484	26.540	-145.307	-88.616

*Data estimated for beta phase.

2373 K, transition point; $\Delta H^\circ = 1.350$

BeO(g)
Beryllium monoxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.046	47.207	0	32.600	26.507
400	7.253	49.304	.727	32.522	24.435
600	7.757	52.341	2.229	32.236	20.450
800	8.146	54.629	3.822	31.867	16.572
1000	8.425	56.478	5.480	31.450	12.797
1200	8.689	58.037	7.191	30.972	9.105
1400	9.040	59.401	8.962	30.450	5.509
1600	9.543	60.639	10.817	26.410	2.075
1800	10.205	61.800	12.789	26.089	-.963
2000	10.984	62.915	14.907	25.903	-3.942

(BeO)₂(g)
Dimeric beryllium monoxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.792	59.156	0	-103.900	-104.673
400	13.689	62.897	1.302	-103.307	-105.198
600	16.146	68.963	4.310	-103.877	-106.017
800	17.477	73.809	7.686	-104.423	-106.654
1000	18.231	77.797	11.263	-104.997	-107.144
1200	18.687	81.165	14.958	-105.679	-107.523
1400	18.980	84.069	18.727	-106.498	-107.752
1600	19.178	86.617	22.544	-114.470	-107.683
1800	19.318	88.885	26.395	-115.205	-106.822
2000	19.419	90.925	30.269	-115.940	-105.818

(BeO)₄(g)
Tetrameric beryllium monoxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	21.364	72.292	0	-391.000	-380.625
400	26.784	79.358	2.463	-391.755	-376.962
600	33.745	91.684	8.589	-392.785	-369.319
800	37.407	101.948	15.742	-393.476	-361.402
1000	39.434	110.533	23.445	-394.075	-353.308
1200	40.642	117.838	31.462	-394.812	-345.110
1400	41.412	124.165	39.673	-395.777	-336.724
1600	41.929	129.731	48.010	-411.018	-327.839
1800	42.291	134.692	56.434	-411.766	-317.460
2000	42.555	139.162	64.920	-412.498	-306.878

(BeO)₆(g)
Hexameric beryllium monoxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	31.459	82.000	0	-651.000	-656.777
400	40.551	92.573	3.687	-650.694	-658.791
600	51.861	111.408	13.054	-649.089	-663.136
800	57.682	127.214	24.070	-646.607	-668.186
1000	60.874	140.461	35.955	-643.973	-673.864
1200	62.769	151.741	48.335	-641.350	-680.126
1400	63.972	161.513	61.017	-638.992	-686.732
1600	64.778	170.112	73.897	-637.985	-693.142
1800	65.344	177.776	86.913	-635.187	-697.800
2000	65.754	184.683	100.024	-632.317	-702.591

Bi₂O₃(c,l)
Dibismuth trioxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	27.130	36.200	0	-137.160	-121.994
400	28.705	44.419	2.853	-136.024	-116.985
600	30.097	56.356	8.750	-136.422	-107.694
800	31.090	65.150	14.869	-134.038	-98.470
1000	32.191	72.203	21.193	-131.501	-89.869
1003	32.209	72.299	21.290	-138.876	-70.509
1003	33.100	79.816	28.830	-131.336	-70.509
1098	33.100	82.812	31.975	-130.627	-64.784
1098	43.000	86.455	35.975	-126.627	-64.784
1200	43.000	90.275	40.361	-116.167	-83.698

1003 K, transition point; ΔH° = 7.540

1098 K, melting point; ΔH° = 4.000

CO(g)
Carbon monoxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	6.965	47.217	0	-26.417	-32.780
400	7.013	49.268	.711	-26.316	-34.972
600	7.276	52.155	2.137	-26.326	-39.306
800	7.624	54.296	3.627	-26.507	-43.609
1000	7.931	56.031	5.183	-26.766	-47.857
1200	8.168	57.499	6.794	-27.060	-52.047
1400	8.346	58.772	8.446	-27.378	-56.187
1600	8.480	59.896	10.130	-27.709	-60.279
1800	8.583	60.901	11.836	-28.057	-64.331
2000	8.664	61.810	13.561	-28.419	-68.343
2200	8.728	62.638	15.301	-28.794	-72.316
2400	8.781	63.400	17.052	-29.187	-76.255
2600	8.825	64.105	18.813	-29.593	-80.162
2800	8.863	64.760	20.582	-30.015	-84.035
3000	8.895	65.373	22.357	-30.455	-87.880

$\text{CO}_2(\text{g})$
Carbon dioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.874	51.070	0	-94.051	-94.258
400	9.877	53.828	.958	-94.064	-94.326
600	11.310	58.124	3.087	-94.115	-94.447
800	12.293	61.520	5.453	-94.208	-94.545
1000	12.980	64.342	7.984	-94.312	-94.619
1200	13.466	66.754	10.632	-94.413	-94.669
1400	13.815	68.857	13.362	-94.512	-94.704
1600	14.074	70.720	16.152	-94.611	-94.725
1800	14.269	72.389	18.987	-94.715	-94.731
2000	14.424	73.901	21.857	-94.828	-94.728
2200	14.547	75.282	24.755	-94.953	-94.713
2400	14.648	76.552	27.674	-95.096	-94.686
2600	14.734	77.728	30.613	-95.253	-94.645
2800	14.807	78.822	33.567	-95.429	-94.589
3000	14.873	79.846	36.535	-95.624	-94.523

$\text{CaO}(\text{c})$
Calcium monoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.050	9.100	0.000	-151.790	-144.234
400	11.180	12.233	1.089	-151.689	-141.665
600	12.075	16.965	3.429	-151.419	-136.711
800	12.501	20.502	5.890	-151.444	-131.814
1000	12.793	23.325	8.421	-151.492	-126.912
1200	13.035	25.679	11.004	-153.565	-121.819
1400	13.256	27.705	13.633	-153.197	-116.556
1600	13.468	29.489	16.306	-152.797	-111.356
1800	13.676	31.087	19.020	-188.908	-105.264
2000	13.882	32.539	21.776	-188.048	-96.018

$\text{CaO}(\text{g})$
Calcium monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.757	52.487	0	10.500	5.120
400	8.147	54.824	.811	10.323	3.311
600	8.564	58.218	2.488	9.929	-.114
800	8.763	60.712	4.223	9.179	-3.359
1000	8.895	62.682	5.989	8.366	-6.411
1200	9.069	64.318	7.784	5.505	-9.116
1400	9.391	65.737	9.626	5.087	-11.518
1600	9.931	67.024	11.555	4.742	-13.873
1800	10.697	68.236	13.614	-32.024	-15.248
2000	11.626	69.410	15.844	-31.690	-13.402

$\text{CdO}(\text{c})$
Cadmium monoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.670	13.100	0	-61.700	-54.609
400	11.410	16.350	1.129	-61.578	-52.204
600	12.120	21.130	3.490	-62.798	-47.558
800	12.570	24.680	5.961	-62.535	-42.519
1000	12.940	27.520	8.513	-62.223	-37.538
1200	13.280	29.910	11.135	-85.332	-29.007
1400	13.610	31.990	13.824	-84.496	-19.697

$\text{CeO}_2(\text{c})$
Cerium dioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.730	14.890	0	-260.200	-244.900
400	16.035	19.409	1.569	-260.026	-239.698
600	17.528	26.227	4.943	-259.558	-229.630
800	18.326	31.389	8.536	-259.108	-219.723
1000	18.810	35.534	12.252	-259.473	-209.927
1200	19.183	38.997	16.052	-260.465	-199.888
1400	19.574	41.983	19.927	-260.112	-189.818
1600	20.059	44.627	23.888	-259.700	-179.809
1800	20.667	47.024	27.959	-259.201	-169.853
2000	21.378	49.237	32.162	-258.593	-159.955

$\text{Ce}_2\text{O}_3(\text{c})$
Dicerium trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	28.090	35.400	0	-429.300	-407.682
400	30.661	44.063	3.009	-428.719	-400.379
600	32.964	56.988	9.399	-427.398	-386.492
800	34.453	66.601	16.145	-426.151	-373.047
1000	35.861	74.520	23.176	-426.461	-359.916

$\text{ClO}(\text{g})$
Chlorine monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.540	54.145	0	24.340	23.446
400	7.942	56.419	.789	24.345	23.140
600	8.429	59.743	2.432	24.384	22.531
800	8.676	62.205	4.145	24.427	21.906
1000	8.816	64.158	5.895	24.465	21.271
1200	8.906	65.773	7.668	24.495	20.630
1400	8.971	67.151	9.456	24.521	19.984
1600	9.022	68.353	11.256	24.540	19.334
1800	9.064	69.418	13.065	24.554	18.683
2000	9.100	70.375	14.881	24.560	18.030

$\text{Cl}_2\text{O}(\text{g})$
Dichlorine monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.427	64.019	0	19.200	23.307
400	12.280	67.508	1.211	19.205	24.709
600	13.086	72.665	3.760	19.289	27.446
800	13.424	76.482	6.416	19.393	30.149
1000	13.592	79.497	9.119	19.491	32.827
1200	13.686	81.984	11.848	19.580	35.487
1400	13.745	84.099	14.591	19.656	38.130
1600	13.783	85.937	17.344	19.722	40.764
1800	13.809	87.562	20.103	19.776	43.392
2000	13.829	89.018	22.867	19.817	46.015

$\text{CoO}(\text{c})$
Cobalt monoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.200	12.660	0	-56.870	-51.198
400	12.602	16.397	1.294	-56.563	-49.315
600	12.996	21.589	3.858	-56.088	-45.793
800	13.134	25.349	6.472	-55.850	-42.402
1000	13.338	28.298	9.116	-55.681	-39.074
1200	13.765	30.764	11.823	-55.726	-35.746
1400	14.415	32.932	14.637	-56.097	-32.403
1600	15.220	34.908	17.599	-55.929	-29.031
1800	16.078	36.751	20.729	-59.275	-25.631

$\text{Co}_3\text{O}_4(\text{c})$
Tricobalt tetroxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	29.480	26.130	0	-219.600	-206.358
300	29.593	26.313	.055	-219.604	-191.571
400	34.208	35.511	3.263	-218.935	-201.939
500	37.008	43.469	6.835	-219.513	-172.866
600	38.927	50.394	10.636	-217.089	-193.807
700	40.743	56.527	14.617	-219.057	-154.294
800	43.176	62.116	18.805	-215.260	-186.313
900	46.919	67.401	23.296	-218.582	-135.785
1000	52.659	72.621	28.255	-212.413	-179.414

$\text{CrO}(\text{g})$
Chromium monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.486	57.159	0	45.000	36.948
400	7.883	59.417	.783	44.831	34.222
600	8.380	62.718	2.415	44.440	29.002
800	8.634	65.168	4.119	43.957	23.926
1000	8.777	67.111	5.862	43.397	18.981
1200	8.868	68.720	7.627	42.708	14.165
1400	8.932	70.092	9.407	41.849	9.459
1600	8.981	71.288	11.199	40.829	4.911
1800	9.020	72.348	12.999	39.636	.491
2000	9.055	73.301	14.807	38.286	-3.790
2200	9.087	74.165	16.621	32.944	-7.799
2400	9.119	74.957	18.441	31.966	-11.455

$\text{CrO}_2(\text{g})$
Chromium dioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.370	64.323	0	-18.000	-20.883
400	11.236	67.496	1.102	-18.212	-21.834
600	12.359	72.288	3.473	-18.607	-23.558
800	12.940	75.932	6.009	-19.046	-25.144
1000	13.256	78.857	8.632	-19.546	-26.613
1200	13.443	81.292	11.303	-20.172	-27.965
1400	13.561	83.373	14.005	-20.970	-29.216
1600	13.639	85.190	16.725	-21.935	-30.321
1800	13.694	86.800	19.459	-23.079	-31.301
2000	13.734	88.245	22.202	-24.390	-32.148
2200	13.764	89.555	24.952	-29.704	-32.727
2400	13.787	90.754	27.707	-30.666	-32.956

$\text{CrO}_3(\text{g})$
Chromium trioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.390	63.591	0	-70.000	-65.359
400	15.258	67.804	1.465	-70.211	-63.738
600	17.338	74.438	4.751	-70.434	-60.445
800	18.321	79.577	8.329	-70.618	-57.088
1000	18.838	83.726	12.050	-70.841	-53.682
1200	19.137	87.190	15.850	-71.182	-50.215
1400	19.324	90.155	19.697	-71.695	-46.698
1600	19.449	92.744	23.575	-72.375	-43.072
1800	19.535	95.040	27.474	-73.239	-39.358
2000	19.598	97.102	31.388	-74.276	-35.541
2200	19.645	98.972	35.312	-79.323	-31.485
2400	19.681	100.683	39.245	-80.026	-27.101

$\text{Cr}_2\text{O}_3(\text{c})$
Dichromium trioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	28.680	19.400	0	-272.600	-253.099
400	26.730	27.280	2.730	-272.137	-246.515
600	28.740	38.620	8.340	-271.316	-233.872
800	29.730	47.030	14.185	-270.633	-221.505
1000	30.600	53.760	20.225	-270.018	-209.293
1200	31.140	59.390	26.405	-269.589	-197.178
1400	31.330	64.210	32.655	-269.479	-185.157
1600	31.340	68.390	38.925	-269.705	-173.067
1800	31.410	72.090	45.195	-270.306	-160.969
2000	31.830	75.410	51.510	-271.203	-148.764

$\text{Cs}_2\text{O}(\text{g})$
Dicesium monoxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	13.238	75.998	0	-22.000	-25.207
400	13.521	79.933	1.365	-23.549	-25.889
600	13.732	85.464	4.094	-24.545	-26.842
800	13.809	89.426	6.849	-25.538	-27.461
1000	13.845	92.512	9.615	-26.712	-28.221
1200	13.865	95.038	12.386	-28.771	-29.715
1400	13.877	97.176	15.161	-28.846	-31.199
1600	13.885	99.030	17.937	-28.935	-32.673
1800	13.890	100.666	20.714	-29.047	-34.135
2000	13.894	102.129	23.493	-29.188	-35.420

*All data estimated except enthalpy of formation at 298 K.

$\text{CsO}(\text{g})$
Cesium monoxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	8.719	61.049	0	15.000	10.177
400	8.854	63.632	.896	14.259	8.731
600	8.976	67.249	2.680	13.809	6.064
800	9.043	69.841	4.483	13.344	3.551
1000	9.093	71.864	6.296	-3.224	1.961
1200	9.137	73.526	8.119	-3.237	3.080
1400	9.177	74.937	9.951	-3.260	4.043
1600	9.216	76.165	11.790	-3.291	5.087
1800	9.253	77.253	13.637	-3.331	6.137
2000	9.290	78.230	15.491	-3.385	7.191

*All data estimated.

$\text{CuO}(\text{c})$
Copper monoxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	10.109	10.190	0	-37.200	-30.570
400	11.170	13.327	1.090	-37.076	-28.322
600	12.224	18.076	3.439	-36.709	-24.021
800	12.796	21.682	5.949	-36.277	-19.856
1000	13.020	24.564	8.533	-35.852	-15.800
1200	13.539	26.973	11.178	-35.458	-11.825
1400*	15.143	29.159	14.018	-38.125	-7.826

*Decomposes above 1400 K.

$\text{Cs}_2\text{O}(\text{c})$
Dicesium monoxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	18.160	35.100	0.000	-82.690	-73.703
300	18.180	35.220	.034	-82.691	-73.648
400*	18.980	40.560	1.890	-83.714	-70.305
500	19.790	44.890	3.830	-83.637	-66.963
600	20.580	48.540	5.845	-83.484	-63.627
700	21.370	51.790	7.945	-83.253	-60.344
763	21.890	53.660	9.305	-83.076	-58.300

*Data extrapolated 350 to 763 K.
763 K, melting point.

$\text{CuO}(\text{g})$
Copper monoxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.522	56.072	0	58.000	50.950
400	8.689	58.601	.877	57.910	48.556
600	8.862	62.161	2.634	57.687	43.923
800	8.982	64.727	4.419	57.393	39.378
1000	9.126	66.746	6.229	57.044	34.914
1200	9.301	68.425	8.071	56.635	30.526
1400	9.486	69.873	9.950	53.007	26.306
1600	9.658	71.151	11.865	52.489	22.528
1800	9.805	72.298	13.812	51.991	18.812
2000	9.922	73.337	15.785	51.508	15.152

$\text{Cu}_2\text{O}(\text{c}, \text{l})$
Dicopper monoxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	14.960	22.083	0	-40.800	-35.354
400	16.155	26.653	1.587	-40.784	-33.492
600	17.640	33.516	4.982	-40.609	-29.880
800	18.478	38.714	8.600	-40.359	-26.341
1000	19.226	42.915	12.368	-40.089	-22.867
1200	20.444	46.516	16.322	-39.792	-19.448
1400	22.809	49.825	20.621	-45.647	-15.898
1517	25.063	51.736	23.407	-45.190	-13.436
1517	23.843	61.858	38.760	-29.837	-13.436
1600	23.843	63.132	40.745	-29.517	-12.542
1800	23.843	65.740	45.514	-28.753	-10.467

1516.7 K, melting point; $\Delta \text{H}^\circ = 15.353$

$\text{Dy}_2\text{O}_3(\text{c})$
Didysprosium trioxide (cubic)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	27.790	35.800	0	-445.320	-428.741
400	29.364	44.198	2.915	-444.173	-423.251
600	30.877	56.438	8.963	-441.702	-413.317
800	31.553	65.423	15.212	-439.199	-404.233
1000	32.114	72.522	21.577	-436.757	-395.774
1200	32.850	78.439	28.070	-434.400	-387.800
1400	33.756	83.570	34.729	-432.158	-380.218
1590	34.528	87.917	41.220	-440.509	-335.242
1590	34.400	88.055	41.440	-440.289	-335.242
1600	34.400	88.270	41.784	-429.856	-372.946
1800	34.400	92.322	48.664	-431.512	-365.666
2000	34.400	95.946	55.544	-429.707	-358.461

1590 K, transition point; $\Delta \text{H}^\circ = 0.220$

$\text{Er}_2\text{O}_3(\text{c})$
Dierbium trioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	25.930	37.200	0	-453.590	-432.336
400	27.742	45.095	2.741	-453.310	-425.110
600	29.477	56.716	8.485	-452.545	-411.175
800	30.466	65.341	14.485	-451.753	-397.513
1000	31.195	72.220	20.654	-451.029	-384.024
1200	31.785	77.962	26.954	-450.425	-370.685
1400	32.279	82.899	33.362	-449.990	-357.421
1600	32.695	87.238	39.861	-449.769	-344.216
1800	33.043	91.109	46.435	-459.320	-331.009
2000	33.329	94.606	53.074	-459.072	-316.746

$\text{EuO}(\text{c})$
Europium monoxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	11.650	19.990	0	-142.900	-136.009
400	12.000	23.480	1.207	-142.731	-133.682
600	12.300	28.410	3.641	-142.428	-129.224
800	12.550	31.990	6.126	-142.239	-124.859
1000	12.890	34.830	8.625	-142.253	-120.569
1200	13.230	37.210	11.237	-144.537	-116.900
1400	13.580	39.270	13.919	-144.537	-111.234
1600	13.920	41.110	16.669	-144.483	-106.485

$\text{Eu}_2\text{O}_3(\text{c})$
Dyeuropium trioxide, cubic

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	29.800	33.500	0.000	-397.400	-374.381
400	31.719	42.557	3.144	-396.694	-366.616
600	33.693	55.832	9.705	-395.139	-351.908
800	34.984	65.710	16.579	-393.644	-337.724
1000	36.027	73.632	23.683	-392.386	-323.895
1200	36.930	80.282	30.980	-395.725	-309.849

*Entropy and heat capacity estimated at 298 K.

$\text{Eu}_2\text{O}_3(\text{c})$
Dyeuropium trioxide (monoclinic)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	29.100	35.000	0	-394.700	-372.128
400	30.909	43.835	3.067	-394.072	-364.504
600	32.924	56.781	9.466	-392.678	-350.016
800	34.445	66.466	16.206	-391.318	-336.002
895	35.119	70.368	19.510	-390.721	-329.467
895	34.300	70.513	19.640	-390.591	-329.467
1000	35.134	74.366	23.287	-390.082	-322.325
1200*	36.237	80.876	30.432	-393.574	-308.410
1400	36.990	86.522	37.759	-392.471	-294.300
1600	37.557	91.500	45.216	-391.278	-280.356
1800	38.014	95.950	52.775	-390.018	-266.569
2000	38.405	99.976	60.418	-456.255	-245.316

*Monoclinic form metastable below 1350 K.

895 K, transition point; $\Delta \text{H}^\circ = 0.130$

FO(g)
Fluorine monoxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.319	51.765	0	26.000	25.093
400	7.694	53.968	.765	26.012	24.783
600	8.246	57.202	2.364	26.051	24.160
800	8.562	59.622	4.047	26.091	23.522
1000	8.750	61.554	5.780	26.128	22.877
1200	8.875	63.161	7.543	26.159	22.224
1400	8.965	64.537	9.328	26.186	21.564
1600	9.035	65.738	11.128	26.209	20.904
1800	9.093	66.806	12.941	26.227	20.240
2000	9.144	67.767	14.765	26.239	19.573

FO₂(g)
Fluorine dioxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.611	61.903	0	3.000	6.376
400	11.319	65.125	1.119	3.004	7.531
600	12.247	69.907	3.483	3.066	9.781
800	12.800	73.512	5.993	3.144	12.008
1000	13.132	76.407	8.589	3.224	14.215
1200	13.341	78.821	11.238	3.297	16.407
1400	13.478	80.889	13.920	3.362	18.584
1600	13.572	82.695	16.626	3.417	20.756
1800	13.639	84.298	19.347	3.457	22.921
2000	13.688	85.738	22.080	3.483	25.081

F₂O(g)
Difluorine monoxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.349	59.118	0	5.860	9.983
400	11.373	62.311	1.109	5.825	11.398
600	12.524	67.170	3.514	5.853	14.183
800	13.065	70.856	6.079	5.920	16.948
1000	13.348	73.805	8.723	5.992	19.697
1200	13.511	76.254	11.410	6.059	22.433
1400	13.613	78.345	14.123	6.116	25.156
1600	13.681	80.168	16.853	6.164	27.872
1800	13.728	81.782	19.594	6.200	30.585
2000	13.762	83.230	22.343	6.222	33.293

Fe₉₄₇O (c,l)
Iron oxide, wustite

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.470	13.740	0	-63.640	-58.590
400	12.110	17.210	1.203	-63.402	-56.903
600	12.760	22.260	3.701	-62.991	-53.745
800*	13.060	25.980	6.285	-62.767	-50.708
1000	13.380	28.920	8.927	-62.932	-47.681
1200	13.880	31.400	11.659	-63.470	-44.574
1400	14.490	33.590	14.487	-63.066	-41.462
1600	14.910	35.560	17.434	-62.642	-38.409
1652	14.930	36.030	18.210	-62.537	-37.608
1652	16.190	40.560	25.701	-55.046	-37.608
1800	16.190	41.960	28.096	-54.879	-36.063

1652 K, melting point; ΔH° = 7.491

*Unstable below 833 K.

FeO(c)
Iron monoxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	11.930	14.520	0	-65.000	-60.080
400	12.390	18.094	1.240	-64.758	-58.436
600	13.120	23.257	3.792	-64.368	-55.364
800	13.700	27.113	6.475	-64.133	-52.405
1000	14.190	30.222	9.263	-64.264	-49.471
1200	14.600	32.845	12.142	-64.782	-46.459
1400	15.000	35.127	15.104	-64.340	-43.439
1600	15.300	37.150	18.134	-63.926	-40.482

*Stoichiometric FeO does not exist as a stable phase.

Fe₂O₃(c)
Diiron trioxide, hematite

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	24.800	20.890	0	-197.000	-177.424
400	28.910	28.840	2.764	-196.595	-170.793
600	33.370	41.490	9.034	-195.392	-158.139
800	37.440	51.620	16.093	-194.016	-145.930
960	47.360	59.060	22.648	-192.627	-136.426
960	34.060	59.060	22.648	-192.627	-136.426
1000	34.050	60.450	24.010	-192.757	-134.082
1200	34.040	66.660	30.820	-193.584	-122.265
1400	34.030	71.900	37.628	-192.678	-110.442
1600	34.020	76.450	44.433	-191.977	-98.754
1800	34.010	80.450	51.236	-192.083	-87.080

960 K, Curie temperature; ΔH° = 0

$\text{Fe}_3\text{O}_4(\text{c})$
Triiron tetroxide, magnetite

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	36.040	34.930	0	-267.300	-242.661
400	41.977	46.412	3.994	-266.663	-234.331
600	49.744	64.959	13.194	-264.692	-218.562
800	63.717	80.817	24.283	-261.735	-203.587
850	81.000	85.027	27.764	-260.454	-199.982
850	54.946	85.027	27.764	-260.454	-199.982
1000	49.693	93.490	35.563	-260.031	-189.381
1200	46.912	102.252	45.168	-261.459	-175.114
1400	46.612	109.439	54.491	-260.559	-160.799
1600	47.634	115.719	63.899	-259.871	-146.594
1800	49.425	121.427	73.596	-260.095	-132.412

850 K, Curie point; $\Delta H^\circ = 0$ 1870 K, melting point; $\Delta H^\circ = 33.0$

$\text{Ga}_2\text{O}_3(\text{c})$
Digallium trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	22.020	20.310	0	-260.300	-238.620
400	24.650	27.180	2.388	-263.010	-230.344
600	27.626	37.797	7.645	-262.548	-214.089
800	29.285	45.996	13.352	-261.747	-198.051
1000	30.182	52.637	19.308	-260.793	-182.235
1200	30.703	58.190	25.400	-259.771	-166.620
1400	31.116	62.954	31.503	-258.708	-151.178
1600	31.544	67.136	37.848	-257.604	-135.891
1800	31.965	70.877	44.200	-256.447	-120.745
2000	32.196	74.259	50.622	-255.255	-105.730

$\text{Gd}_2\text{O}_3(\text{c})$
Digadolinium trioxide (cubic)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	25.220	36.000	0.000	-436.640	-415.773
400	27.359	43.751	2.692	-436.539	-408.657
600	29.291	55.259	8.381	-435.797	-394.849
800	30.437	63.851	14.360	-435.048	-381.312
1000	31.305	70.740	20.538	-434.359	-367.974
1200	31.956	76.509	26.868	-433.758	-354.746
1400	32.360	81.469	33.304	-433.312	-341.597

*Enthalpy of formation estimated at 298 K.

$\text{Gd}_2\text{O}_3(\text{c})$
Digadolinium trioxide (monoclinic)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	25.484	37.500	0	-434.900	-414.480
400	27.105	45.240	2.686	-434.805	-407.519
600	28.749	56.579	8.291	-434.147	-393.991
800	29.734	64.992	14.144	-433.523	-380.701
1000	30.527	71.714	20.172	-432.985	-367.574
1200	31.292	77.347	26.354	-432.531	-354.525
1400*	32.076	82.230	32.690	-432.185	-341.536
1600	32.847	86.564	39.183	-431.869	-328.506
1800	33.504	90.472	45.822	-431.577	-314.779
2000	33.876	94.025	52.566	-431.304	-301.146

*Monoclinic form is metastable below 1550 K.

$\text{GeO}_2(\text{c})$
Germanium dioxide (hexagonal)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.450	13.210	0.000	-132.580	-119.692
400	14.006	17.100	1.352	-132.536	-115.296
600	15.964	23.185	4.367	-132.197	-106.732
800	17.089	27.947	7.683	-131.678	-98.324
1000	17.708	31.834	11.169	-131.101	-90.055
1200	18.067	35.097	14.749	-130.543	-81.894

1389 K, melting point; $\Delta H^\circ = 3 \pm 1$

$\text{GeO}_2(\text{c})$
Germanium dioxide (tetragonal)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.990	9.490	0	-138.600	-124.603
400	14.424	13.401	1.361	-138.547	-119.827
600	16.572	19.726	4.496	-138.088	-110.547
800	17.458	24.630	7.909	-137.472	-101.464
1000	18.085	28.592	11.463	-136.827	-92.539
1200	18.824	31.953	15.151	-136.161	-83.739

1308 K, transition to hexagonal form; $\Delta H^\circ = 5 \pm 1$

GeO₂(vitreous)
Germanium dioxide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	12.667	15.420	0	-128.400	-116.171
400	14.250	19.375	1.375	-128.333	-112.003
600	16.115	25.542	4.429	-127.955	-103.904
800	17.246	30.345	7.774	-127.407	-95.971
1000	17.985	34.279	11.302	-126.788	-88.187
1200	18.478	37.604	14.952	-126.160	-80.519
1400	18.829	40.480	18.684	-124.299	-71.575
1600	19.130	43.014	22.480	-123.570	-62.666
1800	19.467	45.286	26.338	-122.802	-53.843

OH(g)
Hydroxyl (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	7.167	43.881	0	9.318	8.192
400	7.087	45.974	.725	9.328	7.806
600	7.057	48.838	2.137	9.297	7.048
800	7.150	50.878	3.556	9.224	6.309
1000	7.332	52.492	5.004	9.138	5.590
1200	7.549	53.848	6.491	9.050	4.889
1400	7.766	55.028	8.023	8.971	4.202
1600	7.963	56.078	9.596	8.898	3.525
1800	8.137	57.026	11.207	8.832	2.859
2000	8.286	57.891	12.849	8.767	2.199
2200	8.415	58.687	14.520	8.704	1.545
2400	8.526	59.425	16.214	8.637	.895
2600	8.622	60.111	17.929	8.567	.253
2800	8.706	60.753	19.662	8.492	-.383
3000	8.780	61.356	21.411	8.411	-1.013

H₂O(l,g)
Dihydrogen monoxide, water

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	17.997	16.718	0	-68.315	-56.690
373	18.153	20.765	1.353	-67.747	-53.831
373	8.134	46.921	11.113	-57.987	-53.831
400	8.186	47.484	11.344	-58.040	-53.516
600	8.676	50.891	13.028	-58.498	-51.154
800	9.246	53.464	14.819	-58.903	-48.644
1000	9.851	55.592	16.728	-59.243	-46.040
1200	10.444	57.441	18.759	-59.518	-43.370
1400	10.987	59.092	20.903	-59.736	-40.661
1600	11.462	60.591	23.149	-59.907	-37.925
1800	11.869	61.965	25.483	-60.042	-35.168
2000	12.214	63.234	27.892	-60.151	-32.399
2200	12.505	64.412	30.365	-60.240	-29.619
2400	12.753	65.511	32.891	-60.318	-26.830
2600	12.965	66.541	35.464	-60.386	-24.039
2800	13.146	67.508	38.075	-60.453	-21.240
3000	13.304	68.421	40.720	-60.517	-18.437

273.15 K, melting point; ΔH° = 1.436
373.15 K, boiling point; ΔH° = 9.760

H₂O(g)
Dihydrogen monoxide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.025	45.106	0	-57.795	-54.634
400	8.186	47.484	.825	-58.038	-53.515
600	8.676	50.891	2.509	-58.496	-51.153
800	9.246	53.464	4.300	-58.902	-48.643
1000	9.851	55.592	6.209	-59.242	-46.039
1200	10.444	57.441	8.240	-59.517	-43.369
1400	10.987	59.092	10.384	-59.735	-40.660
1600	11.462	60.591	12.630	-59.906	-37.924
1800	11.869	61.965	14.964	-60.041	-35.167
2000	12.214	63.234	17.373	-60.150	-32.398

D₂O(g)
Dideuterium monoxide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.187	47.378	0	-59.561	-56.059
400	8.517	49.828	.850	-59.784	-54.828
600	9.282	53.423	2.628	-60.154	-52.267
800	10.098	56.205	4.566	-60.439	-49.593
1000	10.857	58.542	6.664	-60.646	-46.856
1200	11.494	60.580	8.901	-60.792	-44.083
1400	12.007	62.391	11.253	-60.891	-41.290
1600	12.413	64.022	13.696	-60.956	-38.485
1800	12.737	65.504	16.213	-60.997	-35.673
2000	12.990	66.860	18.787	-61.025	-32.859

$\text{H}_2\text{O}_2(\text{g})$
Dihydrogen dioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.115	56.009	0	-32.580	-25.364
400	11.080	59.116	1.079	-32.931	-22.843
600	12.702	63.934	3.467	-33.428	-17.681
800	13.838	67.753	6.127	-33.752	-12.381
1000	14.696	70.937	8.984	-33.965	-7.012
1200	15.390	73.680	11.994	-34.104	-1.607
1400	15.959	76.096	15.132	-34.188	3.818

$\text{HfO}_2(\text{c})$
Hafnium dioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.400	14.180	0	-267.120	-253.633
400	15.996	18.651	1.554	-266.925	-249.053
600	17.640	25.488	4.937	-266.331	-240.238
800	18.560	30.698	8.564	-265.657	-231.639
1000	19.174	34.910	12.341	-264.970	-223.220
1200	19.634	38.448	16.223	-264.297	-214.929
1400	20.034	41.505	20.190	-263.645	-206.752
1600	20.453	44.207	24.238	-263.012	-198.673
1800	20.961	46.644	28.377	-262.304	-190.658

$\text{HgO}(\text{c})$
Mercury monoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.531	16.795	0.000	-21.700	-13.994
300*	10.551	16.860	.020	-21.698	-13.945
400	11.550	20.037	1.126	-21.609	-11.372
500	12.340	22.703	2.323	-21.429	-8.831
600	12.935	25.008	3.587	-21.192	-6.335
700	13.400	27.038	4.905	-34.955	-2.305

*Data estimated above 298 K.
749 K, decomposition point

$\text{HgO}(\text{g})$
Mercury monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.859	57.134	0	10.000	5.679
400	8.236	59.500	.821	9.786	4.238
600	8.620	62.923	2.512	9.434	1.541
800	8.798	65.431	4.256	-4.799	2.756
1000	8.898	67.405	6.026	-4.844	4.650
1200	8.964	69.034	7.813	-4.894	6.554
1400	9.012	70.419	9.611	-4.949	8.467
1600	9.052	71.625	11.417	-5.011	10.387
1800	9.086	72.694	13.231	-5.075	12.315
2000	9.116	73.652	15.051	-5.146	14.253

$\text{Ho}_2\text{O}_3(\text{c})$
Diholmium trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	27.480	37.800	0	-449.550	-428.212
400	29.082	46.133	2.892	-449.082	-420.994
600	30.349	58.206	8.855	-448.040	-407.169
800	30.968	67.028	14.992	-446.991	-393.702
1000	31.404	73.987	21.231	-446.122	-380.484
1200	31.765	79.746	27.549	-445.564	-367.413
1400	32.087	84.667	33.934	-445.448	-354.402
1600	32.378	88.971	40.381	-445.897	-341.389
1800	32.641	92.800	46.884	-454.297	-327.950
2000	32.874	96.251	53.436	-454.634	-313.918

$\text{In}_2\text{O}_3(\text{c})$
Diindium trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	24.000	24.900	0	-221.270	-198.537
400	26.831	32.414	2.611	-221.096	-190.797
600	29.010	43.778	8.231	-222.077	-175.140
800	30.037	52.277	14.144	-221.324	-159.608
1000	30.731	59.057	20.224	-220.487	-144.273
1200	31.293	64.711	26.428	-219.594	-129.112
1400	31.793	69.573	32.737	-218.645	-114.106
1600	32.261	73.849	39.143	-217.639	-99.240

*Heat capacity estimated at 298 K.

$KO(g)$
Potassium monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	8.600	56.863	0	17.000	11.960
400	8.791	59.420	.887	16.198	10.381
600	8.966	63.022	2.665	15.765	7.569
800	9.060	65.616	4.468	15.352	4.898
1000	9.128	67.645	6.287	14.917	2.334
1200	9.186	69.314	8.118	-4.229	2.688
1400	9.239	70.734	9.961	-4.240	3.843
1600	9.289	71.971	11.814	-4.255	4.999
1800	9.338	73.068	13.676	-4.274	6.155
2000	9.386	74.054	15.549	-4.298	7.316

*All data estimated.

$KO_2(c)$
Potassium dioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.530	29.280	0.000	-68.000	-57.510
300*	18.564	29.395	.034	-67.992	-57.446
400	19.042	34.935	1.963	-68.087	-53.892
500	20.582	39.447	3.986	-67.538	-50.406
600	21.158	43.252	6.074	-66.931	-47.035
700	21.689	46.553	8.217	-66.282	-43.769
800	22.224	49.484	10.412	-65.597	-40.601

*Data estimated above 298 K.

$K_2O(c)$
Dipotassium monoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	17.800	24.380	0	-81.260	-72.006
300	17.828	24.490	.033	-81.260	-71.949
400	18.918	29.781	1.875	-82.401	-68.629
500	19.642	34.084	3.804	-82.323	-65.195
600	20.219	37.718	5.798	-82.159	-61.782
700	20.728	40.873	7.846	-81.932	-58.402
800	21.204	43.672	9.943	-81.658	-55.061
900	21.661	46.196	12.086	-81.346	-51.754
1000	22.108	48.502	14.275	-81.012	-48.485
1100	22.551	50.630	16.508	-118.473	-43.201

*All data estimated except formation enthalpy at 298 K.

$K_2O_2(c)$
Dipotassium dioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	22.900	26.310	0	-118.400	-102.416
300*	22.944	26.452	.042	-118.397	-102.317
400	24.938	33.344	2.443	-119.334	-96.770
500	26.509	39.082	5.017	-118.977	-91.168
600	27.922	44.042	7.740	-118.461	-85.650
700	29.262	48.447	10.599	-117.812	-80.231

*Data above 298 are estimated.

683 K, melting point.

$La_2O_3(c)$
Dilanthanum trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	26.000	30.430	0	-428.700	-407.747
400	27.939	38.381	2.760	-428.353	-400.643
600	29.703	50.084	8.545	-427.603	-386.958
800	30.855	58.793	14.605	-426.678	-373.553
1000	31.812	65.784	20.874	-425.897	-360.356
1200	32.616	71.657	27.320	-429.846	-347.196
1400	33.272	76.736	33.911	-429.115	-333.490
1600	33.811	81.215	40.620	-428.306	-319.868
1800	34.310	85.226	47.432	-427.429	-306.384
2000	34.895	88.870	54.350	-426.480	-292.962

$LiO(g)$
Lithium monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.745	50.395	0	20.100	14.453
400	8.142	52.730	.810	19.917	12.552
600	8.573	56.125	2.488	18.721	9.204
800	8.782	58.623	4.225	18.278	6.098
1000	8.901	60.596	5.995	17.846	3.104
1200	8.981	62.227	7.783	17.415	.195
1400	9.042	63.616	9.586	16.987	-2.641
1600	9.091	64.827	11.399	16.562	-5.416
1800	9.133	65.900	13.222	-18.725	-4.672
2000	9.172	66.864	15.052	-18.787	-3.107

$\text{Li}_2\text{O}(\text{c})$
Dilithium monoxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	12.930	9.056	0	-142.900	-134.148
400	15.246	13.221	1.449	-143.076	-131.128
600	17.668	19.905	4.762	-144.768	-124.623
800	19.297	25.223	8.467	-144.635	-117.921
1000	20.502	29.665	12.453	-144.232	-111.284
1200	21.430	33.488	16.650	-143.630	-104.748
1400	22.250	36.854	21.018	-142.865	-98.327
1600	23.104	39.880	25.552	-141.932	-92.026
1800	23.995	42.653	30.263	-210.556	-78.922

$\text{Li}_2\text{O}_2(\text{c})$
Dilithium dioxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	19.297	13.500	0	-151.700	-136.968
300	19.304	13.619	.036	-151.699	-136.876
400	19.972	19.253	1.996	-151.691	-131.937
500	20.969	23.813	4.041	-153.213	-126.844
570	21.770	26.611	5.536	-153.245	-123.149

*Entropy at 298 estimated, decomposes above 570 K.

$\text{Lu}_2\text{O}_3(\text{c})$
Dilutetium trioxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	24.320	26.281	0	-448.900	-427.556
400	26.832	33.840	2.626	-448.664	-420.298
600	28.635	45.120	8.202	-447.901	-406.270
800	29.639	53.501	14.033	-447.083	-392.507
1000	30.469	60.207	20.946	-446.333	-378.955
1200	31.143	65.824	26.211	-445.711	-365.541
1400	31.615	70.663	32.490	-445.303	-352.208
1600	31.886	74.904	38.843	-445.207	-338.928
1800	32.029	78.669	45.235	-445.516	-325.629
2000	32.204	82.051	51.657	-455.167	-311.971

$\text{MgO}(\text{c})$
Magnesium monoxide, Periclase

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.882	6.440	0.000	-143.760	-136.046
400	10.169	9.251	0.978	-143.764	-133.407
600	11.285	13.616	3.138	-143.652	-128.249
800	11.856	16.947	5.457	-143.537	-123.135
1000	12.232	19.635	7.867	-143.616	-117.866
1200	12.507	21.891	10.343	-143.613	-112.322
1400	12.664	23.831	12.860	-173.790	-105.958
1600	12.821	25.532	15.409	-173.199	-96.028
1800	12.978	27.052	17.988	-174.408	-86.186
2000	13.136	28.427	20.600	-173.686	-76.420

$\text{MgO}(\text{g})$
Magnesium monoxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.689	50.946	0	13.990	8.344
400	8.313	53.288	.813	13.730	6.473
600	10.296	57.002	2.659	13.528	2.900
800	12.323	60.262	4.935	13.600	-.649
1000	13.096	63.120	7.500	11.677	-4.058
1200	12.841	65.496	10.105	11.808	-7.226
1400	12.222	67.430	12.613	-18.377	-9.583
1600	11.605	69.021	14.994	-17.864	-8.366
1800	11.103	70.358	17.263	-17.473	-7.292
2000	10.722	71.507	19.444	-17.182	-6.076

$\text{MnO}(\text{c})$
Manganese monoxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.540	14.270	0	-92.070	-86.738
400	11.306	17.495	1.120	-91.975	-84.931
600	11.993	22.224	3.457	-91.822	-81.445
800	12.475	25.742	5.905	-91.761	-78.003
1000	12.934	28.575	8.445	-92.304	-74.554
1200	13.403	30.974	11.079	-92.334	-70.998
1400	13.883	33.076	13.807	-92.875	-67.422

$\text{MnO}_2(\text{c})$
Manganese dioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	13.005	12.680	0	-124.290	-111.179
300	13.064	12.761	.024	-124.291	-111.098
400	15.173	16.847	1.450	-124.227	-106.706
500	16.250	20.360	3.026	-124.080	-102.340
600	16.920	23.386	4.686	-123.917	-98.008
700	17.399	26.032	6.403	-123.760	-93.706
800	17.775	28.380	8.163	-123.616	-89.424

Decomposes near 800 K.

$\text{Mn}_2\text{O}_3(\text{c})$
Dimanganese trioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	23.670	26.400	0	-229.200	-210.593
400	26.026	33.715	2.541	-229.072	-204.256
600	28.847	44.843	8.049	-228.673	-191.927
800	30.966	53.441	14.036	-228.249	-179.754
1000	32.824	60.554	20.419	-228.852	-167.661
1200	34.530	66.691	27.156	-228.287	-155.470

*Heat capacity estimated at 298 K.

Decomposes above 1350 K.

$\text{Mn}_3\text{O}_4(\text{c})$
Trimanganese tetroxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	33.583	37.200	0	-331.700	-306.727
400	37.532	47.662	3.636	-331.502	-298.223
600	41.401	63.751	11.598	-330.832	-281.720
800	42.556	75.852	20.016	-330.366	-265.448
1000	43.713	85.447	28.620	-331.830	-249.207
1200	47.545	93.695	37.679	-331.608	-232.691
1400	56.719	101.628	47.995	-331.956	-216.221
1445	59.792	103.469	50.615	-332.915	-212.440
1445	50.200	106.466	54.945	-328.585	-212.440
1600	50.200	111.581	62.726	-337.267	-199.480
1800	50.200	117.494	72.766	-337.367	-182.225

1445 K, transition point; $\Delta\text{H}^\circ = 4.330$

1835 K, melting point.

$\text{MoO}(\text{g})$
Molybdenum monoxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	8.605	57.757	0	74.321	66.448
400	8.694	60.301	.882	74.243	63.770
600	8.779	63.843	2.630	74.016	58.579
800	8.845	66.378	4.392	73.704	53.478
1000	8.893	68.357	6.166	73.329	48.463
1200	8.928	69.981	7.948	72.885	43.532
1400	8.956	71.360	9.737	72.368	38.680
1600	8.979	72.557	11.531	71.774	33.908
1800	8.998	73.616	13.328	71.091	29.214
2000	9.015	74.565	15.130	70.305	24.601

*All data estimated except enthalpy of formation at 298 K.

$\text{MoO}_2(\text{c})$
Molybdenum dioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	13.380	11.060	0.000	-140.760	-127.404
400	15.143	15.261	1.460	-140.621	-122.860
600	17.087	21.806	4.702	-140.097	-114.083
800	18.404	26.910	8.256	-139.405	-105.513
1000	19.504	31.137	12.049	-138.582	-97.133
1200	20.530	34.784	16.053	-137.647	-88.927
1400	21.562	38.026	20.262	-136.604	-80.888
1600	22.664	40.976	24.682	-135.446	-73.008
1800	23.896	43.715	29.336	-134.157	-65.276
2000	25.309	46.304	34.253	-132.724	-57.700

$\text{MoO}_2(\text{g})$
Molybdenum dioxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	10.558	66.176	0	-1.987	-5.064
400	11.454	69.410	1.123	-2.185	-6.084
600	12.531	74.284	3.534	-2.492	-7.965
800	13.060	77.970	6.100	-2.788	-9.744
1000	13.341	80.917	8.742	-3.116	-11.447
1200	13.505	83.366	11.428	-3.499	-13.077
1400	13.608	85.456	14.141	-3.952	-14.638
1600	13.677	87.278	16.869	-4.486	-16.131
1800	13.725	88.891	19.610	-5.110	-17.546
2000	13.759	90.339	22.358	-5.846	-18.892

$\text{MoO}_3(\text{c,l})$
Molybdenum trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.920	18.580	0.000	-178.080	-159.661
400	19.792	24.113	1.923	-177.839	-153.401
600	22.063	32.602	6.125	-177.098	-141.333
800	23.844	39.198	10.719	-176.155	-129.549
1000	25.500	44.698	15.655	-175.009	-118.026
1075	26.091	46.564	17.590	-174.528	-113.769
1075	30.170	57.438	29.280	-162.838	-113.769
1200	30.170	60.757	33.051	-161.526	-108.136
1400	30.170	65.408	39.085	-159.518	-99.399

1075 K, melting point; $\Delta H^\circ = 11.690$
1428 K, boiling point to polymeric species.

$\text{MoO}_3(\text{g})$
Molybdenum trioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.192	67.827	0	-82.800	-79.064
400	15.769	72.231	1.530	-82.953	-77.762
600	17.588	79.015	4.889	-83.055	-75.137
800	18.467	84.209	8.504	-83.090	-72.493
1000	18.933	88.385	12.249	-83.135	-69.839
1200	19.204	91.863	16.064	-83.233	-67.171
1400	19.374	94.837	19.923	-83.400	-64.482
1600	19.487	97.432	23.810	-83.648	-61.764
1800	19.565	99.732	27.716	-83.992	-59.006
2000	19.662	101.796	31.635	-84.454	-56.207

$\text{NO}(\text{g})$
Nitrogen monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.133	50.347	0	21.570	20.688
400	7.157	52.444	.727	21.580	20.385
600	7.466	55.397	2.186	21.589	19.785
800	7.832	57.596	3.716	21.595	19.182
1000	8.123	59.377	5.313	21.605	18.577
1200	8.336	60.878	6.960	21.615	17.971
1400	8.491	62.175	8.644	21.623	17.364
1600	8.605	63.317	10.354	21.626	16.754
1800	8.692	64.335	12.084	21.626	16.147
2000	8.759	65.255	13.829	21.619	15.536

$\text{NO}_2(\text{g})$
Nitrogen dioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.837	57.343	0	7.930	12.267
400	9.601	60.046	.939	7.791	13.772
600	10.955	64.208	3.001	7.659	16.798
800	11.881	67.496	5.291	7.638	19.848
1000	12.468	70.215	7.730	7.669	22.898
1200	12.847	72.524	10.265	7.723	25.941
1400	13.099	74.525	12.861	7.783	28.971
1600	13.273	76.286	15.499	7.841	31.994
1800	13.398	77.857	18.167	7.894	35.011
2000	13.490	79.274	20.856	7.935	38.020

$\text{N}_2\text{O}(\text{g})$
Dinitrogen monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	9.230	52.546	0	19.610	24.895
400	10.201	55.400	.992	19.531	26.716
600	11.565	59.813	3.178	19.558	30.310
800	12.486	63.275	5.589	19.711	33.873
1000	13.113	66.133	8.153	19.920	37.390
1200	13.544	68.565	10.821	20.157	40.861
1400	13.845	70.676	13.562	20.406	44.294
1600	14.060	72.540	16.353	20.658	47.688
1800	14.218	74.205	19.182	20.911	51.054
2000	14.337	75.710	22.038	21.160	54.388

$\text{N}_2\text{O}_3(\text{g})$
Dinitrogen trioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	15.683	73.915	0	20.010	33.535
400	17.385	78.771	1.687	19.903	38.175
600	19.821	86.316	5.425	19.996	47.304
800	21.386	92.249	9.558	20.295	56.366
1000	22.376	97.136	13.941	20.682	65.339
1200	23.015	101.276	18.485	21.108	74.233
1400	23.444	104.858	23.134	21.545	83.053
1600	23.742	108.010	27.854	21.979	91.807
1800	23.956	110.819	32.625	22.404	100.513
2000	24.114	113.352	37.433	22.812	109.168

$N_2O_4(g)$
Dinitrogen tetroxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	18.465	72.724	0	2.190	23.375
400	21.157	78.542	2.023	2.057	30.639
600	24.860	87.881	6.655	2.301	44.900
800	27.113	95.369	11.871	2.895	59.014
1000	28.492	101.579	17.443	3.651	72.960
1200	29.367	106.857	23.235	4.481	86.746
1400	29.946	111.430	29.170	5.344	100.389
1600	30.345	115.457	35.201	6.216	113.904
1800	30.630	119.048	41.300	7.084	127.317
2000	30.840	122.287	47.448	7.935	140.627

$N_2O_5(g)$
Dinitrogen pentoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	23.017	82.801	0	2.700	28.186
400	26.494	90.077	2.530	2.713	36.899
600	30.684	101.713	8.298	3.349	53.878
800	32.744	110.856	14.664	4.306	70.579
1000	33.806	118.289	21.331	5.336	87.030
1200	34.410	124.509	28.156	6.356	103.275
1400	34.782	129.842	35.077	7.344	119.349
1600	35.027	134.503	42.060	8.295	135.285
1800	35.177	138.638	49.080	9.199	151.106
2000	35.302	142.351	56.129	10.055	166.825

$NaO(g)$
Sodium monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.400	54.737	0	20.000	14.652
400	8.656	57.245	.870	19.153	12.907
600	8.888	60.806	2.628	18.705	9.885
800	9.002	63.380	4.418	18.307	7.004
1000	9.077	65.397	6.226	17.914	4.224
1200	9.137	67.058	8.048	-5.744	1.980
1400	9.188	68.470	9.880	-5.765	3.271
1600	9.236	69.700	11.723	-5.790	4.563
1800	9.281	70.791	13.575	-5.817	5.858
2000	9.325	71.771	15.435	-5.847	7.157

$NaO_2(c)$
Sodium dioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.240	27.700	0.000	-62.300	-52.281
300*	17.241	27.807	.032	-62.293	-52.218
400	17.648	32.801	1.769	-62.610	-48.860
500	18.417	36.820	3.571	-62.280	-45.459
600	19.204	40.248	5.453	-61.874	-42.131
700	19.908	43.262	7.409	-61.402	-38.878
800	20.484	45.960	9.430	-60.874	-35.696

*Data estimated above 298 K.
825 K, melting point.

$Na_2O(c)$
Disodium monoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	16.520	17.990	0	-99.700	-90.425
400	17.581	22.995	1.737	-101.036	-87.148
600	19.228	30.465	5.433	-101.007	-80.190
800	20.319	36.145	9.387	-100.643	-73.300
1000	22.666	40.882	13.641	-99.970	-66.533
1200	29.576	45.525	18.755	-144.974	-59.052

1405 K, melting point; $\Delta H^\circ = 11.4$

$Na_2O_2(c)$
Disodium dioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	21.350	22.650	0	-122.300	-107.109
300	21.395	22.782	.040	-122.297	-107.013
400	23.314	29.219	2.282	-123.453	-101.836
500	24.722	34.578	4.686	-123.262	-96.450
600	25.929	39.195	7.220	-122.925	-91.117
785	27.943	46.425	12.205	-121.990	-81.433
785	27.080	48.145	13.555	-120.640	-81.433
800	27.080	48.657	13.961	-120.562	-80.684
900	27.080	53.254	17.969	-119.806	-73.373

785 K, transition point; $\Delta H^\circ = 1.350$
948 K, melting point.

NbO(c)
Niobium monoxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	9.860	11.500	0.000	-97.000	-90.529
400	10.515	14.500	1.041	-96.932	-88.330
600	11.276	18.919	3.226	-96.728	-84.068
800	11.844	22.243	5.540	-96.479	-79.889
1000	12.335	24.940	7.959	-96.196	-75.771
1200	12.779	27.229	10.471	-95.884	-71.698
1400	13.186	29.230	13.068	-95.549	-67.693
1600	13.559	31.015	15.743	-95.209	-63.730
1800	13.901	32.632	18.489	-94.875	-59.813
2000	14.214	34.113	21.301	-94.560	-55.939

NbO(g)
Niobium monoxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.358	57.090	0	47.500	40.378
400	7.735	59.306	.769	47.297	37.976
600	8.253	62.550	2.373	46.920	33.401
800	8.529	64.967	4.054	46.535	28.946
1000	8.684	66.888	5.777	46.122	24.599
1200	8.780	68.480	7.524	45.669	20.353
1400	8.844	69.839	9.287	45.170	16.173
1600	8.890	71.023	11.060	44.608	12.074
1800	8.927	72.072	12.842	43.978	8.048
2000	8.961	73.015	14.631	43.271	4.087
2200	8.996	73.870	16.426	42.476	.204
2400	9.035	74.655	18.229	41.591	-3.601
2600	9.081	75.380	20.041	40.607	-7.320
2800	9.137	76.055	21.862	33.340	-10.846
3000	9.203	76.687	23.696	32.625	-13.951

NbO₂(c)
Niobium dioxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	13.740	13.030	0.000	-190.300	-176.980
400	15.172	17.279	1.476	-190.158	-172.480
600	17.041	23.864	4.737	-189.621	-163.699
800	19.033	28.985	8.306	-188.905	-155.165
1000	23.990	33.629	12.485	-187.683	-146.852
1090	35.740	36.087	15.060	-186.469	-143.224
1090	22.000	36.087	15.060	-186.469	-143.224
1200	22.000	38.203	17.480	-185.732	-138.878
1200	19.900	38.203	17.480	-185.732	-138.878
1400	19.900	41.270	21.460	-184.873	-131.137
1600	19.900	43.928	25.440	-184.102	-123.508
1800	19.900	46.271	29.420	-183.419	-115.971
2000	19.900	48.368	33.400	-182.832	-108.516

1090 K, second order transition; ΔH° = 0

1200 K, second order transition; ΔH° = 0

NbO₂(g)
Niobium dioxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	10.494	65.019	0	-47.800	-49.981
400	11.382	68.233	1.116	-48.018	-50.691
600	12.476	73.080	3.514	-48.344	-51.952
800	13.022	76.753	6.070	-48.641	-53.115
1000	13.314	79.693	8.707	-48.961	-54.194
1200	13.486	82.137	11.388	-49.324	-55.191
1400	13.593	84.225	14.097	-49.736	-56.137
1600	13.665	86.045	16.823	-50.219	-57.013
1800	13.715	87.657	19.561	-50.778	-57.825
2000	13.751	89.104	22.308	-51.424	-58.580
2200	13.778	90.416	25.061	-52.168	-59.263
2400	13.799	91.616	27.819	-53.017	-59.871
2600	13.815	92.721	30.581	-53.979	-60.396
2800	13.828	93.746	33.345	-61.242	-60.730
3000	13.839	94.700	36.112	-61.972	-60.643

*All data estimated except enthalpy of formation at 298 K.

Nb₂O₅(c,l)
Diniobium pentoxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	31.570	32.800	0	-454.000	-422.064
400	34.742	42.586	3.399	-453.631	-411.207
600	38.306	57.400	10.730	-452.490	-390.221
800	40.487	68.748	18.630	-451.085	-369.683
1000	41.684	77.924	26.859	-449.590	-349.499
1200	42.488	85.597	35.278	-448.103	-329.587
1400	43.412	92.212	43.863	-446.620	-309.951
1600	44.740	98.090	52.670	-445.104	-290.516
1785	46.330	103.068	61.090	-443.595	-272.717
1785	58.000	116.844	85.680	-419.005	-272.717
1800	58.000	117.329	86.550	-418.703	-271.488
2000	58.000	123.440	98.150	-414.785	-255.355

1785 K, melting point; ΔH° = 24.590

$\text{Nd}_2\text{O}_3(\text{c})$
Dineodymium trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	26.610	57.900	0	-432.100	-411.287
400	28.717	46.058	2.832	-431.719	-404.232
600	31.068	58.174	8.824	-430.858	-390.675
800	32.995	67.382	15.235	-430.073	-377.402
1000	34.632	74.926	22.003	-429.506	-364.307
1200	35.988	81.363	29.068	-430.646	-351.219
1395	37.294	86.875	36.210	-433.559	-338.082
1395	37.200	86.975	36.350	-433.419	-338.081
1400	37.200	87.109	36.536	-433.404	-337.741
1600	37.200	92.076	43.976	-432.792	-324.132
1800	37.200	96.457	51.416	-432.215	-310.578
2000	37.200	100.377	58.856	-431.673	-297.089

1395 K, transition point; $\Delta H^\circ = 0.140$

$\text{NiO}(\text{c})$
Nickel monoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.590	9.080	0.000	-57.300	-50.573
400	12.310	12.440	1.170	-57.156	-48.294
525	16.910	16.270	2.940	-56.743	-45.576
525	13.070	16.270	2.940	-56.743	-45.576
565	14.680	17.290	3.490	-56.651	-44.736
565	12.850	17.290	3.490	-56.651	-44.736
600	12.820	18.060	3.940	-56.621	-43.997
800	12.750	21.730	6.500	-56.383	-39.807
1000	12.940	24.590	9.060	-56.154	-35.699
1200	13.380	26.990	11.690	-55.942	-31.625
1400	13.950	29.090	14.420	-55.722	-27.586
1600	14.540	30.990	17.270	-55.482	-23.579
1800	15.010	32.730	20.230	-55.336	-19.428
2000	15.230	34.330	23.260	-55.063	-15.017

525 K, transition point; $\Delta H^\circ = 0$

565 K, transition point; $\Delta H^\circ = 0$

$\text{NiO}(\text{g})$
Nickel monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.090	57.660	0	74.000	66.243
400	8.640	60.120	.850	73.825	63.615
600	9.410	63.780	2.670	73.410	58.601
800	9.810	66.550	4.590	73.007	53.727
1000	9.950	68.760	6.570	72.656	48.941
1200	9.950	70.570	8.560	72.229	44.249
1400	9.910	72.100	10.550	71.709	39.630
1600	9.850	73.420	12.530	71.078	35.093
1800	9.790	74.580	14.490	66.224	30.802
2000	9.730	75.610	16.440	65.418	26.904

$\text{PO}(\text{g})$
Phosphorus monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.591	53.218	0	-5.630	-11.264
400	7.727	55.464	.779	-6.000	-13.115
600	8.127	58.674	2.365	-9.242	-16.335
800	8.416	61.055	4.021	-9.324	-18.688
1000	8.598	62.954	5.724	-9.408	-21.019
1200	8.715	64.532	7.456	-9.496	-23.333
1400	8.796	65.882	9.208	-9.585	-25.632
1600	8.854	67.061	10.973	-9.677	-27.919
1800	8.899	68.106	12.749	-9.772	-30.191
2000	8.934	69.046	14.532	-9.873	-32.456

$\text{PO}_2(\text{g})$
Phosphorus dioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	9.897	60.607	0	-75.200	-75.731
400	10.913	63.663	1.062	-75.648	-75.825
600	12.189	68.358	3.386	-78.895	-75.570
800	12.837	71.964	5.896	-78.911	-74.459
1000	13.188	74.870	8.502	-78.913	-73.345
1200	13.395	77.294	11.162	-78.916	-72.231
1400	13.525	79.369	13.855	-78.924	-71.116
1600	13.612	81.181	16.569	-78.941	-70.000
1800	13.673	82.788	19.298	-78.968	-68.879
2000	13.717	84.231	22.037	-79.009	-67.757

$(\text{P}_2\text{O}_5)_2(\text{g})$
Dimeric diphosphorus trioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	34.402	82.584	0	-529.200	-498.279
400	41.168	93.719	3.876	-530.641	-487.411
600	47.996	111.902	12.891	-542.424	-464.663
800	51.036	126.179	22.831	-541.012	-438.950
1000	52.594	137.752	33.209	-539.425	-413.615
1200	53.485	147.427	43.825	-537.774	-388.608
1400	54.040	155.716	54.581	-536.102	-363.881
1600	54.406	162.958	65.428	-534.432	-339.394
1800	54.661	169.381	76.336	-532.778	-315.106
2000	54.845	175.150	87.288	-531.153	-291.009

(P₂O₅)₂(c,g)
Dimeric diphosphorus pentoxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	50.600	54.680	0	-719.400	-650.937
400*	62.200	71.218	5.761	-720.402	-627.300
600	80.300	99.982	20.071	-729.862	-580.033
631	82.700	104.082	22.600	-729.109	-572.305
631	66.006	138.789	44.500	-707.209	-572.305
800	70.399	155.011	56.066	-705.547	-536.375
1000	73.329	171.066	70.466	-703.220	-494.344
1200	75.069	184.602	85.320	-700.705	-452.802
1400	76.175	196.263	100.452	-698.097	-411.693
1600	76.918	206.486	115.766	-695.454	-370.960
1800	77.439	215.577	131.205	-692.809	-330.546
2000	77.817	223.757	146.733	-690.194	-290.440

*Data extrapolated 374-631 K.

631 K, sublimation point; ΔH° = 21.9

(P₂O₅)₂(g)
Dimeric diphosphorus pentoxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	45.126	96.525	0	-694.100	-638.113
400	54.377	111.161	5.096	-695.767	-618.642
600	65.043	135.484	17.165	-707.468	-578.940
800	70.399	155.011	30.766	-705.547	-536.375
1000	73.329	171.066	45.166	-703.220	-494.344
1200	75.069	184.602	60.020	-700.705	-452.802
1400	76.175	196.263	75.152	-698.097	-411.693
1600	76.918	206.486	90.466	-695.454	-370.960
1800	77.439	215.577	105.905	-692.809	-330.546
2000	77.817	223.757	121.433	-690.194	-290.440

PbO (red,yellow,l)
Lead monoxide, litharge

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.950	15.900	0.000	-52.340	-45.157
400	11.570	19.205	1.147	-52.209	-42.721
600	12.463	24.074	3.555	-51.903	-38.046
762	13.075	27.128	5.625	-52.792	-34.026
762	13.006	27.653	6.025	-52.392	-34.026
800	13.129	28.289	6.521	-52.321	-33.113
1000	13.754	31.286	9.210	-51.871	-28.362
1159	14.236	33.350	11.435	-51.421	-24.653
1159	13.836	38.639	17.565	-45.291	-24.653
1200	13.836	39.120	18.132	-45.181	-23.925
1400	13.836	41.253	20.899	-44.646	-20.435

762 K, transition point; ΔH° = 0.400

1159 K, melting point; ΔH° = 6.130

PbO(yellow,l)
Lead monoxide, massicot

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.950	16.420	0.000	-51.940	-44.912
400	11.607	19.735	1.150	-51.806	-42.530
600	12.454	24.612	3.562	-51.495	-37.962
800*	13.129	28.289	6.121	-52.321	-33.113
1000	13.754	31.286	8.810	-51.871	-28.362
1159	14.236	33.350	11.035	-51.421	-24.653
1159	13.836	38.639	17.165	-45.291	-24.653
1200	13.836	39.120	17.732	-45.181	-23.925
1400	13.836	41.253	20.499	-44.646	-20.435

*Yellow PbO is metastable below 762 K.

1159 K, melting point; ΔH° = 6.130

PbO(g)
Lead monoxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.770	57.343	0	16.800	11.627
400	8.155	59.685	.812	16.595	9.891
600	8.562	63.080	2.490	16.172	6.626
800	8.750	65.571	4.223	14.520	3.904
1000	8.853	67.536	5.984	14.043	1.302
1200	8.918	69.156	7.762	13.589	-1.198
1400	8.965	70.534	9.550	13.146	-3.637
1600	9.001	71.734	11.347	12.701	-6.026
1800	9.031	72.796	13.150	12.251	-8.314
2000	9.058	73.749	14.959	11.795	-10.577

PbO₂(c)
Lead dioxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	14.580	17.156	0	-66.300	-52.186
300*	14.608	17.246	.027	-66.298	-52.098
400	15.793	21.618	1.550	-66.128	-47.387
500	16.705	25.244	3.176	-65.898	-42.730
600	17.499	28.361	4.887	-65.635	-38.121
700	18.237	31.114	6.674	-66.499	-33.367

*Data above 298 K are estimated.

$\text{Pb}_3\text{O}_4(\text{c})$
Trilead tetroxide, minium

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	37.030	50.660	0	-171.770	-143.798
300	37.128	50.889	.069	-171.763	-143.623
400	41.360	62.188	4.006	-171.175	-134.322
500	44.000	71.720	8.283	-170.355	-125.204
600	45.600	79.893	12.768	-169.459	-116.262
700	46.600	86.997	17.378	-172.024	-106.892
800	47.600	93.285	22.088	-171.082	-97.646
900	48.600	98.949	26.898	-170.036	-88.524
1000	49.600	104.122	31.808	-168.898	-79.540

$\text{PrO}_{1.833}(\text{c})$
Praseodymium oxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	15.200	19.100	0	-255.520	-242.556
300	15.213	19.194	.028	-255.516	-242.475
400	16.985	23.836	1.646	-255.216	-238.168
500	18.204	27.763	3.408	-254.818	-233.950
600	19.212	31.173	5.280	-254.368	-229.823
700	20.119	34.204	7.247	-253.892	-225.769
760	20.637	35.879	8.470	-253.594	-223.372
760	20.833	36.380	8.850	-253.214	-223.372
800	21.314	37.461	9.693	-253.001	-221.807
900	22.518	40.041	11.885	-252.432	-217.933
1000	23.721	42.475	14.197	-251.810	-214.134

*Entropy and heat capacity at 298 K estimated.
760 K, transition point; $\Delta \text{H}^\circ = 0.380$

$\text{Pr}_2\text{O}_3(\text{c})$
Dipraseodymium trioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	28.200	37.200	0	-432.520	-411.158
400	30.010	45.765	2.973	-431.990	-403.938
600	32.096	58.361	9.200	-430.839	-399.169
800	33.630	67.811	15.777	-429.830	-376.767
1000	34.982	75.463	22.640	-429.047	-363.585
1200	36.254	81.954	29.765	-429.730	-350.389
1400	37.487	87.635	37.139	-432.328	-336.674
1600	38.704	92.721	44.759	-431.439	-323.075
1800	39.925	97.350	52.621	-430.340	-309.591

*Heat capacity estimated at 298 K.

$\text{PuO}(\text{c})$
Plutonium monoxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	12.250	16.900	0	-135.000	-128.732
400	12.890	20.593	1.282	-135.762	-126.591
600	13.840	26.010	3.960	-135.821	-122.018
800	14.600	30.101	6.808	-135.958	-117.428
1000	15.210	33.428	9.792	-136.278	-112.781
1200	15.720	36.248	12.887	-136.046	-108.102
1400	16.140	38.704	16.074	-135.740	-103.469
1600	16.460	40.880	19.334	-135.373	-98.883
1800	16.720	42.834	22.653	-134.959	-94.346
2000	16.950	44.608	26.020	-134.508	-89.858

*All data estimated.
2173 K, melting point.

$\text{PuO}_2(\text{c})$
Plutonium dioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	15.834	15.805	0	-252.350	-238.450
400	18.704	20.937	1.785	-252.970	-233.719
600	20.569	28.950	5.750	-252.486	-224.217
800	21.279	34.975	9.943	-252.066	-214.891
1000	21.767	39.777	14.248	-251.885	-205.642
1200	22.261	43.788	18.650	-251.190	-196.457
1400	22.838	47.262	23.158	-250.422	-187.395
1600	23.531	50.355	27.793	-249.554	-178.448
1800	24.354	53.173	32.579	-248.558	-169.619
2000	25.315	55.788	37.544	-247.406	-160.910
2200	26.418	58.251	42.715	-246.070	-152.321
2400	27.663	60.602	48.121	-244.521	-143.865

2715 K, melting point; $\Delta \text{H}^\circ = 18$

$\text{Pu}_2\text{O}_3(\alpha)$
 α -Diplutonium trioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	31.800	36.700	0.000	-430.000	-411.023
400	35.500	46.619	3.447	-431.001	-404.616
600	38.820	61.717	10.916	-429.752	-391.733
800	40.760	73.170	18.888	-428.538	-379.307
1000	42.300	82.435	27.197	-427.656	-367.146
1200	43.560	90.266	35.792	-425.632	-355.230
1400	44.520	97.058	44.607	-423.437	-343.668
1600	45.300	103.056	53.592	-421.112	-332.430
1800	45.940	108.430	62.719	-418.680	-321.489
2000	46.460	113.299	71.961	-416.168	-310.827

*All data estimated except enthalpy of formation and entropy at 298 K.

$\text{Pu}_2\text{O}_3(\beta)$
β-Diplutonium trioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	31.300	33.200	0	-410.000	-389.980
400	35.000	42.972	3.396	-411.052	-383.208
600	38.320	57.867	10.765	-409.902	-369.574
800	40.260	69.176	18.637	-408.789	-356.363
1000	41.800	78.330	26.846	-408.007	-343.392
1200	43.060	86.070	35.341	-406.082	-330.646
1400	44.020	92.785	44.056	-403.988	-318.237
1600	44.800	98.716	52.941	-401.763	-306.137
1800	45.440	104.031	61.968	-399.431	-294.322
2000	45.960	108.847	71.110	-397.019	-282.775

*All data estimated except enthalpy of formation and entropy at 298 K.

$\text{RbO}_2(\text{c})$
Rubidium dioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	18.540	31.090	0	-66.600	-55.788
300*	18.570	31.205	.034	-66.593	-55.721
400	19.861	36.738	1.961	-66.698	-52.009
500	20.721	41.268	3.993	-66.165	-48.398
600	21.346	45.104	6.097	-65.553	-44.902

*Data above 298 K are estimated.

$\text{ReO}_2(\text{c})$
Rhenium dioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	12.994	11.431	0	-107.300	-93.494
400	14.905	15.539	1.429	-107.217	-88.786
600	17.082	22.048	4.654	-106.741	-79.662
800	18.137	27.123	8.187	-106.098	-70.731
1000	18.805	31.245	11.883	-105.410	-61.969
1200	19.506	34.733	15.712	-104.687	-53.346
1400	20.350	37.802	19.696	-103.894	-44.852

$\text{ReO}_3(\text{c})$
Rhenium trioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	17.775	16.553	0	-140.800	-121.216
400	20.380	22.177	1.956	-140.552	-114.558
600	23.175	31.028	6.340	-139.660	-101.739
800	24.806	37.937	11.151	-138.527	-89.267
1000	25.772	43.587	16.219	-137.287	-77.093

$\text{Re}_2\text{O}_7(\text{c})$
Dirhenium heptoxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	39.730	49.540	0	-301.900	-260.327
300	39.850	49.785	.074	-301.893	-260.067
400	43.903	61.861	4.281	-301.395	-246.192
413	44.232	63.270	4.854	-301.312	-244.399
413	44.812	63.319	4.874	-301.292	-244.399
500	47.894	72.170	8.906	-300.579	-232.481
600	51.437	81.215	13.873	-299.531	-218.956
600	66.107	107.381	29.572	-283.832	-218.957
700	66.107	117.571	36.183	-281.243	-208.348

413 K, transition point; $\Delta \text{H}^\circ = 0.020$

600 K, melting point; $\Delta \text{H}^\circ = 15.699$

$\text{RuO}_2(\text{c})$
Ruthenium dioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	12.600	13.900	0	-72.900	-60.394
400	15.745	18.112	1.468	-72.755	-56.137
600	18.246	25.048	4.906	-72.058	-47.964
800	19.483	30.481	8.688	-71.185	-40.065
1000	20.355	34.926	12.675	-70.234	-32.393
1200	21.083	38.703	16.821	-69.228	-24.917

$\text{SO}(\text{g})$
Sulfur monoxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	7.212	53.020	0	-14.155	-14.532
400	7.543	55.185	.751	-14.171	-14.658
600	8.087	58.354	2.318	-14.185	-14.897
800	8.414	60.730	3.971	-14.186	-15.135
1000	8.617	62.631	5.676	-14.185	-15.372
1200	8.765	64.215	7.414	-14.189	-15.609
1400	8.893	65.576	9.180	-14.196	-15.846
1600	9.017	66.772	10.971	-14.206	-16.082
1800	9.138	67.841	12.787	-14.217	-16.314
2000	9.256	68.810	14.626	-14.228	-16.548
2200	9.369	69.697	16.489	-14.237	-16.778
2400	9.474	70.517	18.373	-14.245	-17.010
2600	9.571	71.279	20.278	-14.250	-17.240
2800	9.657	71.992	22.201	-14.252	-17.469
3000	9.733	72.660	24.140	-14.254	-17.690

$\text{SO}_2(\text{g})$
Sulfur dioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	9.530	59.300	0	-86.295	-81.239
400	10.395	62.224	1.016	-86.408	-79.493
600	11.723	66.709	3.237	-86.511	-76.007
800	12.532	70.202	5.669	-86.521	-72.503
1000	13.022	73.056	8.229	-86.485	-69.003
1200	13.335	75.460	10.866	-86.434	-65.511
1400	13.549	77.532	13.556	-86.377	-62.028
1600	13.704	79.352	16.282	-86.325	-58.554
1800	13.822	80.973	19.035	-86.284	-55.083
2000	13.917	82.435	21.809	-86.257	-51.620
2200	13.995	83.765	24.601	-86.244	-48.157
2400	14.063	84.986	27.407	-86.249	-44.695
2600	14.122	86.114	30.225	-86.269	-41.233
2800	14.175	87.162	33.055	-86.303	-37.763
3000	14.224	88.142	35.895	-86.352	-34.297

$\text{SO}_3(\text{g})$
Sulfur trioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.108	61.344	0	-109.935	-98.183
400	13.784	65.146	1.322	-110.104	-94.139
600	16.075	71.209	4.328	-110.164	-86.131
800	17.391	76.031	7.687	-110.035	-78.137
1000	18.157	80.001	11.248	-109.819	-70.187
1200	18.628	83.357	14.930	-109.566	-62.283
1400	18.933	86.253	18.688	-109.301	-54.424
1600	19.140	88.795	22.497	-109.040	-46.602
1800	19.286	91.058	26.340	-108.794	-38.810
2000	19.393	93.096	30.209	-108.568	-31.048
2200	19.474	94.949	34.096	-108.368	-23.307
2400	19.536	96.646	37.997	-108.196	-15.582
2600	19.585	98.212	41.909	-108.051	-7.872
2800	19.623	99.664	45.830	-107.932	-0.166
3000	19.655	101.019	49.758	-107.842	7.526

$\text{Sb}_2\text{O}_3(\text{c})$
Diantimony trioxide (orthorhombic)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.230	29.400	0	-169.400	-149.762
300*	24.278	29.550	.045	-169.396	-149.637
400	26.036	36.809	2.572	-169.158	-143.084
500	26.955	42.726	5.226	-168.855	-136.597
600	27.550	47.696	7.953	-168.540	-130.183
700	27.991	51.978	10.731	-168.247	-123.807
800	28.350	55.739	13.548	-167.999	-117.487
928	28.743	59.976	17.200	-177.274	-109.163

*Data estimated above 298 K.

928 K, melting point.

$\text{Sb}_2\text{O}_4(\text{c})$
Diantimony tetroxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	27.380	30.350	0	-216.900	-190.239
400*	29.604	38.761	2.921	-216.671	-181.159
600	31.123	51.104	9.019	-216.079	-163.537
800	31.956	60.176	15.330	-215.610	-146.103
1000	32.722	67.389	21.798	-224.862	-127.751
1200	33.510	73.424	28.420	-224.614	-108.344

*Data above 298 K are estimated.

$\text{Sb}_2\text{O}_5(\text{c})$
Diantimony pentoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	28.104	29.860	0	-232.300	-198.188
300*	28.175	30.034	.052	-232.303	-197.974
400	30.350	38.495	2.998	-232.355	-186.519
500	31.283	45.377	6.084	-232.351	-175.058
600	31.942	51.141	9.247	-232.356	-163.607
700	32.497	56.108	12.469	-232.397	-152.140

*Data estimated above 298 K.

$\text{Sb}_4\text{O}_6(\text{g})$
Tetrantimony hexoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	43.680	106.140	0	-290.520	-265.358
300	43.780	106.410	.081	-290.522	-265.197
400	48.060	119.660	4.695	-290.486	-256.754
500	50.460	130.670	9.632	-290.250	-248.343
600	51.910	140.000	14.757	-289.950	-239.999
700	52.830	148.080	19.997	-289.680	-231.686
800	53.460	155.180	25.314	-289.501	-223.437
900	53.900	161.500	30.683	-289.454	-215.171
1000	54.220	167.200	36.089	-308.525	-204.915

$\text{Sc}_2\text{O}_3(\text{c}, \text{l})$
Discendium trioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	22.520	18.400	0	-456.220	-434.852
400	25.182	25.433	2.444	-456.125	-427.564
600	27.880	36.213	7.780	-455.586	-413.386
800	29.416	44.463	13.522	-454.909	-399.408
1000	30.352	51.136	19.506	-454.269	-385.640
1200	30.940	56.725	25.640	-453.766	-371.893
1400	31.359	61.527	31.871	-453.474	-358.341
1600	31.745	65.739	38.181	-453.441	-344.754
1800	32.193	69.503	44.573	-455.830	-330.928
2000	32.759	72.923	51.066	-462.992	-316.340
2200	33.459	76.077	57.686	-463.323	-301.646
2400	34.272	79.023	64.457	-463.536	-286.939
2600	35.136	81.800	71.398	-463.608	-272.197
2762	35.805	83.946	77.150	-463.559	-260.288
2762	48.000	96.129	110.800	-429.909	-260.288
2800	48.000	96.785	112.624	-429.426	-257.958
3000	48.000	100.097	122.224	-426.899	-245.797

2762 K, melting point; $\Delta \text{H}^\circ = 33.650$

$\text{SeO}(\text{g})$
Selenium monoxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	7.466	55.923	0	-3.900	-4.592
400	7.859	58.174	.781	-3.987	-4.815
600	8.355	61.466	2.408	-4.113	-5.200
800	8.607	63.908	4.107	-4.210	-5.545
1000	8.747	65.845	5.844	-4.295	-5.871
1200	8.835	67.448	7.603	-4.371	-6.176
1400	8.894	68.815	9.376	-4.438	-6.473
1600	8.938	70.005	11.159	-4.497	-6.761
1800	8.973	71.060	12.951	-4.546	-7.037
2000	9.001	72.007	14.748	-4.588	-7.316

$\text{SeO}_2(\text{c}, \text{g})$
Selenium dioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	13.886	15.940	0	-70.510	-51.976
400	15.825	20.306	1.518	-70.221	-45.684
600	18.752	27.297	4.986	-69.249	-33.606
800	18.776	27.358	5.030	-69.230	-33.480
1000	12.453	70.788	31.175	-43.085	-33.480
1200	13.006	74.414	33.707	-43.113	-30.308
1400	13.305	77.351	36.341	-43.122	-27.108
1600	13.479	79.794	39.020	-43.121	-23.904
1800	13.588	81.880	41.728	-43.112	-20.701

602 K, sublimation point; $\Delta \text{H}^\circ = 26.145$

$\text{SeO}_2(\text{g})$
Selenium dioxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	10.364	62.735	0	-42.850	-38.267
400	11.309	65.919	1.106	-42.974	-36.681
600	12.446	70.747	3.495	-43.080	-33.507
800	13.006	74.414	6.047	-43.113	-30.308
1000	13.305	77.351	8.681	-43.122	-27.108
1200	13.479	79.794	11.360	-43.121	-23.904
1400	13.588	81.880	14.068	-43.112	-20.701

$\text{SiO}(\text{g})$
Silicon monoxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	7.146	50.542	0	-23.800	-30.222
400	7.441	52.682	.742	-23.935	-32.398
600	7.982	55.807	2.288	-24.250	-36.562
800	8.328	58.155	3.922	-24.601	-40.612
1000	8.538	60.038	5.610	-24.981	-44.564
1200	8.671	61.607	7.332	-25.384	-48.451
1400	8.761	62.951	9.075	-25.808	-52.260
1600	8.825	64.125	10.834	-26.253	-56.022
1800	8.873	65.167	12.604	-38.725	-58.878
2000	8.911	66.104	14.383	-39.062	-61.104

$\text{SiO}_2(\text{c})$
Silicon dioxide, quartz

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	10.620	10.000	0.000	-217.720	-204.749
400	12.732	13.431	1.195	-217.764	-200.308
600	15.385	19.146	4.031	-217.532	-191.617
800	17.920	23.875	7.330	-217.005	-183.049
847	21.700	24.970	8.230	-216.775	-181.063
847	16.631	25.177	8.405	-216.600	-181.063
1000	16.733	27.947	10.958	-216.266	-174.663
1100	16.800	29.544	12.635	-216.065	-170.518
1200	16.867	31.009	14.318	-215.874	-166.387
1400	17.001	33.619	17.705	-215.514	-158.164
1600	17.134	35.898	21.118	-215.179	-150.009
1700	17.201	36.939	22.835	-227.091	-145.823
1800	17.268	37.924	24.559	-226.865	-141.045
2000	17.402	39.750	28.026	-226.411	-131.539

847 K, transition point; $\Delta \text{H}^\circ = 0.175$

1100 K, transition point; $\Delta \text{H}^\circ = 0.5$; quartz metastable above 1100 K.

1700 K, melting point of metastable quartz; $\Delta \text{H}^\circ = 2$

$\text{SiO}_2(\text{c})$
Silicon dioxide, cristobalite

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.693	10.200	0.000	-217.370	-204.459
400	12.697	13.647	1.200	-217.409	-200.040
543	14.551	17.812	3.155	-217.296	-193.842
543	14.787	18.383	3.465	-216.986	-193.842
600	15.193	19.880	4.320	-216.893	-191.419
800	16.083	24.386	7.457	-216.528	-182.981
1000*	16.602	28.035	10.729	-216.145	-174.630
1200	16.975	31.096	14.089	-215.753	-166.371
1400	17.279	33.737	17.515	-215.354	-158.170
1600	17.547	36.062	20.998	-214.949	-150.042
1800	17.793	38.143	24.532	-226.542	-141.116
2000	18.025	40.029	28.114	-225.973	-131.659

*Cristobalite is metastable below approximately 1100 K.
543 K, transition point; $\Delta H^\circ = 0.310$
2000 K, melting point; $\Delta H^\circ = 2$

$\text{SiO}_2(\text{c})$
Silicon dioxide, tridymite

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.660	10.360	0.000	-217.270	-204.406
390	12.913	13.519	1.085	-217.299	-200.438
390	13.403	13.647	1.135	-217.249	-200.438
400	13.495	13.988	1.269	-217.240	-200.007
500	14.415	17.099	2.665	-217.121	-195.710
500	14.089	17.189	2.710	-217.076	-195.710
600	15.100	19.855	4.174	-216.939	-191.450
800	16.110	24.358	7.310	-216.575	-183.005
1000	16.615	28.012	10.587	-216.187	-174.649
1200	16.955	31.073	13.945	-215.797	-166.387
1400	17.245	33.708	17.365	-215.404	-158.179
1600	17.534	36.030	20.843	-215.004	-150.046
1800	17.846	38.113	24.380	-226.594	-141.114
2000	18.193	40.011	27.984	-226.003	-131.653

390 K, transition point; $\Delta H^\circ = 0.050$

500 K, transition point; $\Delta H^\circ = 0.045$

$\text{SiO}_2(\text{g})$
Silicon dioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.518	54.699	0	-77.000	-77.356
400*	11.474	57.929	1.122	-77.117	-77.461
600	12.767	62.849	3.557	-77.286	-77.593
800	13.507	66.633	6.192	-77.423	-77.673
1000	13.938	69.698	8.940	-77.564	-77.712
1200	14.203	72.264	11.756	-77.716	-77.735
1400	14.374	74.467	14.615	-77.884	-77.722
1600	14.491	76.395	17.502	-78.075	-77.701
1800	14.573	78.107	20.409	-90.295	-76.804
2000	14.634	79.645	23.330	-90.387	-75.305

*Data above 298 K are estimated.

$\text{SiO}_2(\text{vitreous})$
Silicon dioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.600	11.200	0	-215.940	-203.327
400	12.529	14.595	1.182	-215.997	-199.007
600	14.918	20.181	3.953	-215.830	-190.536
800	16.109	24.656	7.070	-215.485	-182.154
1000	16.738	28.323	10.359	-215.085	-173.858
1200	17.261	31.420	13.758	-214.654	-165.660
1400	17.966	34.130	17.276	-214.163	-157.529
1600	18.983	36.592	20.966	-213.551	-149.492
1800	20.277	38.901	24.888	-224.756	-140.694
2000	21.655	41.109	29.082	-223.575	-131.421

$\text{Sm}_2\text{O}_3(\text{c})$
Disamarium trioxide (cubic)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	27.686	34.600	0.000	-436.760	-415.243
400	30.065	43.099	2.952	-436.411	-407.948
600	32.720	55.846	9.257	-435.901	-393.841
800	34.262	65.489	15.968	-435.624	-379.855
1000	35.097	73.236	22.915	-435.404	-365.935

*Entropy estimated at 298 K.

1150 K, cubic to monoclinic transition point above
1150 K.

$\text{Sm}_2\text{O}_3(\text{c})$
Disamarium trioxide (monoclinic)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	27.370	36.100	0	-435.860	-414.790
400	29.745	44.505	2.919	-435.543	-407.643
600	32.411	57.122	9.160	-435.097	-393.803
800	34.039	66.687	15.818	-434.874	-380.063
1000	34.981	74.396	22.731	-434.688	-366.379
1195*	35.256	80.662	29.590	-436.137	-353.057
1195	36.900	80.871	29.840	-435.887	-353.057
1200	36.900	81.025	30.024	-435.879	-352.711
1400	36.900	86.713	37.404	-439.773	-338.712
1600	36.900	91.640	44.784	-439.814	-324.280
1800	36.900	95.986	52.164	-439.889	-309.844
2000	36.900	99.874	59.544	-439.998	-295.368

*Monoclinic form metastable below 1150 K.

1195 K, transition point; $\Delta\text{H}^\circ = 0.250$

$\text{SnO}(\text{c})$
Tin monoxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	11.417	13.665	0	-68.350	-61.471
300*	11.437	13.736	.021	-68.347	-61.428
400	12.220	17.145	1.208	-68.182	-59.145
500	12.700	19.926	2.455	-68.012	-56.906
600	13.061	22.275	3.744	-69.474	-54.386
700	13.366	24.312	5.066	-69.226	-51.890
800	13.640	26.115	6.416	-68.954	-49.433
900	13.898	27.736	7.793	-68.664	-47.009
1000	14.144	29.213	9.195	-68.356	-44.620

*Data estimated above 298 K.

1250 K, melting point; $\Delta\text{H}^\circ = 5$

$\text{SnO}_2(\text{c})$
Tin dioxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	12.570	12.510	0	-138.820	-124.291
400	14.523	16.477	1.380	-138.842	-119.319
600	17.519	22.981	4.608	-140.185	-109.291
800	19.182	28.276	8.297	-139.436	-99.099
1000	19.976	32.653	12.223	-138.511	-89.120
1200	20.353	36.332	16.260	-137.521	-79.333
1400	20.610	39.489	20.357	-136.504	-69.714
1600	20.859	42.257	24.504	-135.464	-60.245
1800	21.023	44.725	28.695	-134.403	-50.905

$\text{SrO}(\text{c})$
Strontium monoxide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	10.760	13.000	0.000	-141.140	-133.984
400	11.551	16.285	1.140	-141.033	-131.555
600	12.449	21.155	3.549	-140.808	-126.866
800	13.015	24.819	6.099	-140.684	-122.242
1000	13.403	27.768	8.743	-140.838	-117.596
1200	13.685	30.238	11.453	-142.635	-112.661
1400	13.910	32.364	14.213	-142.415	-107.681
1600	14.126	34.236	17.016	-142.166	-102.736
1800	14.374	35.913	19.866	-174.113	-94.958

$\text{SrO}(\text{g})$
Strontium monoxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	7.909	54.958	0	-3.200	-8.553
400	8.276	57.338	.826	-3.407	-10.350
600	8.641	60.773	2.523	-3.894	-13.722
800	8.808	63.285	4.269	-4.575	-16.905
1000	8.917	65.262	6.042	-5.599	-19.851
1200	9.057	66.899	7.838	-8.311	-22.329
1400	9.322	68.313	9.673	-9.015	-24.609
1600	9.789	69.586	11.581	-9.661	-26.791
1800	10.482	70.777	13.604	-42.435	-26.035
2000	11.364	71.925	15.786	-42.152	-24.226

$\text{TaO}(\text{g})$
Tantalum monoxide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	7.314	57.691	0	46.000	39.089
400	7.681	59.802	.764	45.776	36.764
600	8.237	63.029	2.359	45.373	32.347
800	8.637	65.456	4.048	44.995	28.062
1000	8.978	67.421	5.810	44.635	23.870
1200	9.268	69.084	7.636	44.292	19.752
1400	9.503	70.531	9.514	43.956	15.687
1600	9.691	71.813	11.434	43.613	11.671
1800	9.856	72.964	13.389	43.258	7.701
2000	10.018	74.010	15.376	42.882	3.770

$\text{TaO}_2(\text{g})$
Tantalum dioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.516	66.957	0	-48.000	-50.395
400	11.407	70.178	1.118	-48.232	-51.176
600	12.495	75.035	3.521	-48.570	-52.570
800	13.035	78.712	6.080	-48.865	-53.859
1000	13.324	81.654	8.719	-49.169	-55.072
1200	13.492	84.100	11.402	-49.499	-56.221
1400	13.600	86.188	14.112	-49.863	-57.314
1600	13.675	88.009	16.840	-50.271	-58.351
1800	13.735	89.624	19.581	-50.725	-59.334
2000	13.789	91.074	22.333	-51.233	-60.267

$\text{Ta}_2\text{O}_5(\text{c})$
Ditantalum pentoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	32.300	34.200	0	-489.000	-459.712
400	35.484	44.207	3.476	-487.958	-449.860
600	39.318	59.364	10.978	-485.427	-431.336
800	41.840	71.051	19.115	-482.508	-413.741
1000	43.310	80.559	27.643	-479.384	-396.907
1200	44.340	88.549	36.410	-476.160	-380.711
1400	45.464	95.465	45.386	-472.839	-365.066
1600	46.939	101.628	54.620	-469.361	-349.906
1800	48.679	107.256	64.180	-465.651	-335.191
2000	50.223	112.469	74.079	-461.701	-320.907

$\text{TbO}_{1.715}(\text{c})$
Terbium oxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	14.100	19.300	0	-227.800	-215.773
300	14.128	19.387	.026	-227.798	-215.699
400	15.281	23.629	1.503	-227.616	-211.691
500	16.026	27.123	3.070	-227.358	-207.742
600	16.644	30.100	4.704	-227.069	-203.845
700	17.221	32.709	6.398	-226.776	-199.996
800	17.793	35.046	8.148	-226.479	-196.187
900	18.377	37.175	9.957	-226.171	-192.420
1000	18.982	39.143	11.824	-225.855	-188.693

*Entropy and heat capacity at 298 K estimated.

$\text{TbO}_{1.812}(\text{c})$
Terbium oxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	13.900	19.400	0	-229.900	-217.223
300	13.940	19.486	.026	-229.899	-217.145
400	15.540	23.743	1.509	-229.744	-212.914
500	16.483	27.319	3.114	-229.481	-208.738
600	17.138	30.386	4.796	-229.179	-204.618
700	17.619	33.065	6.535	-228.878	-200.547
800	17.976	35.443	8.316	-228.587	-196.516
900	18.231	37.576	10.127	-228.315	-192.526

*Entropy and heat capacity at 298 K estimated.

$\text{Tb}_2\text{O}_3(\text{c})$
Diterbium trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	27.500	37.500	0	-445.800	-424.617
400	29.669	45.934	2.928	-445.352	-417.448
600	31.412	58.341	9.060	-444.201	-403.747
800	32.557	67.537	15.458	-443.167	-390.413
1000	33.720	74.925	22.085	-442.284	-377.344
1200	34.980	81.183	28.953	-441.524	-364.426
1400	36.305	86.674	36.081	-440.909	-351.609
1600	37.625	91.609	43.475	-442.509	-338.830
1800	38.856	96.113	51.125	-446.854	-325.426

$\text{TeO}_2(\text{c,l})$
Tellurium dioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	15.100	19.000	0	-77.100	-64.612
400	16.513	23.661	1.619	-76.857	-60.381
600	17.703	30.617	5.058	-76.345	-52.255
800	18.325	35.802	8.665	-80.180	-43.846
1000	18.782	39.941	12.377	-79.909	-34.790
1006	18.794	40.954	12.490	-92.540	-37.510
1006	27.600	46.773	19.250	-85.780	-37.510
1200	27.600	51.640	24.604	-71.169	-27.251

*Heat capacity estimated at 298 K.

1006 K, melting point; $\Delta H^\circ = 6.760$

$\text{TeO}_2(\text{g})$
Tellurium dioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.813	65.520	0	-15.100	-16.482
400	11.718	68.830	1.150	-15.326	-16.918
600	12.722	73.800	3.607	-15.796	-17.616
800	13.189	77.530	6.204	-20.641	-17.689
1000	13.431	80.500	8.869	-21.417	-16.857
1200	13.571	82.970	11.570	-22.203	-15.881

$\text{ThO}(\text{g})$
Thorium monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.473	57.351	0	-6.077	-12.066
400	7.864	59.604	.782	-6.333	-14.072
600	8.353	62.896	2.409	-6.844	-17.833
800	8.621	65.339	4.108	-7.406	-21.413
1000	8.845	67.286	5.855	-8.031	-24.844
1200	9.099	68.921	7.648	-8.710	-28.145
1400	9.395	70.345	9.497	-9.424	-31.326
1600	9.712	71.620	11.408	-10.164	-34.405
1800	10.031	72.782	13.382	-11.682	-37.307
2000	10.339	73.855	15.419	-12.379	-40.119
2200	10.630	74.855	17.517	-16.653	-42.557
2400	10.901	75.791	19.670	-17.618	-44.868

$\text{ThO}_2(\text{c})$
Thorium dioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	14.770	15.590	0	-293.120	-279.353
400	16.210	20.160	1.587	-292.933	-274.676
600	17.440	27.000	4.970	-292.430	-265.653
800	18.110	32.120	8.530	-291.919	-256.800
1000	18.610	36.210	12.204	-291.438	-248.080
1200	19.050	39.650	15.971	-290.986	-239.459
1400	19.460	42.610	19.823	-290.557	-230.893
1600	19.850	45.240	23.754	-290.151	-222.409
1800	20.230	47.600	27.763	-290.519	-213.880
2000	20.610	49.750	31.847	-290.065	-205.389
2200	20.980	51.730	36.006	-293.186	-196.637
2400	21.350	53.570	40.239	-292.990	-187.865

$\text{ThO}_2(\text{g})$
Thorium dioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.317	68.701	0	-118.670	-120.738
400	12.110	72.145	1.196	-118.874	-121.411
600	12.955	77.239	3.714	-119.236	-122.602
800	13.336	81.025	6.348	-119.651	-123.664
1000	13.531	84.024	9.036	-120.156	-124.612
1200	13.642	86.501	11.754	-120.753	-125.447
1400	13.711	88.610	14.490	-121.440	-126.176
1600	13.757	90.444	17.237	-122.218	-126.802
1800	13.788	92.066	19.992	-123.840	-127.240
2000	13.811	93.520	22.752	-124.710	-127.574
2200	13.828	94.837	25.516	-129.226	-127.512
2400	13.841	96.041	28.283	-130.496	-127.302

$\text{TiO}(\text{g})$
Titanium monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.762	55.776	0	13.000	5.858
400	8.131	58.108	.809	12.821	3.447
600	8.646	61.514	2.493	12.455	-1.163
800	8.894	64.940	4.250	12.022	-5.634
1000	9.021	66.039	6.043	11.498	-9.986
1200	9.094	67.691	7.855	9.908	-14.192
1400	9.141	69.097	9.679	9.411	-18.172
1600	9.174	70.320	11.510	8.826	-22.074
1800	9.206	71.402	13.348	8.137	-25.896
2000	9.242	72.374	15.193	3.899	-29.539
2200	9.290	73.257	17.046	2.634	-32.822
2400	9.353	74.068	18.910	1.369	-35.989
2600	9.433	74.819	20.788	.109	-39.051
2800	9.530	75.522	22.684	-1.143	-42.017
3000	9.644	76.183	24.601	-2.385	-44.890

$\text{TiO}_2(\text{c})$
Titanium dioxide, rutile

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.160	12.040	0.000	-225.670	-212.466
400	14.893	16.167	1.435	-225.585	-207.964
600	16.804	22.622	4.631	-225.182	-199.235
800	17.519	27.573	8.077	-224.714	-190.652
1000	17.755	31.511	11.608	-224.320	-182.181
1200	17.961	34.765	15.178	-224.995	-173.748
1400	18.307	37.558	18.802	-224.553	-165.243
1600	18.752	40.031	22.507	-224.137	-156.799
1800	19.195	42.266	26.302	-223.754	-148.406
2000	19.715	44.313	30.189	-226.847	-139.957

$\text{TiO}_2(\text{c})$
Titanium dioxide, anatase

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.220	11.930	0.000	-224.600	-211.364
400	15.343	16.158	1.471	-224.479	-206.854
600	16.907	22.732	4.724	-224.019	-198.138
800	17.565	27.696	8.178	-223.543	-189.580
1000	17.972	31.662	11.734	-223.124	-181.136
1200	18.287	34.967	15.360	-223.743	-172.738
1300*	18.429	36.436	17.196	-223.484	-168.498

*Anatase transforms irreversibly to rutile.

$\text{TiO}_2(\text{g})$
Titanium dioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.552	62.151	0	-73.000	-74.737
400	11.419	65.378	1.121	-73.229	-75.292
600	12.495	70.236	3.524	-73.619	-76.240
800	13.033	73.913	6.083	-74.038	-77.048
1000	13.322	76.056	8.721	-74.537	-77.743
1200	13.491	79.301	11.404	-76.099	-78.295
1400	13.597	81.389	14.114	-76.571	-78.625
1600	13.668	83.210	16.841	-77.133	-78.882
1800	13.718	84.822	19.580	-77.806	-79.059
2000	13.755	86.270	22.327	-82.039	-79.063
2200	13.784	87.582	25.081	-83.310	-78.703
2400	13.810	88.783	27.840	-84.598	-78.228
2600	13.835	89.889	30.605	-85.900	-77.645
2800	13.864	90.915	33.375	-87.217	-76.958
3000	13.897	91.873	36.150	-88.549	-76.180

$\text{Ti}_2\text{O}_3(\text{c})$
Dititanium Trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	22.910	18.480	0	-363.500	-342.729
400	28.911	26.076	2.648	-363.190	-335.663
473	32.191	31.207	4.885	-362.685	-330.684
473	30.880	31.662	5.100	-362.470	-330.684
600	32.620	39.225	9.144	-361.537	-322.261
800	34.094	48.834	15.831	-360.018	-309.390
1000	34.954	56.541	22.742	-358.561	-296.897
1200	35.530	62.968	29.794	-359.155	-284.623
1400	35.936	68.478	36.943	-357.510	-272.335
1600	36.218	73.296	44.160	-355.998	-260.272
1800	36.400	77.573	51.423	-354.674	-248.388
2000	36.494	81.414	58.714	-360.447	-236.448

473 K, transition point; $\Delta H^\circ = 0.215$

$\text{Ti}_3\text{O}_5(\text{c})$
Trititanium pentoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	37.000	30.920	0	-587.800	-553.944
400	49.199	43.403	4.357	-587.131	-542.447
450	56.180	49.598	6.990	-586.362	-536.909
450	46.384	54.709	9.290	-584.062	-536.909
600	46.126	67.985	16.212	-582.913	-521.372
800	47.450	81.400	25.544	-581.727	-501.030
1000	49.879	92.236	35.265	-580.596	-480.977
1200	52.689	101.577	45.521	-582.232	-461.065
1400	55.321	109.902	56.328	-580.110	-441.038
1600	57.379	117.431	67.610	-577.822	-421.325
1800	58.632	124.271	79.226	-575.557	-401.900
2000	59.012	130.475	91.005	-583.821	-382.429

450 K, transition point; $\Delta H^\circ = 2.300$

$\text{Ti}_4\text{O}_7(\text{c})$
Tetratitanium heptoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	51.560	47.000	0	-813.000	-767.145
400	57.345	63.046	5.576	-812.463	-751.547
600	63.271	87.546	17.700	-810.768	-721.443
800	67.028	106.290	30.749	-808.842	-691.938
1000	69.948	121.572	44.457	-806.862	-662.929
1200	72.361	134.545	58.695	-808.760	-634.190
1400	74.378	145.855	73.375	-805.948	-605.319
1600	76.047	155.900	88.423	-803.183	-576.849
1800	77.390	164.938	103.772	-800.597	-548.714
2000	78.420	173.147	119.358	-812.035	-520.471

$\text{Ti}_2\text{O}(\text{c,l})$
Dithallium monoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	18.850	34.700	0.000	-40.400	-19.682
300	18.867	34.817	.035	-40.396	-34.255
400	19.620	40.353	1.961	-40.830	-12.541
500	20.230	44.799	3.954	-39.833	-30.322
600	20.785	48.537	6.006	-44.036	1.930
700	21.314	51.781	8.111	-41.531	-26.084
800	21.829	54.669	10.268	-44.978	17.391
852	22.094	56.043	11.410	-41.000	-22.789
852	26.700	64.506	18.620	-33.790	-22.789
900	26.700	65.969	19.902	-33.386	-22.180
1000	26.700	68.782	22.572	-37.975	31.788

*Heat capacity estimated at 298 K.

852 K, melting point; $\Delta H^\circ = 7.210$

$\text{Ti}_2\text{O}(g)$
Dithallium monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.470	75.850	0	1.500	-4.662
300	12.480	75.930	.023	1.492	-4.701
400	13.000	79.600	1.298	1.131	-6.715
500	13.280	82.530	2.613	.726	-8.629
600	13.460	84.970	3.951	-1.982	-10.334
700	13.580	87.050	5.303	-2.438	-11.680
800	13.640	88.870	6.664	-2.896	-12.985
900	13.700	90.480	8.031	-3.357	-14.211
1000	13.740	91.930	9.403	-3.818	-15.393

$\text{Ti}_2\text{O}_3(c)$
Dithallium trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	25.200	38.000	0	-94.300	-74.566
300	25.296	38.156	.047	-94.297	-74.443
400	28.653	45.959	2.767	-93.924	-67.877
500	30.242	52.542	5.720	-93.421	-61.421
600	31.130	58.142	8.793	-95.149	-54.946
700	31.687	62.985	11.935	-94.594	-48.282
800	32.067	67.243	15.124	-94.022	-41.720
900	32.344	71.036	18.345	-93.442	-35.209
1000	32.557	74.456	21.591	-92.856	-28.767

*Heat capacity estimated at 298 K.

$\text{Ti}_2\text{O}_3(c)$
Dithallium trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	27.900	33.400	0	-451.400	-428.893
400	29.355	41.832	2.926	-450.879	-421.285
600	30.434	53.976	8.923	-449.716	-406.739
800	30.962	62.809	15.066	-448.653	-392.581
1000	31.368	69.762	21.300	-447.811	-378.648
1200	31.713	75.513	27.610	-447.116	-364.893
1400	31.975	80.423	33.980	-446.553	-351.218
1600	32.109	84.703	40.391	-446.135	-337.646
1680	32.114	86.269	42.960	-446.011	-332.213
1680	32.000	86.454	43.270	-445.701	-332.213
1800	32.000	88.662	47.110	-445.579	-324.131
2000	32.000	92.033	53.510	-445.876	-309.844

1680 K, transition point; $\Delta H^\circ = 0.310$

$\text{UO}_2(c)$
Uranium dioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	15.200	18.410	0	-259.200	-246.500
400	17.081	23.184	1.659	-258.962	-242.196
600	18.976	30.509	5.285	-258.355	-233.942
800	20.009	36.125	9.194	-257.843	-225.888
1000	20.537	40.654	13.255	-258.207	-217.893
1200	20.790	44.423	17.390	-258.780	-209.714
1400	21.019	47.644	21.570	-258.150	-201.586
1600	21.496	50.477	25.815	-260.143	-193.221
1800	22.476	53.060	30.202	-259.852	-184.871
2000	24.168	55.508	34.853	-259.320	-176.566
2200	26.685	57.923	39.924	-258.390	-168.331
2400	30.012	60.382	45.581	-256.896	-160.205
2600	33.958	62.937	51.970	-254.690	-152.232
2800	38.120	65.606	59.179	-251.684	-144.455
3000	41.840	68.368	67.190	-247.896	-136.926

3115 K, melting point; $\Delta H^\circ = 18.176$

$\text{UO}_3(\gamma)$
Uranium trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.520	22.970	0	-292.570	-273.924
300	19.567	23.091	.036	-292.565	-273.808
400	21.311	28.997	2.093	-292.260	-267.601
500	22.213	33.857	4.273	-291.912	-261.475
600	22.801	37.962	6.525	-291.590	-255.419
700	23.241	41.512	8.828	-291.322	-249.412
800	23.602	44.639	11.171	-291.129	-243.441
900	23.917	47.438	13.547	-291.023	-237.486

$\text{U}_4\text{O}_{13}(c)$
Tetrauranium enneaoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	70.400	79.880	0	-1078.100	-1021.856
348	98.400	92.120	3.960	-1072.066	-1012.518
400	74.640	102.640	7.872	-1076.274	-1002.953
600	79.560	134.040	23.376	-1073.589	-966.908
800	83.400	157.480	39.672	-1071.668	-931.688
1000	87.320	176.480	56.740	-1073.121	-896.634
1200	91.400	192.760	74.608	-1074.928	-860.911
1400	95.800	207.200	93.320	-1071.276	-825.556
1400	98.800	209.160	96.080	-1068.516	-825.548
1600	98.800	222.360	115.840	-1074.582	-789.844

348 K, transition point; $\Delta H^\circ = 0$

1400 K, transition point; $\Delta H^\circ = 2.670$

VO(c)
Vanadium monoxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.861	9.300	0.000	-103.200	-96.606
400	11.873	12.660	1.167	-103.018	-94.379
600	12.800	17.660	3.639	-102.576	-90.152
800	13.631	21.456	6.283	-102.061	-86.087
1000	14.431	24.585	9.090	-101.478	-82.160
1200	15.168	27.282	12.051	-100.837	-78.354
1400	15.832	29.671	15.152	-100.162	-74.661
1600	16.458	31.826	18.381	-99.472	-71.066
1800	17.157	33.803	21.740	-98.767	-67.555

VO(g)
Vanadium monoxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.337	55.160	0	30.500	23.421
400	7.710	57.369	.767	30.281	21.037
600	8.236	60.604	2.366	29.852	16.508
800	8.522	63.017	4.045	29.402	12.126
1000	8.685	64.938	5.767	28.899	7.864
1200	8.786	66.531	7.515	28.326	3.711
1400	8.856	67.891	9.279	27.664	-.342
1600	8.910	69.077	11.056	26.903	-4.293
1800	8.959	70.129	12.843	26.036	-8.139
2000	9.010	71.075	14.640	25.046	-11.883
2200	9.070	71.937	16.447	18.448	-15.501
2400	9.142	72.729	18.268	17.142	-18.529
2600	9.228	73.464	20.105	15.842	-21.448
2800	9.329	74.152	21.961	14.552	-24.269
3000	9.444	74.799	23.838	13.271	-26.997

V₂O₃(c)
Divanadium trioxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	25.250	23.500	0	-293.500	-274.467
400	28.075	31.358	2.730	-293.102	-268.021
600	30.599	43.294	8.635	-291.999	-255.707
800	31.855	52.283	14.890	-290.789	-243.795
1000	32.839	59.497	21.359	-289.590	-232.106
1200	34.074	65.586	28.043	-288.391	-220.814
1400	35.894	70.967	35.028	-287.118	-209.652
1600	38.351	75.914	42.444	-285.652	-198.685
1800	41.047	80.580	50.386	-283.903	-187.911

V₂O₄(c)
Divanadium tetroxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	27.958	24.600	0	-341.100	-329.700
340	30.240	28.419	1.218	-340.976	-311.445
340	31.695	34.601	3.320	-338.874	-311.445
400	32.653	39.835	5.253	-337.818	-326.346
600	35.054	53.529	12.024	-335.105	-321.184
800	37.280	63.931	19.266	-332.121	-316.989
1000	38.735	72.423	26.882	-328.954	-313.571
1200	39.375	79.551	34.704	-325.773	-310.791
1400	39.664	85.643	42.608	-322.721	-308.539
1600	40.366	90.976	50.597	-319.809	-306.716
1800	42.388	95.830	58.843	-316.871	-305.250
1818	42.667	96.252	59.608	-329.107	-202.473
1818	51.000	111.215	86.810	-301.905	-202.473
2000	51.000	116.081	96.092	-285.195	-306.917

340 K, transition point; ΔH° = 2.102

1818 K, melting point; ΔH° = 27.202

V₂O₅(c,l)
Divanadium pentoxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	30.500	31.140	0	-370.600	-339.234
400	34.519	40.752	3.341	-370.315	-328.555
600	37.978	55.478	10.628	-369.315	-307.875
800	40.866	66.788	18.504	-368.061	-287.582
950	43.527	74.025	24.827	-366.895	-272.591
950	45.500	90.176	40.170	-351.552	-272.591
1000	45.500	92.509	42.445	-351.030	-268.448
1200	45.500	100.805	51.545	-349.102	-252.114
1400	45.500	107.819	60.645	-347.434	-236.087

Decomposes above 1500 K.

950 K, melting point; ΔH° = 15.343

WO(g)
Tungsten monoxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.287	58.722	0	108.000	100.123
400	7.646	60.914	.761	107.798	97.466
600	8.176	64.124	2.348	107.418	92.378
800	8.472	66.521	4.015	107.038	87.422
1000	8.640	68.431	5.728	106.645	82.569
1200	8.744	70.016	7.467	106.226	77.795
1400	8.813	71.369	9.223	105.773	73.108
1600	8.862	72.549	10.991	105.287	68.472
1800	8.899	73.595	12.767	104.765	63.898
2000	8.930	74.535	14.550	104.207	59.382

$\text{WO}_2(\text{c})$
Tungsten dioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.320	12.080	0.000	-140.940	-127.605
400	15.121	16.271	1.457	-140.808	-123.064
600	17.077	22.820	4.701	-140.274	-114.302
800	18.055	27.882	8.224	-139.585	-105.747
1000	18.610	31.975	11.895	-138.841	-97.366
1200	19.063	35.407	15.661	-138.077	-89.140
1400	19.794	38.394	19.539	-137.267	-81.030
1600	21.195	41.120	23.624	-136.310	-73.064
1800	23.279	43.733	28.065	-135.052	-65.232

$\text{WO}_2(\text{g})$
Tungsten dioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	10.471	68.209	0	11.000	7.600
400	11.355	71.415	1.113	10.788	6.474
600	12.454	76.252	3.507	10.472	4.385
800	13.006	79.919	6.059	10.190	2.399
1000	13.303	82.856	8.693	9.897	.491
1200	13.477	85.299	11.372	9.574	-1.359
1400	13.587	87.385	14.079	9.213	-3.138
1600	13.660	89.204	16.805	8.811	-4.877
1800	13.711	90.816	19.542	8.365	-6.564
2000	13.748	92.263	22.288	7.873	-8.201

*All data estimated except enthalpy of formation at 298 K.

$\text{WO}_3(\text{c,l})$
Tungsten trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.600	18.150	0.000	-201.480	-182.650
400	19.696	23.645	1.909	-201.257	-176.245
600	22.247	32.179	6.136	-200.483	-163.898
800	23.249	38.740	10.702	-199.540	-151.844
1000	23.989	43.998	15.418	-198.571	-140.024
1051	24.316	45.190	16.640	-198.321	-137.036
1051	23.641	45.580	17.050	-197.911	-137.036
1200	24.036	48.749	20.611	-197.224	-128.460
1400	24.589	52.496	25.473	-196.290	-117.059
1600	25.159	55.816	30.448	-195.316	-105.808
1747	25.584	58.047	34.160	-194.567	-97.609
1747	31.400	68.093	51.730	-177.017	-97.609
1800	31.400	69.029	53.391	-176.441	-95.218
2000	31.400	72.338	59.671	-174.295	-86.313

1051 K, transition point; $\Delta H^\circ = 0.410$

1747 K, melting point; $\Delta H^\circ = 17.550$

$\text{WO}_3(\text{g})$
Tungsten trioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	14.580	68.434	0	-70.000	-66.162
400	16.071	72.941	1.566	-70.120	-64.827
600	17.746	79.816	4.968	-70.172	-62.168
800	18.557	85.045	8.608	-70.154	-59.502
1000	18.990	89.237	12.367	-70.142	-56.834
1200	19.244	92.724	16.192	-70.163	-54.169
1400	19.403	95.703	20.058	-70.225	-51.483
1600	19.509	98.301	23.950	-70.334	-48.802
1800	19.583	100.604	27.859	-70.493	-46.105
2000	19.637	102.670	31.782	-70.705	-43.386
2200	19.677	104.543	35.713	-70.973	-40.649
2400	19.707	106.257	39.652	-71.298	-37.870
2600	19.731	107.835	43.596	-71.681	-35.061
2800	19.750	109.298	47.544	-72.120	-32.232
3000	19.766	110.662	51.495	-72.620	-29.353

*All data estimated except enthalpy of formation at 298 K.

$(\text{WO}_3)_2(\text{g})$
Dimeric tungsten trioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	36.726	99.298	0	-278.200	-259.322
400	39.407	110.510	3.892	-277.681	-252.945
600	41.642	126.990	12.036	-276.443	-240.850
800	42.515	139.106	20.463	-275.260	-229.169
1000	42.937	148.643	29.013	-274.205	-217.758
1200	43.171	156.494	37.626	-273.283	-206.551
1400	43.314	163.160	46.276	-272.489	-195.462
1600	43.408	168.951	54.948	-271.820	-184.514
1800	43.472	174.067	63.637	-271.267	-173.637
2000	43.519	178.650	72.336	-270.837	-162.821
2200	43.553	182.800	81.043	-270.529	-152.052
2400	43.579	186.590	89.757	-270.342	-141.270
2600	43.600	190.079	98.475	-270.279	-130.503
2800	43.616	193.311	107.196	-270.331	-119.758
3000	43.629	196.321	115.921	-270.509	-108.965

*All data estimated except enthalpy of formation at 298 K.

(WO₃)₃(g)
Trimeric tungsten trioxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	53.284	120.599	0	-483.600	-446.831
400	58.219	137.015	5.702	-482.958	-434.354
600	62.806	161.634	17.876	-481.142	-410.443
800	64.742	180.003	30.656	-479.229	-387.167
1000	65.711	194.565	43.711	-477.416	-364.346
1200	66.259	206.598	56.913	-475.751	-341.881
1400	66.597	216.839	70.201	-474.247	-319.645
1600	66.819	225.747	83.544	-472.908	-297.662
1800	66.973	233.627	96.924	-471.732	-275.834
2000	67.084	240.689	110.330	-470.730	-254.134
2200	67.166	247.087	123.755	-469.903	-232.540
2400	67.229	252.934	137.195	-469.254	-210.963
2600	67.278	258.317	150.646	-468.785	-189.437
2800	67.317	263.305	164.106	-468.485	-167.973
3000	67.349	267.950	177.573	-468.372	-146.462

*All data estimated except enthalpy of formation at 298 K.

(WO₃)₄(g)
Tetrameric tungsten trioxide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	73.894	144.635	0	-670.200	-616.356
400	79.917	167.276	7.862	-669.084	-598.114
600	85.538	200.920	24.495	-666.263	-563.242
800	87.921	225.897	41.871	-663.375	-529.341
1000	89.118	245.658	59.587	-660.649	-496.127
1200	89.794	261.972	77.484	-658.134	-463.451
1400	90.212	275.847	95.488	-655.842	-431.127
1600	90.487	287.912	113.559	-653.777	-399.182
1800	90.678	298.582	131.677	-651.931	-367.477
2000	90.815	308.143	149.827	-650.319	-335.973
2200	90.917	316.804	168.001	-648.943	-304.639
2400	90.995	324.718	186.192	-647.806	-273.353
2600	91.056	332.004	204.398	-646.910	-242.158
2800	91.105	338.754	222.614	-646.240	-211.064
3000	91.144	345.041	240.839	-645.821	-179.930

*All data estimated except enthalpy of formation at 298 K.

W₃O₈(g)
Tritungsten octoxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	49.301	118.036	0	-408.700	-378.472
400	53.445	133.157	5.251	-408.147	-368.218
600	57.403	155.699	16.397	-406.617	-348.586
800	59.101	172.475	28.068	-405.024	-329.484
1000	59.956	185.765	39.982	-403.532	-310.757
1200	60.442	196.743	52.026	-402.181	-292.322
1400	60.741	206.084	64.147	-400.984	-274.063
1600	60.939	214.209	76.316	-399.946	-256.015
1800	61.076	221.395	88.518	-399.063	-238.084
2000	61.175	227.835	100.744	-398.344	-220.246
2200	61.248	233.670	112.987	-397.792	-202.489
2400	61.304	239.001	125.242	-397.409	-184.723
2600	61.348	243.910	137.508	-397.197	-166.988
2800	61.383	248.458	149.781	-397.145	-149.295
3000	61.411	252.694	162.060	-397.272	-131.538

*All data estimated except enthalpy of formation at 298 K.

Y₂O₃(c)
Dyttrium trioxide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	24.500	23.690	0	-455.380	-434.194
400	26.865	31.264	2.631	-455.139	-426.991
600	29.061	42.636	8.255	-454.405	-413.059
800	30.024	51.147	14.176	-453.648	-399.397
1000	30.418	57.896	20.227	-453.002	-385.913
1200	30.578	63.457	26.328	-452.518	-372.556
1330	30.684	66.608	30.310	-452.289	-363.903
1330	31.500	66.841	30.620	-451.979	-363.903
1400	31.500	68.457	32.825	-451.828	-359.257
1600	31.500	72.663	39.125	-451.523	-346.074
1800	31.500	76.373	45.425	-451.182	-332.822
2000	31.500	79.692	51.725	-451.691	-318.777

1330 K, transition point; ΔH° = 0.310

$\text{Yb}_2\text{O}_3(\text{c})$
Dyittrbium trioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	27.570	31.800	0	-433.680	-412.718
400	29.381	40.176	2.908	-433.174	-405.631
600	30.885	52.429	8.962	-432.235	-392.062
800	31.389	61.397	15.199	-431.260	-378.826
1000	31.516	68.419	21.493	-430.428	-365.822
1200	31.534	74.167	27.798	-434.572	-352.461
1365	31.599	78.232	33.005	-434.391	-341.170
1365	32.150	78.342	33.155	-434.241	-341.170
1400	32.150	79.156	34.200	-434.185	-338.785
1600	32.150	83.449	40.710	-434.476	-319.635
1800	32.150	87.236	47.140	-492.687	-297.882
2000	32.150	90.623	53.570	-490.934	-276.334

1365 K, transition point; $\Delta H^\circ = 0.150$

$\text{ZnO}(\text{c})$
Zinc monoxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	9.820	10.430	0	-83.762	-76.600
400	10.680	13.450	1.049	-83.703	-74.159
600	11.500	17.950	3.277	-83.524	-69.422
800	12.010	21.340	5.631	-85.159	-64.480
1000	12.440	24.070	8.078	-85.032	-59.326
1200	12.830	26.370	10.605	-112.364	-53.729
1400	13.210	28.370	13.210	-111.613	-44.006
1600	13.570	30.160	15.888	-110.802	-34.408
1800	13.930	31.780	18.639	-109.930	-24.911
2000	14.290	33.270	21.461	-108.999	-15.522

$\text{ZrO}(\text{g})$
Zirconium monoxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.373	54.332	0	15.000	8.885
400	7.754	56.553	.771	14.759	6.833
600	8.343	59.813	2.383	14.268	2.976
800	9.010	62.299	4.114	13.764	-.713
1000	9.948	64.406	6.006	13.306	-4.277
1200	10.980	66.311	8.099	12.089	-7.705
1400	11.833	68.072	10.386	12.126	-11.006
1600	12.338	69.690	12.811	12.224	-14.318
1800	12.557	71.160	15.307	12.317	-17.642
2000	12.517	72.483	17.817	12.349	-20.975

$\text{ZrO}_2(\text{c})$
Zirconium dioxide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.430	12.040	0	-263.040	-249.240
400	15.155	16.251	1.464	-262.950	-244.536
600	16.813	22.752	4.682	-262.577	-235.404
800	17.706	27.722	8.141	-262.142	-226.413
1000	18.261	31.737	11.742	-261.711	-217.530
1200	18.582	35.098	15.430	-262.177	-208.679
1400	18.708	37.974	19.162	-261.554	-199.813
1478	18.708	38.988	20.620	-261.334	-196.380
1478	18.780	40.294	22.550	-259.404	-196.380
1600	18.780	41.784	24.841	-259.076	-191.193
1800	18.780	43.996	28.597	-258.608	-182.736
2000	18.780	45.974	32.353	-258.227	-174.327
2200	18.780	47.764	36.109	-262.907	-165.777
2400	18.780	49.390	39.865	-262.588	-156.959

1478 K, transition point; $\Delta H^\circ = 1.93$

$\text{ZrO}_2(\text{g})$
Zirconium dioxide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.009	65.402	0	-68.400	-70.510
400	11.818	68.756	1.165	-68.609	-71.197
600	12.759	73.750	3.634	-68.985	-72.410
800	13.207	77.489	6.236	-69.407	-73.492
1000	13.442	80.464	8.903	-69.910	-74.456
1200	13.578	82.928	11.606	-71.361	-75.259
1400	13.663	85.028	14.331	-71.745	-75.879
1600	13.720	86.856	17.070	-72.207	-76.439
1800	13.759	88.475	19.818	-72.747	-76.937
2000	13.787	89.926	22.573	-73.367	-77.371
2200	13.808	91.241	25.332	-79.044	-77.563
2400	13.824	92.443	28.096	-79.717	-77.396
2600	13.837	93.550	30.862	-80.408	-77.176
2800	13.847	94.576	33.630	-81.117	-76.900
3000	13.855	95.532	36.401	-81.843	-76.575

Phosphides

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

Sources of data from general references are listed below, with the reference given immediately after each formula:

BP(c) (1), InP(c) (30), UP(c) (33).

Additional sources:

GaP(c):

Ilegams, M., M. B. Panish, and J. R. Arthur. Phase Equilibriums and Vapor Pressures in the Gallium-Phosphorus System. *J. Chem. Thermodyn.*, v. 6, 1974, pp. 157-177.

Koschenko, V. I. Termodinami Cheskie Funktsii i Kharakteristiki Prochnosti Mezhatomnoi Vyazi Nekotorykh Polprovodnikov So Strukturoi Almaza i Tipa $A^{IV}B^{III}$ (Thermodynamic Functions and Characteristics of the Interatomic Bond Strength of Some $A^{IV}B^{III}$ Semiconductor Compounds With Diamond Structure). *Vses. Inst. Nauchnoi i Tekh. Inf.*, Moscow, Doc. 5034, 1981, 40 pp.

Pankratz, L. B. High-Temperature Heat Contents and Entropies of Gallium Phosphide, Indium Phosphide, and Indium Sulfide. *BuMines RI 6592*, 1965, 7 pp.

GdP(c):

Gordienko, S. P., V. F. Gol'nik, and K. E. Mironov. Gadolinium Monophosphide at Elevated Temperatures. *Inorg. Mater. (Engl. Transl.)*, v. 18, 1982, pp. 1448-1451.

Rakhmenkulov, F. S., K. E. Mironov, and R. E. Paukov. The Heat Capacity of Gadolinium Monophosphide in the Range 11.3-297.2 K. *Russ. J. Phys. Chem. (Engl. Transl.)*, v. 52, 1978, pp. 1040-1041.

InP(c):

Pankratz, L. B. High-Temperature Heat Contents and Entropies of Gallium Phosphide, Indium Phosphide, and Indium Sulfide. *BuMines RI 6592*, 1965, 7 pp.

Piesbergen, U. (The Average Atomic Heats of the $A^{III}B^{IV}$ Semiconductors AlSb, GaAs, InP, InAs, InSb and the Atomic Heat of the Element Ga Between 12 and 273° K.) *Z. Naturforsch., A*, v. 18, 1963, pp. 141-147.

Sirota, N. N., A. M. Antyukhov, V. V. Novikov, and V. A. Fyodorov. Thermodynamic Functions of $(InP)_x(InAs)_{1-x}$ From 5 to 300 K. *Cryst. Res. and Technol.*, v. 17, 1982, pp. 279-287.

MnP(c):

Baratashvili, I. B., A. A. Nadiradze, I. A. Makharadze, and L. A. Shvartsman. (Thermodynamic Properties of Manganese Phosphide (Mn_2P).) *Dokl. Akad. Nauk SSSR*, v. 224, 1975, pp. 844-846.

Makharadze, I. A., I. B. Baratashvili, and B. Sh. Tsagareishvili. Enthalpy and Specific Heat of Manganese Phosphides at High Temperature. *Inorg. Mater. (Engl. Transl.)*, v. 11, 1975, pp. 599-601.

Mn_2P (c):

Grandjean, F., D. W. Osborne, W. G. Lyon, and H. E. Flotow. Dimanganese Phosphide, Mn_2P : Heat Capacity From 5 to 350 K, Magnetic Entropy, and Thermodynamic Functions to 1300 K. *J. Chem. Thermodyn.*, v. 9, 1977, pp. 549-559.

UP(c):

Counsell, J. F., R. M. Dell, A. R. Junkison, and J. F. Martin. Thermodynamic Properties of Uranium Compounds. Trans. Faraday Soc., v. 63, 1967, pp. 72-79.

Uno, F., M. Kanno, and T. Mukiabo. Heat Capacity of Uranium Phosphides Above Room Temperature. J. Nucl. Sci. and Technol., v. 10, 1973, pp. 764-765.

Yokokawa, H., Y. Takahashi, and T. Mukaibo. Heat Capacity of Uranium Monophosphide From 80-1080° K and the Electronic Contribution. Thermodynamics of Nuclear Materials 1974. Int. At. Energy Agency, v. 2, 1975, pp. 419-430.

BP(c)
Boron monophosphide, cubic

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.248	6.400	0	-27.600	-26.160
300	7.260	6.445	.014	-27.602	-26.150
400	7.930	8.625	.773	-27.936	-25.602
500	8.600	10.467	1.600	-28.145	-24.991
600	9.270	12.094	2.493	-31.183	-24.098
700	9.940	13.573	3.454	-31.212	-22.911
800	10.610	14.944	4.481	-31.209	-21.725
900	11.280	16.233	5.576	-31.165	-20.541
1000	11.950	17.456	6.737	-31.077	-19.365
1100	12.620	18.626	7.966	-30.939	-18.205

GaP(c)
Gallium monophosphide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.542	12.280	0	-24.000	-21.824
400	11.251	15.490	1.114	-25.680	-20.582
600	11.846	20.183	3.433	-28.729	-17.732
800	12.158	23.636	5.836	-28.547	-14.090
1000	12.388	26.375	8.291	-28.329	-10.501
1200*	12.585	28.651	10.788	-28.078	-6.960
1400	12.767	30.605	13.324	-27.793	-3.462

*Data extrapolated above 1100 K.

GdP(c)
Gadolinium monophosphide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.611	19.570	0	-75.000	-73.065
400	12.070	23.053	1.208	-75.332	-72.337
600	12.558	28.049	3.676	-78.308	-70.548
800	12.898	31.709	6.222	-78.145	-67.985
1000	13.197	34.620	8.832	-78.016	-65.468
1200	13.478	37.051	11.500	-77.923	-62.964
1400	13.752	39.150	14.223	-77.886	-60.466
1600	14.022	41.004	17.001	-81.120	-57.926
1800	14.289	42.670	19.832	-81.051	-55.021
2000	14.554	44.190	22.716	-80.930	-52.148

InP(c)
Indium monophosphide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.880	15.100	0	-21.200	-18.654
400	11.545	18.405	1.147	-21.516	-17.720
600	11.983	23.188	3.509	-25.425	-15.198
800	12.111	26.656	5.921	-25.361	-11.798
910	12.138	28.218	7.255	-25.323	-9.935
910	11.707	28.306	7.335	-25.243	-9.935
1000	12.292	29.438	8.415	-25.225	-8.422
1200	13.593	31.794	11.004	-25.002	-5.078

910 K, transition point; ΔH° = 0.080

MnP(c)
Manganese monophosphide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.200	15.600	0	-27.000	-26.442
400	12.425	19.087	1.211	-27.240	-26.198
600	13.296	24.324	3.801	-30.175	-25.406
800	13.611	28.198	6.496	-30.030	-23.845
1000	13.764	31.254	9.235	-30.520	-22.296
1200	13.854	33.772	11.997	-30.555	-20.649

Mn₂P(c)
Dimanganese phosphide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	17.577	21.752	0	-40.900	-39.896
400	18.958	27.130	1.867	-41.148	-39.500
600	20.684	35.165	5.842	-44.138	-38.391
800	22.022	41.303	10.116	-44.014	-36.505
1000	23.196	46.346	14.640	-44.981	-34.619
1200	24.262	50.672	19.387	-44.852	-32.558

UP(c)
Uranium monophosphide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.860	18.710	0	-64.000	-63.073
400	12.460	22.290	1.240	-64.245	-62.705
600	13.200	27.490	3.810	-67.293	-61.645
800	13.700	31.360	6.500	-67.374	-59.760
1000	14.100	34.460	9.290	-68.335	-57.769
1200	14.430	37.060	12.140	-69.482	-55.490
1400	14.720	39.310	15.050	-69.383	-53.175
1600	14.980	41.290	18.030	-71.878	-50.528

Selenides

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

All formation reactions for selenides use $\text{Se}_2(\text{g})$. A formation table for $2\text{Se}(\text{c,l}) = \text{Se}_2(\text{g})$ is included.

Most data were from reference 23, except as follows:

$\text{NiSe}_{1.05}(\text{c})$ (22), $\text{NiSe}_{1.14}(\text{c})$ (22), $\text{NiSe}_{1.25}(\text{c})$ (22), $\text{NiSe}_2(\text{c})$ (22), and $\text{PbSe}(\text{c,l})$ (18, 30).

Additional sources:

$\text{As}_2\text{Se}_3(\text{c,l})$:

Rasulov, S. M., and R. A. Medzhidov. Thermodynamic Properties of Glassy, Crystalline, and Liquid Arsenic Selenide. Russ. J. Phys. Chem. (Engl. Transl.), v. 51, 1977, pp. 969-970.

Zhdanov, V. M., and A. K. Mal'tsev. Low Temperature Heat Capacity, Enthalpy, and Entropy of Crystalline and Vitreous Arsenic Sesquiselenide and of Crystalline Arsenic Sesquitelluride. Russ. J. Phys. Chem. (Engl. Trans.), v. 42, 1968, pp. 1078-1080.

$\text{CdSe}(\text{c})$:

Shaulov, Yu. Kh., E. N. Kostina, and G. A. Mil'ner. Heat Capacity and Entropy of Cadmium Selenide at Low Temperatures. Russ. J. Phys. Chem. (Engl. Transl.), v. 51, 1977, pp. 417-419.

$\text{EuSe}(\text{c})$:

McMasters, O. D., K. A. Gschneidner, Jr., E. Kaldis, and G. Sampietro. High-Temperature Enthalpies and Standard Gibbs Free Energies of Formation of the Europium Chalcogenides: EuO , EuS , EuSe , and EuTe . J. Chem. Thermodyn., v. 6, 1974, pp. 845-857.

$\text{FeSe}_2(\text{c,l})$:

Gronvold, F. Heat Capacities and Thermodynamic Properties of Iron Diselenide and Nickel Diselenide From 300 to 1000 K. J. Chem. Thermodyn., v. 7, 1975, pp. 645-654.

Svendsen, S. R. The Enthalpy of Iron Diselenide From 300 to 853 K by Drop Calorimetry. Acta Chem. Scand., v. 26, 1972, pp. 3834-3838.

$\text{GeSe}_2(\text{c})$:

Irene, E. A., and H. Wiedemeier. Knudsen Measurements of the Sublimation and the Heat of Formation of Germanium Selenide. Z. Anorg. und Allg. Chem., v. 424, 1976, pp. 277-286.

Karbanov, S. G., M. I. Karakhanova, V. P. Zlomanov, A. S. Pashinkin, and A. V. Novoselova. (Vapor Pressure of Germanium Disulfide and Germanium Diselenide.) Izv. Akad. Nauk SSSR, Neorg. Mater., v. 7, 1971, pp. 1914-1917.

Zlomanov, V. P., A. F. Novozhilov, and A. V. Makarov. Sublimation of GeSe and GeSe_2 . Inorg. Mater. (Engl. Transl.), v. 16, 1980, pp. 419-423.

$\text{In}_2\text{Se}(\text{g})$:

Greenberg, J. H., V. A. Borjakova, and V. F. Shevelkov. Thermodynamic Properties of In_2Se . J. Chem. Thermodyn., v. 5, 1973, pp. 233-237.

 $\text{MnSe}(\text{c})$:

Lukashenko, G. M., and R. I. Polotskaya. Thermodynamic Properties of Manganese Selenides. Inorg. Mater. (Engl. Transl.), v. 14, 1978, pp. 1203-1205.

Smoes, S., W. R. Pattje, and J. Drowart. Thermodynamic Study of the Vaporization of Manganese Metal and Manganese Selenide by Knudsen-Cell Mass Spectrometry. High Temp. Sci., v. 10, 1978, pp. 109-130.

 $\text{NiSe}_2(\text{c})$:

Gronvold, F. Heat Capacities and Thermodynamic Properties of Iron Diselenide and Nickel Diselenide From 300 to 1000 K. J. Chem. Thermodyn., v. 7, 1975, pp. 645-654.

Gronvold, F., and E. F. Westrum, Jr. Heat Capacities and Thermodynamic Functions of Iron Disulfide (Pyrite), Iron Diselenide, and Nickel Diselenide From 5 to 350 K. The Estimation of Standard Entropies of Transition Metal Chalcogenides. Inorg. Chem., v. 1, 1962, pp. 36-48.

 $\text{PbSe}(\text{c}, \text{l})$:

Rasulov, S. M., and R. A. Medzhidov. Enthalpy and Heat Capacity of Lead Selenide in the Temperature Interval 300-1480° K. High Temp. (Engl. Transl.), v. 16, 1978, pp. 251-256.

 $\text{SnSe}_2(\text{c})$:

Wiedemeier, H., and G. Pultz. Equilibrium Sublimation and Thermodynamic Properties of SnSe and SnSe_2 . Z. Anorg. und Allg. Chem., v. 499, 1983, pp. 130-144.

Wiedemeier, H., G. Pultz, U. Gaur, and B. Wunderlich. Heat Capacity Measurements of SnSe and SnSe_2 . Thermochim. Acta, v. 43, 1981, pp. 297-303.

 $\text{TlSe}(\text{c}, \text{l})$:

Mamedov, K. K., M. A. Aldzhanov, M. I. Mekhtiev, and I. G. Kerimov. Teploemkost Sulfida, Selenida i Tellurida Talliya pri Nizkikh Temperaturakh (Heat Capacity of Thallium Sulfide, Selenide, and Telluride at Low Temperatures). Inzh.-Fiz. Zh., v. 39, 1980, pp. 1005-1009.

Morgant, G., B. Legendre, and C. Souleau. Capacites Calorifiques des Compose TlSe et Tl_2Se Dans Les Etats Solide et Liquide (Molar Heat Capacities of TlSe and Tl_2Se in the Solid and Liquid State). Ann. Chim. Fr., v. 7, 1982, pp. 301-308.

$\text{Ag}_2\text{Se}(\text{c})$
Silver selenide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	19.480	35.890	0	-27.050	-23.010
300	19.510	36.010	.035	-27.046	-22.985
400	20.820	41.810	2.055	-26.747	-21.675
406	20.900	42.120	2.180	-26.727	-21.600
406	20.160	46.260	3.861	-25.046	-21.600
500	20.380	50.480	5.766	-24.787	-20.829
600	20.600	54.220	7.815	-24.513	-20.064
700*	20.830	57.410	9.886	-24.249	-19.341
800	21.060	60.210	11.981	-23.994	-18.660
900	21.280	62.700	14.097	-23.750	-18.010
1000	21.510	64.950	16.237	-23.512	-17.380

*Data extrapolated above 630 K.
406 K, transition point; $\Delta\text{H}^\circ = 1.681$

$\text{As}_2\text{Se}_3(\text{c,l})$
Diarsenic Triselenide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	29.050	46.500	0	-74.450	-57.197
300	29.077	46.680	.054	-74.445	-57.090
400	30.346	55.227	3.028	-74.164	-51.346
500	32.011	62.162	6.139	-73.791	-45.680
600	34.650	68.215	9.463	-73.237	-40.110
634	35.807	70.156	10.660	-72.988	-38.240
634	51.677	74.888	13.660	-69.988	-38.240
700	53.891	80.093	17.130	-68.365	-35.013
800	60.934	87.709	22.842	-65.471	-30.432

634 K, melting point; $\Delta\text{H}^\circ = 3.000$

$\text{CSe}(\text{g})$
Carbon monoselenide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	7.010	53.200	0	71.050	64.274
400	7.290	55.310	.730	71.026	61.959
600	7.620	58.330	2.223	70.815	57.464
800	7.870	60.550	3.772	70.472	53.071
1000	8.100	62.330	5.368	70.073	48.763
1200	8.310	63.330	7.009	69.660	44.536
1400	8.530	65.130	8.693	69.256	40.376
1600	8.740	66.280	10.420	68.872	36.280
1800	8.950	67.320	12.189	68.517	32.234
2000	9.160	68.280	14.001	68.195	28.205

$\text{CSe}_2(\text{g})$
Carbon diselenide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.960	62.900	0	28.400	27.408
400	12.860	66.560	1.272	28.411	27.068
600	13.580	71.940	3.927	28.353	26.399
800	13.920	75.900	6.680	28.205	25.772
1000	14.150	79.030	9.489	28.017	25.182
1200	14.340	81.630	12.339	27.823	24.635
1400	14.520	83.850	15.225	27.640	24.122
1600	14.680	85.800	18.144	27.481	23.625
1800	14.830	87.540	21.095	27.351	23.153
2000	14.980	89.110	24.076	27.255	22.685

$\text{CdSe}(\text{c})$
Cadmium monoselenide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.850	22.210	0	-51.250	-45.505
400*	12.080	25.730	1.220	-51.182	-43.554
600	12.530	30.710	3.681	-52.568	-39.743
800	12.970	34.380	6.231	-52.447	-35.487
1000	13.420	37.320	8.871	-52.229	-31.264
1200	13.870	39.810	11.599	-52.379	-23.475
1400	14.310	41.980	14.417	-74.535	-14.889

*Data above 298 K estimated.

$\text{Cu}_2\text{Se}(\text{c})$
Copper diselenide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	19.460	31.000	0	-32.250	-28.091
300	19.490	31.120	.036	-32.245	-28.065
395	21.200	36.720	1.971	-31.917	-26.785
395	19.950	40.840	3.599	-30.289	-26.785
400	19.940	41.090	3.699	-30.268	-26.744
500	19.890	45.530	5.691	-30.003	-25.894
600	19.840	49.160	7.678	-29.774	-25.098
700	19.790	52.210	9.660	-29.575	-24.330
800	19.740	54.850	11.636	-29.405	-23.592
900	19.690	57.170	13.608	-29.261	-22.873
1000	19.640	59.250	15.575	-29.146	-22.178

395.4 K, transition point; $\Delta\text{H}^\circ = 1.628$

EuSe(c)
Europium monoselenide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	11.680	25.430	0	-110.450	-103.810
400	11.980	28.910	1.200	-110.434	-101.550
600	12.470	33.860	3.650	-110.381	-97.113
800	12.930	37.510	6.190	-110.358	-92.690
1000	13.370	40.440	8.820	-110.422	-88.267
1200	13.820	42.920	11.540	-112.746	-83.601
1400	14.260	45.080	14.350	-112.738	-78.736
1600	14.700	47.010	17.240	-112.638	-73.887

*Entropy at 298 K estimated.

FeSe_{0.961}(c)
Iron selenide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	13.090	16.540	0	-32.001	-26.650
300	13.120	16.620	.024	-31.996	-26.617
400	14.220	20.570	1.397	-31.727	-24.867
500	15.010	23.830	2.860	-31.431	-23.185
600	15.670	26.620	4.395	-31.119	-21.561
700	16.260	29.080	5.992	-30.802	-19.991
731	16.440	29.790	6.495	-30.707	-19.520
731	14.110	32.920	8.786	-28.416	-19.520
800	13.910	34.190	9.755	-28.388	-18.600
900	14.540	35.850	11.169	-28.419	-17.461
1000	16.020	37.460	12.691	-28.513	-16.249

730.8 K, transition point; ΔH° = 2.291

FeSe_{1.143}(c)
Iron selenide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	15.140	20.950	0	-34.831	-29.216
300	15.180	21.040	.028	-34.824	-29.180
400	18.180	25.710	1.656	-34.391	-27.361
451	21.030	28.050	2.654	-34.027	-26.484
451	17.150	28.050	2.654	-34.027	-26.484
500	15.840	29.740	3.455	-33.850	-25.675
600	17.090	32.680	5.068	-33.552	-24.070
638	29.690	34.110	5.957	-33.178	-23.476
638	15.860	34.110	5.957	-33.178	-23.476
700	15.760	35.580	6.937	-33.055	-22.541
800	15.700	37.670	8.507	-32.926	-21.042
900	16.010	39.540	10.090	-32.879	-19.567
1000	16.550	41.250	11.716	-32.960	-18.085

451 K, transition point; ΔH° = 0

638 K, transition point; ΔH° = 0

FeSe_{1.333}(c)
Iron selenide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	17.530	22.290	0	-39.101	-32.234
300	17.610	22.400	.031	-39.093	-32.193
307	17.850	22.820	.159	-39.053	-32.032
307	16.060	22.820	.159	-39.053	-32.032
400	16.320	27.090	1.663	-38.750	-29.945
500	16.730	30.780	3.314	-38.454	-27.783
600	17.210	33.870	5.011	-38.168	-25.675
700	17.720	36.560	6.757	-37.890	-23.612
800	19.000	38.990	8.580	-37.604	-21.588
900	21.430	41.360	10.594	-37.221	-19.610
978	60.950	43.730	12.828	-36.365	-18.112
978	20.400	43.730	12.828	-36.365	-18.112
1000	20.690	44.180	13.280	-36.337	-17.695
1100	22.020	46.220	15.416	-36.196	-15.836

307 K, transition point; ΔH° = 0

978 K, transition point; ΔH° = 0

FeSe₂(c,l)
Iron diselenide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	16.870	19.950	0	-62.700	-49.352
300	16.888	20.054	.031	-62.698	-49.269
400	17.875	25.046	1.769	-62.581	-44.810
500	19.094	29.302	3.685	-62.355	-40.385
600	21.439	32.965	5.698	-62.090	-36.013
700	27.087	36.625	8.078	-61.515	-31.705
800	39.352	40.974	11.349	-60.117	-27.525
857	47.800	43.949	13.816	-58.748	-25.261
857	33.700	52.578	21.208	-51.356	-25.261
900	32.385	54.221	22.628	-50.804	-23.980
1000	44.216	57.861	26.092	-49.475	-21.066

856.7 K, peritectic decomposition point; ΔH° = 7.392

GaSe(c)
Gallium monoselenide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.590	16.800	0	-54.650	-48.073
400*	11.910	20.250	1.197	-55.967	-45.401
600	12.530	25.200	3.641	-55.815	-40.147
800	13.150	28.890	6.209	-55.527	-34.961
1000	13.770	31.890	8.901	-55.107	-29.867
1200	14.390	34.450	11.717	-54.552	-24.861

*Data above 298 K estimated.

$\text{Ga}_2\text{Se}_3(\text{c})$
Digallium triselenide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	27.790	43.000	0	-147.650	-128.623
400*	28.650	51.290	2.874	-150.309	-121.269
600	30.330	63.220	8.772	-150.006	-106.798
800	32.020	72.180	15.008	-149.339	-92.478
1000	33.710	79.500	21.581	-148.311	-78.376
1200	35.400	85.800	28.492	-146.913	-64.516

*Data above 298 K estimated.

$\text{GeSe}(\text{g})$
Germanium monoselenide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.380	59.200	0	8.550	1.791
400	8.590	61.700	.867	8.326	-.486
600	8.750	65.220	2.604	7.863	-4.788
800	8.810	67.750	4.360	7.389	-8.939
1000	8.840	69.710	6.124	6.884	-12.962
1200	8.860	71.330	7.894	6.328	-16.880
1400	8.870	72.690	9.668	-3.029	-19.305
1600	8.890	73.880	11.444	-3.542	-21.605
1800	8.900	74.930	13.223	-4.039	-23.830
2000	8.910	75.870	15.003	-4.522	-26.002

$\text{GeSe}_2(\text{c})$
Germanium diselenide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	17.010	26.900	0	-61.500	-49.953
300*	17.020	27.010	.031	-61.497	-49.884
400	17.680	31.990	1.766	-61.332	-46.036
500	18.340	36.010	3.568	-61.128	-42.233
600	19.010	39.410	5.435	-60.872	-38.474
700	19.670	42.390	7.369	-60.555	-34.767
800	20.330	45.060	9.370	-60.176	-31.104
900	21.000	47.500	11.436	-59.740	-27.502
1000	21.660	49.740	13.569	-59.248	-23.948

*Data above 298 K estimated.

$\text{H}_2\text{Se}(\text{g})$
Hydrogen selenide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.280	52.300	0	-9.650	-7.263
400	8.800	54.810	.872	-9.992	-6.393
600	9.600	58.540	2.714	-10.558	-4.470
800	10.340	61.400	4.709	-10.980	-2.366
1000	11.060	63.790	6.849	-11.271	-.186
1200	11.770	65.870	9.132	-11.441	2.051
1400	12.470	67.730	11.556	-11.498	4.314
1600	13.180	69.440	14.122	-11.445	6.572
1800	13.880	71.040	16.827	-11.280	8.805
2000	14.580	72.540	19.674	-10.997	11.017

$\text{HgSe}(\text{c})$
Mercury monoselenide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	12.800	24.100	0	-27.050	-20.151
300	12.810	24.180	.024	-27.047	-20.108
400	13.180	27.920	1.325	-26.905	-17.815
500	13.550	30.900	2.661	-26.725	-15.563
600*	13.920	33.410	4.035	-26.505	-13.355
700	14.290	35.580	5.445	-40.292	-9.606
800	14.660	37.510	6.893	-39.845	-5.249
900	15.030	39.260	8.377	-39.360	-.956
1000	15.400	40.860	9.899	-38.834	3.285

*Data extrapolated above 510 K.

$\text{InSe}(\text{c}, \text{l})$
Indium monoselenide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	12.020	19.500	0	-44.850	-37.867
400*	12.420	23.090	1.245	-44.788	-35.494
600	13.200	28.270	3.807	-45.421	-30.562
800	13.980	32.180	6.525	-45.110	-25.653
933	14.500	34.360	8.420	-44.807	-22.434
933	14.500	43.260	16.720	-36.507	-22.434
1000	14.500	44.270	17.691	-36.337	-21.439
1200	14.500	46.910	20.591	-35.818	-18.501

*Data above 298 K estimated.

933 K, melting point; $\Delta\text{H}^\circ = 8.300$

$\text{In}_2\text{Se(g)}$
Diindium selenide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.596	79.669	0	21.850	15.014
400	13.730	83.686	1.393	21.385	12.745
600	13.829	89.276	4.150	18.760	9.273
800	13.864	93.259	6.920	17.725	6.271
1000	13.881	96.355	9.695	16.716	3.522
1200	98.887	98.887	12.472	15.722	.978
1400	13.895	101.028	15.251	14.742	-1.399
1600	13.899	102.884	18.030	13.773	-3.642
1800	13.901	104.521	20.810	12.816	-5.760
2000	13.903	105.986	23.590	11.873	-7.779

$\text{La}_2\text{Se}_3(\text{c})$
Dilanthanum triselenide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	30.010	48.330	0	-272.950	-253.221
400*	30.410	57.210	3.077	-272.721	-246.525
600	31.190	69.680	9.237	-272.395	-233.506
800	31.970	78.760	15.553	-271.878	-220.614
1000	32.750	85.980	22.025	-271.437	-207.852
1200	33.530	92.020	28.653	-275.646	-195.053
1400	34.310	97.250	35.437	-275.082	-181.681
1600	35.090	101.880	42.377	-274.326	-168.373
1800	35.870	106.060	49.473	-273.378	-155.199

*Data above 298 K estimated.

MnSe(c)
Manganese monoselenide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.200	21.700	0	-57.650	-53.163
400*	12.360	25.310	1.251	-57.569	-51.646
600	12.690	30.380	3.756	-57.514	-48.697
800	13.010	34.080	6.325	-57.554	-45.762
1000	13.330	37.010	8.959	-58.184	-42.789
1200	13.650	39.470	11.657	-58.298	-39.698
1400	13.970	41.600	14.420	-58.923	-36.572
1600	14.300	43.490	17.247	-62.580	-33.124

*Data above 298 K estimated.

$\text{NiSe}_{1.05}(\text{c})$
Nickel selenide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	12.640	17.980	0	-35.382	-29.504
300	12.650	18.050	.020	-35.384	-29.469
400	13.190	21.770	1.320	-35.258	-27.511
500	13.640	24.770	2.660	-35.158	-25.593
600	14.110	27.290	4.050	-35.080	-23.683
700	14.650	29.510	5.480	-34.979	-21.795
800	15.300	31.510	6.980	-34.745	-19.926
900	15.950	33.340	8.540	-34.460	-18.087
1000	16.880	35.070	10.180	-34.106	-16.293

$\text{NiSe}_{1.14}(\text{c})$
Nickel selenide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.130	18.450	0	-37.981	-31.462
300	13.150	18.530	.020	-37.983	-31.426
400	14.030	22.440	1.390	-37.832	-29.253
500	21.730	25.810	2.900	-37.607	-27.137
503	23.540	25.900	3.000	-37.547	-27.019
600	14.950	28.650	4.450	-37.415	-25.073
700	15.420	30.980	5.970	-37.269	-23.011
800	15.980	33.080	7.540	-37.010	-20.996
900	16.690	34.990	9.170	-36.701	-19.006
1000	17.530	36.800	10.880	-36.322	-17.073

503 K, transition point; $\Delta H^\circ = 0$

$\text{NiSe}_{1.25}(\text{c})$
Nickel selenide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	13.590	19.140	0	-40.612	-33.345
300	13.600	19.220	.030	-40.606	-33.294
400	14.460	23.270	1.430	-40.480	-30.888
500	15.180	26.560	2.910	-40.340	-28.502
589	18.880	29.270	4.400	-40.103	-26.399
600	16.140	29.580	4.570	-40.094	-26.158
700	16.420	32.080	6.190	-39.903	-23.844
800	16.970	34.310	7.860	-39.600	-21.572
900	17.880	36.350	9.600	-39.235	-19.334
995	18.930	38.220	11.360	-38.792	-17.271
1000	18.760	38.310	11.460	-38.762	-17.153

589 K, transition point; $\Delta H^\circ = 0$ 995 K, transition point; $\Delta H^\circ = 0$

NiSe₂(c)
Nickel diselenide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	18.028	24.740	0	-53.300	-41.125
300	18.047	24.852	.033	-53.297	-41.121
400	18.929	30.168	1.883	-53.094	-37.093
500	19.458	34.451	3.804	-52.891	-33.117
600	19.900	38.037	5.772	-52.716	-29.182
700	20.282	41.135	7.782	-52.514	-25.267
800	20.538	43.860	9.823	-52.218	-21.394
900	21.006	46.302	11.897	-51.896	-17.563
1000	22.077	48.564	14.045	-51.509	-13.773

PbSe(c,l)
Lead monoselenide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	12.000	24.500	0	-41.250	-35.260
400	12.419	28.097	1.248	-41.164	-33.226
600	12.912	33.229	3.782	-40.997	-29.299
800	13.443	37.013	6.416	-41.969	-25.035
1000	14.106	40.082	9.168	-41.637	-20.844
1200	14.923	42.723	12.069	-41.116	-16.723
1359	15.689	44.626	14.500	-40.555	-13.537
1359	45.494	51.050	23.230	-31.825	-13.537
1400	41.455	52.342	25.013	-30.522	-13.004

1359 K, melting point; ΔH° = 8.730

PbSe(g)
Lead monoselenide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.660	63.000	0	13.550	8.061
400	8.780	65.570	.890	13.278	6.226
600	8.870	69.150	2.657	12.678	2.823
800	8.900	71.710	4.435	10.850	.026
1000	8.920	73.700	6.216	10.212	-2.613
1200	8.920	75.320	8.000	9.616	-5.108
1400	8.930	76.700	9.785	9.050	-7.533
1600	8.930	77.890	11.571	8.500	-9.884
1800	8.930	78.940	13.357	7.962	-12.118
2000	8.930	79.880	15.144	7.437	-14.323

SiSe(g)
Silicon monoselenide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.030	56.200	0	31.850	25.112
400	8.390	58.620	.840	31.667	22.836
600	8.650	62.080	2.548	31.248	18.507
800	8.750	64.590	4.289	30.784	14.328
1000	8.810	66.550	6.046	30.292	10.276
1200	8.850	68.160	7.813	29.786	6.314
1400	8.880	69.520	9.586	29.273	2.456
1600	8.910	70.710	11.366	28.754	-1.358
1800	8.940	71.760	13.151	16.225	-4.250
2000	8.960	72.710	14.942	15.853	-6.527

SnSe(g)
Tin monoselenide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.580	60.800	0	13.650	7.847
400	8.740	63.350	.884	13.348	5.910
600	8.840	66.920	2.644	11.014	2.649
800	8.880	69.470	4.417	10.414	-.044
1000	8.900	71.450	6.195	9.830	-2.590
1200	8.910	73.080	7.976	9.261	-5.027
1400	8.910	74.450	9.758	8.702	-7.358
1600	8.920	75.640	11.542	8.159	-9.618
1800	8.920	76.690	13.326	7.626	-11.803
2000	8.920	77.630	15.110	7.107	-13.939

SnSe₂(c)
Tin diselenide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	17.840	26.700	0	-61.300	-48.260
300	17.860	26.810	.030	-61.300	-48.182
400	18.350	32.020	1.840	-61.152	-43.834
500	18.730	36.160	3.700	-61.011	-39.517
600	19.060	39.600	5.590	-62.506	-34.916
700	19.370	42.560	7.510	-62.280	-30.333

TlSe(c,l)
Thallium monoselenide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	11.930	27.560	0	-31.300	-26.267
300	11.940	27.634	.020	-31.301	-26.238
400	12.150	31.105	1.230	-31.229	-24.560
465	12.170	32.937	2.020	-31.201	-23.478
465	12.300	33.066	2.080	-31.141	-23.478
500	12.300	33.959	2.510	-31.130	-22.902
600	12.300	36.202	3.740	-32.240	-21.198
619	12.300	36.586	3.975	-32.236	-20.848
619	18.820	45.100	9.245	-26.966	-20.848
700	18.820	47.414	10.770	-26.425	-20.075
800	18.820	49.927	12.650	-25.759	-19.221

465 K, transition point; ΔH° = 0.060

619 K, melting point; ΔH° = 5.270

Silicates

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

Sources of data from general references are listed below, with the reference(s) given immediately after each formula:

$BaSiO_3(c)$ (26), $Ba_2SiO_4(c)$ (26), $Be_2SiO_4(c)$ (7), $Fe_2SiO_4(c,l)$ (31), $K_2SiO_3(c)$ (4), $MgSiO_3(c,l)$ (7, 26), $Mg_2SiO_4(c)$ (7, 26), $Na_2SiO_3(c,l)$ (7, 33), $Na_2Si_2O_4(c,l)$ (7, 33), $Ni_2SiO_4(c)$ (22), $ZrSiO_4(c)$ (7, 32).

Additional sources:

Al_2SiO_5 (kyanite), Al_2SiO_5 (andalusite), and Al_2SiO_5 (sillimanite):

Haas, J. L., Jr., G. R. Robinson, Jr., and B. S. Hemmingway. Thermodynamic Tabulations for Selected Phases in the System $CaO-Al_2O_3-SiO_2-H_2O$ at 101.325 kPa (1 atm) Between 273.15 and 1800 K. J. Phys. and Chem. Ref. Data, v. 10, 1981, pp. 575-669.

$BaSiO_3(c)$ and $Ba_2SiO_4(c)$:

Fegley, B., Jr. (MA Inst. Tech., Cambridge, MA). Private communication, 1981; available upon request from L. B. Pankratz, BuMines, Albany, OR.

Weller, W. W., and K. K. Kelley. Low-Temperature Heat Capacities and Entropies at 298.16° K of Crystalline Silicates of Barium and Strontium. BuMines RI 6556, 1964, 8 pp.

$CaSiO_3$ (wollastonite):

Southard, J. C. A Modified Calorimeter for High Temperatures. The Heat Content of Silica, Wollastonite, and Thorium Dioxide Above 25°. J. Am. Chem. Soc., v. 63, 1941, pp. 3142-3146.

Torgeson, D. R., and Th. G. Sahama. A Hydrofluoric Acid Solution Calorimeter and the Determination of the Heats of Formation of Mg_2SiO_4 , $MgSiO_3$, and $CaSiO_3$. J. Am. Chem. Soc., v. 70, 1948, pp. 2156-2160.

Wagner, H. Zur Thermochemie der Metasilikate des Calciums und Magnesiums und des Diopsids (Thermochemistry of the Metasilicates of Calcium and Magnesium and of Diopside). Z. Anorg. und Allg. Chem., v. 208, 1932, pp. 1-12.

$CaSiO_3$ (pseudowollastonite):

Haas, J. L., Jr., G. R. Robinson, Jr., and B. S. Hemmingway. Thermodynamic Tabulations for Selected Phases in the System $CaO-Al_2O_3-SiO_2-H_2O$ at 101.325 kPa (1 atm) Between 273.15 and 1800 K. J. Phys. and Chem. Ref. Data, v. 10, 1981, pp. 575-669.

$Fe_2SiO_4(c,l)$:

Orr, R. L. High-Temperature Heat Contents of Magnesium Orthosilicate and Ferrous Orthosilicate. J. Am. Chem. Soc., v. 75, 1953, pp. 528-529.

Robie, R. A., C. B. Finch, and B. S. Hemmingway. Heat Capacity and Entropy of Fayalite (Fe_2SiO_4) Between 5.1 and 383 K: Comparison of Calorimetric and Equilibrium Values for the QFM Buffer Reaction. Am. Mineral., v. 67, 1982, pp. 463-469.

$K_2SiO_3(c)$ and $K_2Si_2O_5(c,l)$:

Beyer, R. P., M. J. Ferrante, and G. E. Daut. Thermodynamic Properties of Potassium Metasilicate and Disilicate. BuMines RI 8410, 1980, 21 pp.

$Li_2SiO_3(c)$ and $Li_2Si_2O_5(c)$:

Bennington, K. O., M. J. Ferrante, and J. M. Stuve. Thermodynamic Properties of Two Lithium Silicates, Li_2SiO_3 and $Li_2Si_2O_5$. BuMines RI 8187, 1976, 19 pp.

$MnSiO_3(c)$:

Kelley, K. K. The Specific Heats at Low Temperatures of Ferrous Silicate, Manganous Silicate, and Zirconium Silicate. J. Am. Chem. Soc., v. 63, 1941, pp. 2750-2752.

King, E. G. Heats of Formation of Manganous Metasilicate (Rhodonite) and Ferrous Orthosilicate (Fayalite). J. Am. Chem. Soc., v. 74, 1952, pp. 4446-4448.

Southard, J. G., and G. E. Moore. High-Temperature Heat Contents of Manganese Teroxide, Manganese Silicate, and Manganese Carbide. J. Am. Chem. Soc., v. 64, 1942, pp. 1769-1770.

$SrSiO_3(c)$ and $Sr_2SiO_4(c)$:

Fegley, B., Jr. (MA Inst. Tech., Cambridge, MA). Private communication, 1981; available upon request from L. B. Pankratz, BuMines, Albany, OR.

$\text{Al}_2\text{SiO}_5(\text{c})$
Aluminum silicate, kyanite

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	29.242	20.188	0	-620.000	-584.110
400	35.339	29.706	3.314	-620.227	-571.804
600	41.899	45.435	11.116	-619.808	-547.648
800	45.309	58.003	19.871	-618.992	-523.714
1000	47.241	68.341	29.143	-623.290	-499.618
1200	48.343	77.061	38.712	-622.256	-474.986
1400	48.923	84.562	48.446	-621.164	-450.523
1600	49.149	91.113	58.258	-620.087	-426.237

$\text{Al}_2\text{SiO}_5(\text{c})$
Aluminum silicate, andalusite

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	29.157	22.413	0	-619.100	-583.873
400	35.294	31.909	3.307	-619.334	-571.792
600	41.506	47.578	11.077	-618.947	-548.073
800	44.249	59.941	19.685	-618.277	-524.550
1000	45.824	69.994	28.702	-622.831	-500.812
1200	47.240	78.472	38.005	-622.063	-476.486
1400	49.011	85.880	47.621	-621.089	-452.294
1600	51.425	92.574	57.653	-619.792	-428.279
1800	54.661	98.809	68.246	-630.017	-403.602

$\text{Al}_2\text{SiO}_5(\text{c})$
Aluminum silicate, sillimanite

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	29.764	22.966	0	-618.500	-583.438
400	35.289	32.550	3.335	-618.706	-571.420
600	41.324	48.141	11.067	-618.357	-547.821
800	44.556	60.515	19.684	-617.678	-524.410
1000	46.474	70.681	28.803	-622.130	-500.798
1200	47.653	79.267	38.225	-621.243	-476.620
1400	48.367	86.671	47.833	-620.277	-452.589
1600	48.767	93.159	57.551	-619.294	-428.717
1800	48.943	98.915	67.326	-630.337	-404.113

$\text{BaSiO}_3(\text{c})$
Barium metasilicate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	21.462	26.200	0	-388.050	-368.156
400*	24.430	32.975	2.355	-388.033	-361.365
600	27.103	43.456	7.543	-388.215	-348.007
800	28.655	51.479	13.128	-388.112	-334.627
1000	29.883	58.008	18.985	-387.915	-321.266
1200	30.983	63.555	25.073	-389.501	-307.599
1400	32.022	68.410	31.374	-389.029	-293.982
1600	33.030	72.752	37.879	-388.415	-280.457
1800	34.019	76.699	44.584	-399.662	-266.169
2000	34.996	80.334	51.486	-398.609	-251.397

*Data above 298 K estimated.

$\text{Ba}_2\text{SiO}_4(\text{c})$
Barium orthosilicate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	32.229	42.100	0	-546.800	-519.893
400*	36.583	52.258	3.531	-546.707	-510.721
600	40.489	67.933	11.289	-547.085	-492.684
800	42.742	79.908	19.625	-546.939	-474.585
1000	44.518	89.642	28.356	-546.640	-456.518
1200	46.106	97.900	37.420	-549.957	-437.798
1400	47.604	105.121	46.792	-549.214	-419.158
1600	49.056	111.573	56.459	-548.252	-400.654
1800	50.480	117.433	66.412	-559.076	-381.436
2000	51.887	122.825	76.649	-557.525	-361.787

*Data above 298 K estimated.

$\text{Be}_2\text{SiO}_4(\text{c})$
Beryllium orthosilicate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	22.840	15.342	0	-506.000	-478.657
400*	28.860	22.946	2.651	-506.197	-469.279
600	35.650	36.054	9.162	-505.868	-450.860
800	39.680	46.920	16.735	-504.989	-432.653
1000	41.600	56.005	24.885	-503.879	-414.684
1200	42.590	63.683	33.312	-502.797	-396.965
1400	43.240	70.300	41.897	-501.827	-379.389
1600	43.702	76.104	50.592	-507.999	-361.785
1800	44.156	81.277	59.378	-518.926	-342.765

*Data above 298 K estimated.

$\text{CaSiO}_3(\text{c})$
Calcium metasilicate, wollastonite

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	20.380	19.600	0	-390.760	-370.382
400	23.747	26.120	2.268	-390.720	-363.422
600	27.043	36.457	7.389	-390.272	-349.857
800	28.679	44.486	12.978	-389.942	-336.442
1000	29.618	50.994	18.815	-389.572	-323.111
1200	30.398	56.462	24.815	-391.197	-309.692
1400	31.462	61.221	30.993	-390.306	-296.172

$\text{CaSiO}_3(\text{c})$
Calcium metasilicate, pseudowollastonite

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	20.901	20.852	0	-389.000	-368.995
400	23.491	27.384	2.271	-388.957	-362.164
600	26.474	37.535	7.298	-388.603	-348.835
800	28.236	45.411	12.781	-388.379	-335.619
1000	29.427	51.847	18.555	-388.072	-322.464
1200	30.297	57.293	24.531	-389.720	-309.214
1400	30.965	62.015	30.660	-388.879	-295.856
1600	31.497	66.186	36.908	-387.982	-282.650
1800	31.931	69.922	43.252	-435.590	-267.765

$\text{Ca}_2\text{SiO}_4(\text{c})$
Calcium orthosilicate

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	30.310	28.850	0	-554.000	-526.111
400	33.745	38.255	3.269	-553.947	-516.585
600	38.045	52.819	10.481	-553.479	-497.994
800	41.099	64.200	18.408	-553.296	-479.536
1000	43.546	73.643	26.881	-552.869	-461.152
1121	44.803	78.682	32.219	-556.855	-450.034
1121	43.986	81.753	35.662	-553.412	-450.034
1200	44.956	84.789	39.184	-552.847	-442.775
1400	47.404	91.903	48.420	-551.158	-424.552
1600	49.851	98.392	58.146	-549.057	-406.631
1712	51.223	101.813	63.809	-559.759	-396.484
1712	48.908	103.794	67.200	-556.368	-396.484
1800	48.908	106.243	71.500	-628.480	-386.432

1121 K, transition point; $\Delta \text{H}^\circ = 3.443$

1712 K, transition point; $\Delta \text{H}^\circ = 3.391$

$\text{Fe}_2\text{SiO}_4(\text{c,l})$
Iron silicate, fayalite

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	31.525	36.090	0	-353.700	-330.009
400	36.150	46.100	3.480	-353.456	-321.949
600	40.369	61.658	11.183	-352.681	-306.356
800	42.956	73.643	19.528	-352.004	-291.024
1000	45.070	83.461	28.335	-351.923	-275.804
1200	46.999	91.850	37.543	-352.476	-260.525
1400	48.840	99.234	47.128	-350.960	-245.313
1490	49.651	102.302	51.560	-350.238	-238.556
1490	57.300	117.188	73.740	-328.058	-238.556
1600	57.300	121.269	80.043	-326.354	-232.010
1800	57.300	128.018	91.503	-336.045	-219.517
2000	57.300	134.055	102.963	-340.379	-206.017

1490 K, melting point; $\Delta \text{H}^\circ = 22.180$

$\text{K}_2\text{SiO}_3(\text{c})$
Potassium metasilicate

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	28.100	34.930	0	-370.000	-347.939
400	30.970	43.620	3.020	-371.234	-340.171
600	34.480	56.890	9.589	-370.951	-324.675
800	37.220	67.200	16.765	-370.191	-309.360
1000	39.750	75.780	24.465	-369.066	-294.267
1200	42.180	83.240	32.655	-404.956	-273.793

$\text{K}_2\text{Si}_2\text{O}_5(\text{c,l})$
Potassium disilicate

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	38.407	45.550	0	-599.400	-564.553
400	43.800	57.700	4.223	-600.671	-552.411
510	46.900	68.730	9.225	-600.519	-539.149
510	47.920	69.300	9.515	-600.229	-539.149
600	50.130	77.260	13.930	-599.853	-528.397
800	54.760	92.320	24.420	-598.551	-504.760
867	56.270	96.790	28.140	-597.972	-496.932
867	54.510	97.230	28.520	-597.592	-496.932
1000	54.650	105.000	35.780	-596.655	-481.526
1200	54.860	115.000	46.730	-632.753	-453.005
1318	54.980	120.100	53.210	-631.506	-435.331
1318	65.800	126.500	61.630	-623.086	-435.331
1400	65.800	130.500	67.030	-621.353	-423.736
1600	65.800	139.300	80.190	-617.212	-395.840

510 K, transition point; $\Delta \text{H}^\circ = 0.290$

867 K, transition point; $\Delta \text{H}^\circ = 0.380$

1318 K, melting point; $\Delta \text{H}^\circ = 8.420$

$\text{Li}_2\text{SiO}_3(\text{c})$
Lithium metasilicate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	23.880	19.080	0	-393.800	-372.084
400	28.560	26.830	2.697	-393.967	-364.634
600	33.240	39.410	8.932	-395.341	-349.497
800	35.920	49.360	15.865	-394.753	-334.292
1000	37.800	57.590	23.250	-393.839	-319.266
1200	39.270	64.620	30.960	-392.693	-304.471
1400	40.410	70.760	38.935	-391.346	-289.861

$\text{Li}_2\text{Si}_2\text{O}_5(\text{c})$
Lithium disilicate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	34.590	29.200	0	-611.800	-577.149
400	41.230	40.370	3.890	-612.013	-565.268
600	48.570	58.630	12.945	-613.172	-541.457
800	52.760	73.230	23.115	-612.117	-517.697
1000	55.540	85.320	33.960	-610.633	-494.240
1200	57.880	95.650	45.300	-608.825	-471.141
1215	58.060	96.370	46.170	-608.675	-469.421
1215	59.500	96.580	46.425	-608.420	-469.421

1215 K, transition point; $\Delta\text{H}^\circ = 0.255$

$\text{MgSiO}_3(\text{c,l})$
Magnesium metasilicate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	19.581	16.197	0	-370.220	-349.463
400	22.513	22.404	2.158	-370.284	-342.359
600	25.573	32.170	6.996	-370.098	-328.424
800	27.672	39.825	12.328	-369.741	-314.585
903	28.630	43.234	15.228	-369.512	-307.492
903	28.762	43.411	15.388	-369.352	-307.492
1000	28.762	46.346	18.178	-371.269	-300.680
1200	28.762	51.590	23.931	-370.957	-286.607
1258	28.762	52.947	25.599	-370.897	-282.519
1258	29.262	53.257	25.989	-370.507	-282.519
1400	29.262	56.387	30.144	-400.465	-271.795
1600	29.262	60.294	35.996	-399.559	-253.491
1800*	29.262	63.741	41.849	-410.711	-234.446
1850	29.262	64.543	43.312	-410.471	-229.554
1850	35.000	74.273	61.312	-392.471	-229.554
2000	35.000	77.002	66.562	-390.902	-216.413

*Data above 1600 K estimated.

903 K, transition point; $\Delta\text{H}^\circ = 0.160$

1258 K, transition point; $\Delta\text{H}^\circ = 0.390$

1850 K, melting point; $\Delta\text{H}^\circ = 18.000$

$\text{Mg}_2\text{SiO}_4(\text{c})$
Magnesium orthosilicate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	28.367	22.739	0	-519.600	-491.159
400	32.877	31.769	3.141	-519.663	-481.427
600	37.388	46.062	10.221	-519.283	-462.372
800	39.929	57.192	17.971	-518.713	-443.491
1000	41.732	66.305	26.145	-522.405	-424.390
1200	43.180	74.045	34.641	-521.824	-404.859
1400	44.430	80.797	43.404	-581.476	-383.783
1600	45.559	86.805	52.405	-579.288	-355.706
1800	46.608	92.232	61.622	-588.954	-327.058
2000	47.601	97.194	71.044	-586.326	-298.102

$\text{MnSiO}_3(\text{c})$
Manganese metasilicate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	20.709	21.300	0	-315.700	-296.512
400	24.130	27.927	2.305	-315.660	-289.960
600	27.093	38.356	7.470	-315.282	-277.182
800	28.642	46.380	13.055	-314.857	-264.553
1000	29.707	52.891	18.895	-314.988	-252.004
1200	30.516	58.382	24.921	-314.595	-239.451
1400	31.148	63.136	31.090	-314.721	-226.936
1600	31.636	67.328	37.370	-317.908	-214.179
1800	31.997	71.077	43.736	-329.754	-200.377

$\text{Na}_2\text{SiO}_3(\text{c,l})$
Sodium metasilicate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	26.740	27.210	0	-371.630	-349.151
400	30.540	35.640	2.931	-373.012	-341.353
600	35.161	48.979	9.542	-372.672	-325.560
800	38.181	59.531	16.892	-371.684	-309.993
1000	40.493	68.308	24.768	-370.277	-294.716
1200	42.433	75.867	33.065	-415.066	-278.857
1362	43.835	81.325	40.054	-412.828	-260.600
1362	42.380	90.415	52.434	-400.448	-260.600
1400	42.380	91.581	54.045	-399.959	-256.704
1600	42.380	97.240	62.521	-397.422	-236.429
1800	42.380	102.232	70.997	-406.946	-215.619
2000	42.380	106.697	79.473	-404.368	-194.503

1362 K, melting point; $\Delta\text{H}^\circ = 12.380$

$\text{Na}_2\text{Si}_2\text{O}_5(\text{c,l})$
Sodium disilicate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	37.520	39.210	0	-589.220	-554.367
400	43.834	51.149	4.154	-590.617	-542.334
600	52.002	70.643	13.825	-589.821	-518.307
800	56.205	86.246	24.692	-588.088	-494.714
951	57.986	96.123	33.321	-586.505	-477.212
951	58.000	96.228	33.421	-586.405	-477.212
980	58.000	97.970	35.103	-586.090	-473.886
980	70.000	98.123	35.253	-585.940	-473.886
1000	70.000	99.537	36.653	-585.486	-471.604
1147	70.000	109.136	46.943	-582.213	-455.102
1147	62.430	116.547	55.443	-573.713	-455.102
1200	62.430	119.367	58.752	-619.440	-448.734
1400	62.430	128.991	71.238	-615.854	-420.558
1600	62.430	137.327	83.724	-612.386	-392.926
1800	62.430	144.680	96.210	-633.027	-364.022
2000	62.430	151.258	108.696	-629.451	-334.337

951 K, transition point; ΔH° = 0.100

980 K, transition point; ΔH° = 0.150

1147 K, melting point; ΔH° = 8.500

$\text{Ni}_2\text{SiO}_4(\text{c})$
Nickel silicate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	30.470	25.600	0	-336.000	-308.812
400	36.220	35.370	3.400	-335.890	-299.534
600	43.330	51.610	11.460	-334.904	-281.550
800	45.670	64.470	20.410	-333.372	-263.972
1000	46.350	74.740	29.620	-331.712	-246.812
1200	47.330	83.270	38.970	-330.165	-229.982
1400	49.360	90.700	48.620	-328.562	-213.404
1600	52.520	97.490	58.790	-326.691	-197.094
1800	56.870	103.910	69.710	-344.526	-179.837

$\text{SrSiO}_3(\text{c})$
Strontium metasilicate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	20.984	23.100	0	-390.400	-370.302
400*	24.223	29.780	2.323	-390.349	-363.441
600	27.005	40.207	7.485	-389.975	-350.062
800	28.515	48.197	13.047	-389.612	-336.816
1000	29.656	54.686	18.867	-389.478	-323.604
1200	30.652	60.183	24.900	-390.921	-310.182
1400	31.580	64.978	31.124	-390.263	-296.772
1600	32.472	69.254	37.529	-389.490	-283.483
1800	33.342	73.129	44.111	-432.832	-266.582
2000	34.199	76.686	50.865	-430.990	-248.213

*Data above 298 K estimated.

$\text{Sr}_2\text{SiO}_4(\text{c})$
Strontium orthosilicate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	32.082	36.600	0	-550.800	-523.695
400*	36.979	46.805	3.549	-550.555	-514.466
600	41.102	62.701	11.417	-549.659	-496.608
800	43.271	74.844	19.870	-548.832	-479.056
1000	44.874	84.678	28.690	-548.496	-461.604
1200	46.255	92.984	37.805	-551.364	-443.726
1400	47.530	100.211	47.184	-550.092	-425.883
1600	48.750	106.638	56.813	-548.648	-408.248
1800	49.937	112.448	66.682	-623.500	-384.226
2000	51.103	117.770	76.786	-620.206	-357.822

*Data above 298 K estimated.

$\text{ZrSiO}_4(\text{c})$
Zirconium metasilicate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	23.580	20.083	0	-486.000	-458.646
400	27.400	27.576	2.607	-486.006	-449.294
600	31.950	39.657	8.596	-485.466	-431.033
800	34.100	49.173	15.222	-484.636	-413.012
1000*	35.200	56.910	22.161	-483.756	-395.198
1200	35.780	63.387	29.267	-483.772	-377.523
1400	35.950	68.917	36.443	-482.732	-359.895
1600	36.000	73.723	43.641	-481.813	-342.426
1800	36.000	77.963	50.841	-493.028	-324.213

*Data above 940 K estimated.

Silicides

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

Sources of data from general references are listed below, with the reference given immediately after each formula:

CoSi(c,l) (31), $\text{CoSi}_2(\text{c,l})$ (31), FeSi(c,l) (16, 31), $\text{FeSi}_2(\text{c})$ (16, 31), $\text{Fe}_3\text{Si(c)}$ (16, 31), MnSi(c,l) (1), $\text{MnSi}_{1.7}(\text{c})$ (1), $\text{Mn}_2\text{Si(c)}$ (1), $\text{Mn}_3\text{Si}_3(\text{c,l})$ (1), $\text{MoSi}_2(\text{c})$ (2), $\text{Mo}_3\text{Si(c)}$ (2), $\text{Mo}_5\text{Si}_3(\text{c})$ (2), NiSi(c,l) (22), $\text{Ni}_{1.04}\text{Si}_{1.93}(\text{c})$ (22), $\text{Ni}_2\text{Si(c,l)}$ (22), $\text{TaSi}_2(\text{c})$ (1).

Additional sources:

CoSi(c,l) :

Kalishevich, G. I., P. V. Gel'd, and R. P. Krentsis. Thermal Capacity, Enthalpy and Entropy of Cobalt Monosilicide. High Temp. (Engl. Transl.), v. 2, 1964, pp. 11-14.

$\text{CoSi}_2(\text{c,l})$:

Kalishevich, G. I., P. V. Gel'd, and R. P. Krentsis. Heat Capacities of the Higher Silicides of Vanadium, Cobalt, and Nickel Between 60° and 300° K. Russ. J. Phys. Chem. (Engl. Transl.), v. 42, 1968, pp. 675-676.

CrSi(c) :

Eremenko, V. N., G. M. Lukashenko, and V. R. Sidorko. Thermodynamic Properties of Vanadium, Chromium, and Manganese Silicides at Elevated Temperatures. Rev. Int. Hautes Temp. et Refract., v. 12, 1975, pp. 237-240.

Kalishevich, G. I., P. V. Gel'd, and R. P. Krentsis. Standard Heat Capacities and Enthalpies of Silicon, Chromium, and Chromium Silicides. Russ. J. Phys. Chem. (Engl. Transl.), v. 39, 1965, pp. 1602-1603.

_____. Heat Capacities of the Higher Silicides of Vanadium, Cobalt, and Nickel Between 60° and 300° K. Russ. J. Phys. Chem. (Engl. Transl.), v. 42, 1968, pp. 675-676.

$\text{CrSi}_2(\text{c,l})$:

Eremenko, V. N., G. M. Lukashenko, and V. R. Sidorko. Thermodynamic Properties of Vanadium, Chromium, and Manganese Silicides at Elevated Temperatures. Rev. Int. Hautes Temp. et Refract., v. 12, 1975, pp. 237-240.

Kalishevich, G. I., P. V. Gel'd, and R. P. Krentsis. Specific Heat, Enthalpy, and Entropy of Cr_5Si_3 and CrSi_2 . High Temp. (Engl. Transl.), v. 4, 1966, pp. 613-618.

$\text{Cr}_3\text{Si(c)}$:

Eremenko, V. N., G. M. Lukashenko, and V. R. Sidorko. Thermodynamic Properties of Vanadium, Chromium, and Manganese Silicides at Elevated Temperatures. Rev. Int. Hautes Temp. et Refract., v. 12, 1975, pp. 237-240.

Golutvin, Y. M., and C. K. Liang. (Heats of Formation, Heat Contents, and Heat Capacities of Chromium Silicides.) Zh. Fiz. Khim., v. 35, 1961, pp. 129-141.

Surikov, V. I., G. I. Kalishevich, and P. V. Gel'd. Thermodynamic Characteristics of Trichromium Silicide, Trichromium Germanide, Trivanadium Silicide, and Trivanadium Germanide. *Russ. J. Phys. Chem.* (Engl. transl.), v. 49, 1975, pp. 326-327.

$\text{Cr}_5\text{Si}_3(\text{c,l})$:

Eremenko, V. N., G. M. Lukashenko, and V. R. Sidorko. Thermodynamic Properties of Vanadium, Chromium, and Manganese Silicides at Elevated Temperatures. *Rev. Int. Hautes Temp. et Refract.*, v. 12, 1975, pp. 237-240.

Kalishevich, G. I., P. V. Gel'd, and R. P. Krentsis. Specific Heat, Enthalpy, and Entropy of Cr_5Si_3 and CrSi_2 . *High Temp.* (Engl. transl.), v. 4, 1966, pp. 613-618.

$\text{FeSi}(\text{c,l})$, $\text{FeSi}_2(\text{c})$, and $\text{Fe}_3\text{Si}(\text{c})$:

Hultgren, R., P. D. Desai, D. T. Hawkins, M. Gleiser, and K. K. Kelley. Selected Values of the Thermodynamic Properties of Binary Alloys. ASM, 1973, 1435 pp.

$\text{U}_3\text{Si}(\text{c})$:

Flotow, H. E., D. W. Osborne, W. G. Lyon, F. Grandjean, D. R. Fredrickson, and I. J. Hastings. Heat Capacity and Thermodynamic Properties of Triuranium Silicide From 1 to 1203 K. *J. Chem. Thermodyn.*, v. 9, 1977, pp. 475-481.

O'Hare, P. A. G., M. Ader, W. N. Hubbard, G. K. Johnson, and J. L. Settle. Calorimetric Studies on Actinide Compounds and Materials of Interest in Reactor Technology. *Thermodynamics of Nuclear Materials* 1974. *Int. At. Energy Agency*, v. 2, 1975, pp. 439-453.

$\text{VSi}_2(\text{c,l})$:

Bondarenko, V. P., I. A. Dvorina, V. I. Zmii, E. N. Fomichev, N. P. Slyusar, and A. D. Krivorotenko. (Enthalpy and Heat Capacity of Titanium and Vanadium Silicides.) *Poroshk. Metall.*, v. 11, 1973, pp. 47-49.

Freund, P. F., and K. E. Spear. Assessment of the Thermodynamic Properties of Vanadium Silicides Utilizing Ternary Phase Equilibria. *J. Less-Common Met.*, v. 60, 1978, pp. 185-193.

Kalishevich, G. I., P. V. Gel'd, and R. P. Krentsis. Heat Capacities of the Higher Silicides of Vanadium, Cobalt, and Nickel Between 60° and 300° K. *Russ. J. Phys. Chem.* (Engl. transl.), v. 42, 1968, pp. 675-676.

Kalishevich, G. I., P. V. Gel'd, and Yu. V. Putintsev. High Temperature Changes in the Enthalpy of the Higher Vanadium, Cobalt, and Nickel Silicides. *High Temp.* (Engl. transl.), v. 6, 1968, pp. 959-962.

$\text{V}_3\text{Si}(\text{c})$:

Freund, P. F., and K. E. Spear. Assessment of the Thermodynamic Properties of Vanadium Silicides Utilizing Ternary Phase Equilibria. *J. Less-Common Met.*, v. 60, 1978, pp. 185-193.

Pankratz, L. B., and K. K. Kelley. High-Temperature Heat Content and Entropy Data for Vanadium Silicide. *BuMines RI 6241*, 1963, 5 pp.

Surikov, V. I., G. I. Kalishevich, and P. V. Gel'd. Thermodynamic Characteristics of Trichromium Silicide, Trichromium Germanide, Trivanadium Silicide, and Trivanadium Germanide. *Russ. J. Phys. Chem.* (Engl. transl.), v. 49, 1975, pp. 326-327.

CoSi(c,l)
Cobalt monosilicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.600	10.300	0	-24.000	-23.589
400	11.780	13.610	1.150	-23.991	-23.455
600	12.660	18.580	3.610	-23.996	-23.180
800	13.180	22.290	6.190	-24.200	-22.880
1000	13.740	25.290	8.880	-24.412	-22.532
1200	14.450	27.860	11.700	-24.781	-22.129
1400	15.330	30.140	14.670	-25.444	-21.636
1600	16.390	32.260	17.840	-25.525	-21.109
1738	17.250	33.650	20.160	-37.435	-20.348
1738	20.000	43.250	36.850	-20.745	-20.348
1800	20.000	43.950	38.090	-24.223	-20.261
2000	20.000	46.060	42.090	-23.746	-19.858

1738 K, melting point; ΔH° = 16.69

CoSi₂(c,l)
Cobalt disilicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.420	10.230	0	-24.600	-22.826
400	11.281	13.426	1.110	-25.147	-22.145
600	12.269	18.202	3.472	-26.368	-20.381
800	13.013	21.836	6.002	-27.818	-18.167
1000	13.686	24.813	8.673	-29.297	-15.580
1200	14.331	27.365	11.475	-30.965	-12.695
1400	14.964	29.622	14.405	-32.975	-9.500
1600	15.589	31.661	17.460	-34.502	-6.072
1600	18.500	41.630	33.410	-18.552	-6.072
1800	18.500	43.809	37.110	-47.157	-2.729

1600 K, melting point; ΔH° = 15.95

CrSi(c)
Chromium monosilicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.780	10.760	0	-13.800	-13.982
400	12.080	14.150	1.180	-13.727	-14.055
600	13.110	19.270	3.710	-13.595	-14.249
800	13.700	23.130	6.400	-13.500	-14.476
1000	14.170	26.240	9.180	-13.450	-14.730
1200	14.580	28.860	12.060	-13.461	-14.985
1400	14.970	31.140	15.020	-13.588	-15.240
1600	15.350	33.160	18.050	-13.827	-15.459

CrSi₂(c,l)
Chromium disilicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	15.200	13.300	0	-23.300	-22.897
400	16.650	17.980	1.630	-23.293	-22.761
600	18.310	25.080	5.140	-23.299	-22.495
800	19.580	30.520	8.930	-23.300	-22.220
1000	20.810	35.020	12.960	-23.248	-21.948
1200	22.090	38.930	17.250	-23.130	-21.714
1400	23.460	42.430	21.810	-22.964	-21.480
1600	24.930	45.660	26.640	-22.734	-21.310
1730	25.930	47.650	29.950	-46.636	-20.546
1730	20.300	65.340	60.560	-16.026	-20.546
1800	20.300	66.140	61.980	-16.216	-20.698

1730 K, melting point; ΔH° = 30.61

Cr₃Si(c)
Trichromium silicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	21.580	20.700	0	-30.000	-29.776
300	21.630	20.830	0.040	-29.999	-29.777
400	23.810	27.370	2.320	-29.969	-29.705
500	25.480	32.870	4.790	-29.911	-29.636
600	26.950	37.650	7.410	-29.837	-29.591
700	28.330	41.910	10.170	-29.729	-29.561
800	29.650	45.780	13.070	-29.570	-29.546
900	30.950	49.340	16.100	-29.350	-29.548
1000	32.220	52.670	19.260	-29.074	-29.584

Cr₅Si₃(c,l)
Pentachromium trisilicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	44.080	43.500	0	-61.000	-61.522
400	48.470	57.140	4.740	-60.763	-61.743
600	53.080	77.770	14.950	-60.307	-62.317
800	55.660	93.430	25.840	-60.000	-63.040
1000	57.720	106.070	37.180	-59.814	-63.804
1200	60.360	116.810	48.970	-59.917	-64.597
1400	64.620	126.410	61.430	-60.278	-65.416
1600	71.500	135.450	74.990	-60.401	-66.113
1800	82.000	144.440	90.270	-95.732	-64.358
1920	90.440	149.990	100.600	-94.304	-62.324
1920	120.000	181.600	161.300	-33.604	-62.324
2000	120.000	186.500	170.900	-30.067	-63.587

1920 K, melting point; ΔH° = 60.70

FeSi(c,l)
Iron monosilicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.794	10.680	0	-17.600	-17.499
400	11.324	13.926	1.126	-17.627	-17.464
600	12.364	18.714	3.496	-17.794	-17.349
800	13.404	22.414	6.072	-18.074	-17.162
1000	14.444	25.516	8.856	-18.636	-16.872
1200	15.484	28.244	11.850	-19.476	-16.445
1400	16.524	30.706	15.050	-19.244	-15.948
1600	17.564	32.980	18.460	-18.907	-15.510
1683	17.996	33.680	19.934	-18.951	-15.318
1683	20.000	43.886	36.774	-2.111	-15.318
1800	20.000	45.230	39.114	-13.737	-15.436

1683 K, melting point; ΔH° = 16.84

FeSi₂(c)
Iron disilicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	15.330	13.260	0	-19.400	-18.726
400	16.050	17.880	1.596	-19.473	-18.499
600	17.430	24.630	4.944	-19.780	-17.940
800	18.840	29.820	8.571	-20.205	-17.250
1000	20.220	34.170	12.474	-20.896	-16.426
1200	21.630	37.980	16.656	-21.829	-15.457

Fe₃Si(c)
Triiron silicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	23.480	24.760	0	-22.400	-22.609
400	25.320	31.920	2.484	-22.343	-22.694
600	29.360	42.920	7.944	-22.258	-22.877
800	36.540	52.000	14.280	-22.098	-23.104
1000	35.200	60.240	21.632	-22.288	-23.408
1200	41.480	67.160	29.264	-23.596	-23.464

MnSi(c,l)
Manganese monosilicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.977	11.100	0	-14.480	-14.167
400	12.053	14.493	1.179	-14.481	-14.062
600	13.195	19.618	3.715	-14.503	-13.848
800	13.992	23.527	6.436	-14.578	-13.624
1000	14.689	26.725	9.305	-15.219	-13.354
1200	15.347	29.461	12.309	-15.317	-12.978
1400	15.986	31.875	15.442	-15.899	-12.560
1548	16.452	33.505	17.843	-19.425	-12.092
1548	18.815	42.676	32.039	-5.229	-12.092
1600	18.815	43.298	33.017	-5.171	-12.320
1800	18.815	45.514	36.780	-16.965	-12.382
2000	18.815	47.496	40.543	-16.622	-11.894

1548 K, melting point; ΔH° = 14.196

MnSi_{1.7}(c)
Manganese silicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	14.007	13.425	0	-18.070	-17.511
400	15.680	17.809	1.523	-18.088	-17.321
600	16.985	24.457	4.812	-18.140	-16.927
800	17.585	29.434	8.274	-18.311	-16.505
1000	17.982	33.403	11.833	-19.136	-15.997
1200	18.298	36.710	15.462	-19.505	-15.340
1400	18.576	39.552	19.149	-20.448	-14.598

Mn₃Si(c)
Trimanganese silicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	23.865	24.770	0	-19.020	-18.221
300	23.936	24.918	.044	-19.021	-18.216
400	26.891	32.244	2.598	-18.930	-17.964
500	28.927	38.473	5.393	-18.775	-17.732
600	30.602	43.899	8.371	-18.595	-17.544
700	32.106	48.730	11.508	-18.395	-17.394
800	33.519	53.111	14.790	-18.172	-17.269
900	34.879	57.137	18.210	-17.922	-17.172
1000	36.206	60.881	21.764	-19.232	-17.063

$Mn_5Si_3(c,l)$
Pentamanganese trisilicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	46.715	57.100	0	-48.000	-49.595
400	50.376	71.390	4.962	-47.906	-50.166
600	54.592	92.679	15.492	-47.930	-51.295
800	57.750	108.828	26.734	-48.276	-52.394
1000	60.603	122.025	38.572	-51.492	-53.267
1200	63.335	133.316	50.967	-52.045	-53.612
1400	66.010	143.281	63.902	-55.071	-53.728
1573	68.299	151.103	75.520	-72.998	-52.630
1573	77.591	177.359	116.820	-31.698	-52.630
1600	77.591	178.680	118.915	-31.631	-52.991
1800	77.591	187.818	134.433	-67.184	-53.140
2000	77.591	195.993	149.951	-66.326	-51.632

1573 K, melting point; ΔH° = 41.30

$MoSi_2(c)$
Molybdenum disilicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	15.300	15.540	0	-31.400	-31.308
400	16.376	20.204	1.619	-31.411	-31.279
600	17.493	27.077	5.017	-31.481	-31.200
800	18.255	32.217	8.594	-31.582	-31.088
1000	18.914	36.363	12.312	-31.689	-30.936
1200	19.533	39.866	16.157	-31.788	-30.792
1400	20.133	42.923	20.124	-31.881	-30.611
1600	20.723	45.650	24.210	-31.972	-30.450
1800	21.307	48.124	28.413	-56.078	-28.581
2000	21.888	50.399	32.733	-55.889	-25.547

$Mo_3Si(c)$
Trimolybdenum silicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	22.227	25.160	0	-28.300	-28.333
400	22.741	31.763	2.290	-28.320	-28.346
600	23.799	41.182	6.944	-28.480	-28.326
800	24.874	48.176	11.811	-28.667	-28.244
1000	25.954	53.842	16.893	-28.820	-28.114
1200	27.036	58.770	22.192	-28.948	-27.966
1400	28.119	62.919	27.708	-29.077	-27.788
1600	29.202	66.744	33.440	-29.221	-27.607
1800	30.286	70.246	39.389	-41.414	-26.557
2000	31.370	73.493	45.554	-41.542	-24.908

$Mo_5Si_3(c)$
Pentamolybdenum trisilicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	43.098	49.680	0	-74.200	-74.775
400	45.384	62.695	4.517	-74.221	-74.977
600	48.053	81.642	13.881	-74.371	-75.326
800	50.075	95.750	23.699	-74.571	-75.607
1000	51.910	107.123	33.899	-74.760	-75.823
1200	53.671	116.744	44.458	-74.954	-76.039
1400	55.398	125.148	55.365	-75.198	-76.189
1600	57.106	132.657	66.616	-75.515	-76.350
1800	58.803	139.481	78.207	-111.970	-73.920
2000	60.493	145.764	90.136	-112.156	-69.704

$NiSi(c,l)$
Nickel monosilicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.700	11.200	0	-20.600	-20.469
400	11.800	14.500	1.200	-20.580	-20.368
600	12.800	19.500	3.600	-20.790	-20.316
800	13.200	23.200	6.200	-20.921	-20.097
1000	13.500	26.200	8.900	-20.979	-19.869
1200	13.800	28.700	11.600	-21.134	-19.682
1265	13.900	29.400	12.500	-21.183	-19.566
1265	19.100	37.700	23.000	-10.683	-19.566
1400	19.100	39.700	25.600	-10.091	-20.605

1265 K, melting point; ΔH° = 10.50

$Ni_{1.04}Si_{1.93}(s)$
Nickel silicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	15.650	15.620	0	-21.400	-21.254
400	17.240	20.480	1.690	-21.396	-21.207
600	18.440	27.730	5.270	-21.526	-21.103
800	19.370	33.160	9.050	-21.651	-20.928
1000	20.320	37.590	13.020	-21.660	-20.737
1200	21.160	41.370	17.170	-21.619	-20.564

$\text{Ni}_2\text{Si}(\text{c,l})$
Dinickel silicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	16.970	18.300	0	-33.600	-33.457
400	17.950	23.470	1.790	-33.654	-33.410
600	18.410	30.830	5.430	-34.116	-33.210
800	19.500	36.260	9.210	-34.602	-32.810
1000	21.110	40.770	13.260	-34.820	-32.330
1200	23.130	44.790	17.680	-34.829	-31.817
1400	26.020	48.560	22.570	-34.546	-31.340
1490	27.900	50.230	24.990	-34.263	-31.149
1490	26.200	51.430	26.780	-32.473	-31.149
1560	26.200	52.640	28.610	-32.334	-31.095
1560	27.700	59.430	39.210	-21.734	-31.095
1600	27.700	60.130	40.320	-21.601	-31.329
1800	27.700	63.390	45.860	-41.276	-31.394

1490 K, transition point; ΔH° = 1.79

1560 K, melting point; ΔH° = 10.60

$\text{TaSi}_2(\text{c})$
Tantalum disilicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	15.624	13.470	0	-28.470	-26.845
400	16.895	18.262	1.664	-28.465	-26.295
600	18.015	25.355	5.170	-28.450	-25.212
800	18.647	30.629	8.840	-28.450	-24.130
1000	19.138	34.845	12.620	-28.468	-23.032
1200	19.573	38.373	16.491	-28.485	-21.961
1400	19.981	41.421	20.447	-28.497	-20.864
1600	20.376	44.115	24.483	-28.512	-19.800
1800	20.762	46.537	28.597	-52.537	-17.037
2000	21.144	48.744	32.787	-52.254	-13.120

$\text{U}_3\text{Si}(\text{c})$
Triuranium silicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	25.790	41.590	0	-24.900	-25.225
400	27.630	49.430	2.722	-24.788	-25.357
600	30.860	61.260	8.574	-24.653	-25.683
800	33.990	70.550	15.059	-24.827	-25.997
1000	37.070	78.470	22.164	-27.322	-26.098
1038	37.640	79.870	23.583	-27.312	-26.054
1038	37.310	80.810	24.563	-26.332	-26.054
1200	37.310	86.230	30.609	-29.221	-25.574

1038 K, transition point; ΔH° = 0.98

$\text{VSi}_2(\text{c,l})$
Vanadium disilicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	15.480	14.100	0	-28.900	-28.359
400	17.100	18.910	1.671	-28.885	-28.180
600	18.303	26.113	5.232	-28.846	-27.836
800	18.906	31.465	8.956	-28.855	-27.497
1000	19.436	35.741	12.790	-28.921	-27.134
1200	20.026	39.335	16.735	-29.015	-26.784
1400	20.718	42.473	20.807	-29.123	-26.397
1600	21.533	45.291	25.030	-29.227	-26.029
1800	22.480	47.881	29.429	-53.311	-23.951
1950	23.278	49.711	32.860	-53.115	-21.522
1950	46.000	68.532	69.560	-16.415	-21.522
2000	46.000	69.696	71.860	-15.210	-21.668

1950 K, melting point; ΔH° = 36.70

$\text{V}_3\text{Si}(\text{c})$
Trivanadium silicide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	21.720	24.400	0	-39.600	-39.348
400	23.091	31.005	2.293	-39.695	-39.249
560	23.855	38.921	6.060	-39.888	-39.038
560	24.419	39.010	6.110	-39.838	-39.038
600	24.613	40.701	7.091	-39.873	-38.979
800	25.586	47.915	12.111	-40.072	-38.653
1000	26.559	53.729	17.325	-40.318	-38.263
1200	27.532	58.658	22.734	-40.621	-37.832
1400	28.505	62.975	28.338	-41.022	-37.333

560 K, transition point; ΔH° = 0.05

Sulfates

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

All formation reactions for sulfates use $S_2(g)$.

Sources of data: $Cs_2SO_4(c,l)$ and $Cs_2SO_4(g)$ (11), $K_2SO_4(c,l)$, $K_2SO_4(g)$, $Na_2SO_4(c,l)$, and $Na_2SO_4(g)$ (3), $Li_2SO_4(c,l)$ and $Li_2SO_4(g)$ (9).

Data for all other sulfates were from

DeKock, C. W. Thermodynamic Properties of Selected Transition Metal Sulfates and Their Hydrates. BuMines IC 8910, 1982, 45 pp.

$\text{CoSO}_4 \cdot \text{H}_2\text{O}(\text{c})$
Cobalt sulfate monohydrate

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	34.004	42.000	0	-302.155	-258.580
300	34.170	42.211	.063	-302.155	-258.308
400	43.165	53.273	3.930	-301.771	-243.734
500	52.159	63.871	8.696	-300.599	-229.338

*Data except enthalpy of formation and entropy at 298 K estimated.

$\text{CoSO}_4(\text{c})$
Cobalt sulfate

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.670	28.060	0	-227.655	-196.533
400*	28.625	35.921	2.734	-227.398	-185.937
600	32.466	48.344	8.888	-226.400	-165.400
800	34.861	58.028	15.632	-225.262	-145.234
964	36.500	64.679	21.485	-224.156	-128.945
964	36.495	65.213	22.000	-223.641	-128.945
1000	36.837	66.557	23.320	-223.394	-125.413
1200	38.653	73.436	30.871	-222.023	-105.938
1400	40.388	79.525	38.776	-220.798	-86.703

*Data above 298 K estimated except temperature and enthalpy of transition.

964 K, transition point; $\Delta H^\circ = 0.515$

$\text{CoSO}_4 \cdot 6\text{H}_2\text{O}(\text{c})$
Cobalt sulfate hexahydrate

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	84.340	87.863	0	-656.685	-543.735
300	84.759	88.386	.173	-656.690	-543.033
337*	92.978	98.715	3.446	-656.607	-529.016
400	106.274	115.769	9.727	-655.846	-505.224
500	125.572	141.598	21.337	-653.154	-467.839

*Data above 300 K estimated except temperature of dissociation.

337 K, dissociates to $\text{CoSO}_4 \cdot \text{H}_2\text{O}(\text{c})$ and saturated solution.

$\text{CoSO}_4 \cdot 7\text{H}_2\text{O}(\text{c})$
Cobalt sulfate heptahydrate

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	93.483	97.048	0	-727.455	-600.633
300	93.924	97.628	.173	-727.463	-599.846
318*	98.144	103.156	1.881	-727.477	-592.281
400	117.421	127.880	10.745	-726.667	-557.372
500	140.331	156.554	23.638	-723.755	-515.336

*Data above 300 K estimated except dissociation temperature.

317.78 K, dissociates to $\text{CoSO}_4 \cdot 6\text{H}_2\text{O}(\text{c})$ and saturated solution.

$\text{Cr}_2(\text{SO}_4)_3(\text{c})$
Chromium sulfate(c)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	67.250	61.850	0	-751.065	-654.095
300*	67.458	62.267	.125	-751.059	-653.493
400	77.864	83.137	7.404	-750.399	-621.051
500	86.643	101.485	15.643	-749.031	-588.852
600	93.796	117.939	24.679	-747.112	-556.986
700	99.322	132.834	34.348	-744.777	-525.476
800	103.222	146.369	44.489	-742.154	-494.329
900	105.495	158.674	54.938	-739.370	-463.517

*Data above 298 K estimated.

$\text{Cr}_2(\text{SO}_4)_3 \cdot 8\text{H}_2\text{O}(\text{c})$
Chromium sulfate octahydrate

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	141.000	138.000	0	-1348.565	-1141.421
300	141.536	138.874	.261	-1348.579	-1140.136
400	170.536	183.563	15.865	-1347.986	-1070.674
500	199.536	224.732	34.369	-1344.869	-1001.647

*Data except enthalpy of formation at 298 K estimated.

$\text{Cr}_2(\text{SO}_4)_3 \cdot 14\text{H}_2\text{O}(\text{c})$
Chromium sulfate hydrate

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	197.000	195.000	0	-1778.065	-1488.257
300	197.925	196.221	.365	-1778.092	-1486.459
400	247.925	260.009	22.658	-1777.104	-1389.269
500	297.925	320.703	49.950	-1771.586	-1292.850

*Data except enthalpy of formation at 298 K estimated.

$\text{Cr}_2(\text{SO}_4)_3 \cdot 15\text{H}_2\text{O}(\text{c})$
Chromium sulfate hydrate

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	206.000	204.000	0	-1848.165	-1544.430
300	206.999	205.277	.382	-1848.194	-1542.546
400	260.999	272.223	23.782	-1847.149	-1440.683
500	314.999	336.264	52.582	-1841.186	-1339.648

*Data except enthalpy of formation at 298 K estimated.

$\text{Cr}_2(\text{SO}_4)_3 \cdot 16\text{H}_2\text{O}(\text{c})$
Chromium sulfate hydrate

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	216.000	214.000	0	-1917.365	-1600.002
300	217.073	215.339	.401	-1917.395	-1598.033
400	275.073	285.731	25.008	-1916.191	-1491.612
500	333.073	353.342	55.415	-1909.687	-1386.104

*Data except enthalpy of formation at 298 K estimated.

$\text{Cr}_2(\text{SO}_4)_3 \cdot 17\text{H}_2\text{O}(\text{c})$
Chromium sulfate hydrate

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	225.000	233.000	0	-1986.765	-1658.457
300	226.128	234.395	.417	-1986.798	-1656.421
400	287.129	307.803	26.080	-1985.588	-1546.320
500	348.129	378.426	57.843	-1978.791	-1437.168

*Data except enthalpy of formation at 298 K estimated.

$\text{Cs}_2\text{SO}_4(\text{c}, \text{l})$
Cesium sulfate

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	32.300	50.640	0	-360.155	-325.760
400	36.160	60.688	3.492	-361.067	-313.687
600	42.260	76.520	11.342	-360.008	-290.182
800	50.780	89.758	20.587	-357.741	-267.207
940	56.527	98.373	28.076	-355.227	-251.585
940	44.190	99.469	29.106	-354.197	-251.585
1000	46.410	102.271	31.824	-385.790	-243.424
1200	53.810	111.387	41.846	-382.026	-215.279
1278	56.700	114.865	46.156	-380.180	-204.497
1278	49.400	121.540	54.686	-371.650	-204.497
1400*	49.400	126.044	60.713	-369.502	-188.641
1600	49.400	132.640	70.593	-366.036	-163.041
1800	49.400	138.459	80.473	-362.642	-137.869
2000	49.400	143.664	90.353	-359.326	-113.076

*Data extrapolated above 1300 K.

940 K, transition point; $\Delta \text{H}^\circ = 1.030$

1278 K, melting point; $\Delta \text{H}^\circ = 8.530$

$\text{Cs}_2\text{SO}_4(\text{g})$
Cesium sulfate (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	26.307	97.126	0	-283.655	-263.119
400	29.410	105.316	2.846	-285.213	-255.684
600	33.029	118.013	9.134	-285.716	-240.785
800	34.818	127.789	15.938	-285.891	-225.781
1000	35.781	135.672	23.007	-318.107	-209.142
1200	36.346	142.250	30.225	-317.147	-187.435
1400	36.702	147.881	37.532	-316.184	-165.893
1600	36.940	152.799	44.890	-315.231	-144.490
1800	37.107	157.160	52.303	-314.311	-123.201
2000	37.227	161.076	59.737	-313.441	-102.016

$\text{CuO} \cdot \text{CuSO}_4(\text{c})$
Copper oxysulfate

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	33.450	40.358	0	-234.455	-197.110
400	38.092	50.876	3.657	-234.222	-184.378
600	43.701	67.511	11.900	-233.007	-159.689
800	46.539	80.513	20.953	-231.340	-135.495
1000	48.744	91.127	30.474	-229.483	-111.745
1200	52.455	100.303	40.551	-227.336	-88.387

$\text{CuSO}_4(\text{c})$
Copper sulfate

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	23.632	26.173	0	-199.655	-167.749
300	23.710	26.319	.044	-199.655	-167.550
400	27.580	33.718	2.625	-199.487	-156.866
500	30.290	40.180	5.526	-199.074	-146.254
600	32.300	45.889	8.660	-198.499	-135.741
700	33.890	50.991	11.972	-197.813	-125.334
800	35.270	55.609	15.431	-197.036	-115.034
900	36.530	59.036	19.022	-196.176	-104.834
1000	37.700	63.747	22.734	-195.238	-94.736
1100	38.730	67.390	26.558	-194.232	-84.731

$\text{CuSO}_4 \cdot \text{H}_2\text{O}(\text{c})$
Copper sulfate monohydrate

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	32.013	34.900	0	-274.875	-228.961
300*	32.180	35.099	.059	-274.879	-228.676
400	41.176	45.588	3.727	-274.673	-213.283
500	50.172	55.743	8.295	-273.658	-198.036

*Data above 298 K estimated.

$\text{CuSO}_4 \cdot 3\text{H}_2\text{O}(\text{c})$
Copper sulfate trihydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	49.000	52.900	0	-417.915	-344.148
300*	49.244	53.204	.091	-417.926	-343.690
400	62.443	69.178	5.675	-417.902	-318.915
500	75.641	84.530	12.579	-416.680	-294.285

*Data above 298 K estimated.

$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}(\text{c})$
Copper sulfate pentahydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	67.027	71.800	0	-560.225	-458.873
300*	67.360	72.216	.124	-560.242	-458.245
400	85.348	94.057	7.760	-560.264	-424.195
500	103.336	115.035	17.194	-558.641	-390.332

*Data above 298 K estimated.

$\text{Cu}_2\text{SO}_4(\text{c})$
Dicopper sulfate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	31.000	43.600	0	-194.955	-165.882
300	31.068	43.792	.057	-194.953	-165.701
400	34.613	53.222	3.344	-194.673	-155.986
500	37.872	61.301	6.970	-194.146	-146.371
600	40.846	68.473	10.909	-193.394	-136.881
700	43.535	74.975	15.130	-192.437	-127.535

*Data except enthalpy of formation at 298 K estimated.

$\text{FeSO}_4(\text{c})$
Iron sulfate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	24.040	28.909	0	-238.155	-207.483
400	27.880	36.535	2.652	-237.992	-197.023
600	32.990	48.904	8.788	-237.085	-176.710
800	35.710	58.808	15.687	-235.864	-156.768
1000	37.160	66.943	22.983	-234.831	-137.126
1200	38.200	73.813	30.523	-234.117	-117.644
1400	39.040	79.767	38.250	-232.404	-98.367
1600	39.780	85.029	46.133	-230.684	-79.337
1800	40.460	89.754	54.157	-229.269	-60.500
2000	41.100	94.050	62.313	-231.146	-41.484

*Data 295 - 800 K and above 1100 K extrapolated.

$\text{FeSO}_4 \cdot \text{H}_2\text{O}(\text{c})$
Iron sulfate monohydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	33.346	37.700	0	-312.755	-268.094
300	33.513	37.907	.062	-312.756	-267.816
400	42.517	48.781	3.863	-312.449	-252.862
500	51.521	59.236	8.565	-311.370	-238.074

*Data except enthalpy of formation and entropy at 298 K estimated.

$\text{FeSO}_4 \cdot 4\text{H}_2\text{O}(\text{c})$
Iron sulfate tetrahydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	65.924	67.500	0	-524.855	-439.250
300*	66.190	67.909	.122	-524.855	-438.719
400	80.590	88.922	7.461	-524.157	-410.076
500	94.990	108.452	16.240	-522.193	-381.756

*Data above 298 K estimated.

$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}(\text{c})$
Iron sulfate heptahydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	94.313	97.800	0	-735.795	-609.394
300*	94.784	98.385	.175	-735.801	-608.610
400	119.049	129.032	10.886	-734.878	-566.290
500	140.964	157.995	23.906	-731.867	-524.451

*Data above 298 K estimated.

$\text{Fe}_2(\text{SO}_4)_3(\text{c})$
Diiron trisulfate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	64.950	67.550	0	-663.165	-567.376
300	65.207	67.953	.120	-663.166	-566.780
400	76.317	88.369	7.243	-662.752	-534.693
500	84.277	106.287	15.288	-661.697	-502.787
600	90.928	122.255	24.056	-660.206	-471.138
700	96.850	136.724	33.450	-658.361	-439.766
800	102.282	150.015	43.410	-656.226	-408.687
900	102.720	162.742	54.184	-653.579	-377.939

$K_2SO_4(c,l)$
Potassium sulfate

T	C_p°	S°	$H^\circ-H_{298}^\circ$	ΔH_f°	ΔG_f°
298	31.386	41.956	0	-358.975	-324.920
400	35.289	51.743	3.402	-360.079	-313.070
600	41.235	67.205	11.060	-359.160	-289.718
800	47.710	79.966	19.971	-357.132	-266.847
857	49.515	83.312	22.742	-356.345	-260.441
857	43.977	85.669	24.762	-354.325	-260.441
1000	46.750	92.663	31.249	-352.885	-244.886
1200	50.640	101.531	40.988	-387.686	-217.859
1342	53.390	107.346	48.375	-384.791	-197.925
1342	48.150	113.471	56.595	-376.571	-197.925
1400	48.150	115.509	59.387	-375.626	-190.224
1600*	48.150	121.938	69.017	-372.408	-163.960
1800	48.150	127.609	78.647	-369.251	-138.093
2000	48.150	132.682	88.277	-366.161	-112.576

*Data above 1500 K extrapolated.

857 K, transition point; $\Delta H^\circ = 2.020$

1342 K, melting point; $\Delta H^\circ = 8.220$

$K_2SO_4(g)$
Potassium sulfate (ideal gas)

T	C_p°	S°	$H^\circ-H_{298}^\circ$	ΔH_f°	ΔG_f°
298	25.987	87.486	0	-276.855	-256.375
400	29.240	95.607	2.822	-278.539	-249.075
600	32.960	108.259	9.088	-279.021	-234.211
800	34.781	118.019	15.882	-279.100	-219.258
1000	35.758	125.896	22.946	-279.068	-204.301
1200	36.330	132.470	30.159	-316.396	-183.695
1400	36.691	138.099	37.464	-315.430	-161.653
1600	36.932	143.015	44.828	-314.477	-139.752
1800	37.100	147.376	52.232	-313.547	-117.968
2000	37.222	151.291	59.665	-312.654	-96.285

$Li_2SO_4(c,l)$
Lithium sulfate

T	C_p°	S°	$H^\circ-H_{298}^\circ$	ΔH_f°	ΔG_f°
298	28.109	27.234	0	-358.655	-325.281
400	33.280	36.252	3.138	-358.633	-313.874
600	40.215	51.099	10.509	-359.333	-291.146
800	46.520	63.531	19.181	-357.464	-268.673
848	48.454	66.296	21.459	-356.837	-263.363
848	51.000	74.315	28.259	-350.037	-263.363
1000	51.000	82.724	36.011	-347.561	-248.038
1132	51.000	89.047	42.743	-345.455	-235.033
1132	49.000	90.858	44.793	-343.405	-235.033
1200	49.000	93.717	48.125	-342.471	-228.552
1400	49.000	101.270	57.925	-339.767	-209.781
1600*	49.000	107.813	67.725	-337.116	-191.393
1800	49.000	113.584	77.525	-404.247	-166.402
2000	49.000	118.747	87.325	-400.979	-140.151

*Data above 1500 K extrapolated.

848 K, transition point; $\Delta H^\circ = 6.800$

1132 K, melting point; $\Delta H^\circ = 2.050$

$Li_2SO_4(g)$
Lithium sulfate (ideal gas)

T	C_p°	S°	$H^\circ-H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	24.332	77.130	0	-264.355	-245.857
400	28.128	84.847	2.684	-264.787	-239.466
600	32.363	97.161	8.787	-266.755	-226.206
800	34.416	106.785	15.487	-266.858	-212.670
1000	35.514	114.595	22.491	-266.781	-199.130
1200	36.156	121.131	29.663	-266.634	-185.611
1400	36.561	126.737	36.938	-266.453	-172.121
1600	36.831	131.638	44.279	-266.262	-158.659
1800	37.020	135.988	51.665	-335.808	-138.289
2000	37.157	139.896	59.083	-334.922	-116.391

*Data except enthalpy of formation at 298 K estimated.

$MnSO_4(c)$
Manganese sulfate

T	C_p°	S°	$H^\circ-H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.020	26.790	0	-270.055	-238.414
300	24.110	26.939	.045	-270.055	-238.217
400	28.019	34.470	2.671	-269.900	-227.623
500	30.643	41.018	5.611	-269.534	-217.089
600	32.674	46.791	8.780	-269.040	-206.646
700	34.313	51.956	12.133	-268.456	-196.295
800	35.642	56.627	15.633	-267.806	-186.032
900	36.702	60.889	19.252	-267.104	-175.853
1000	37.512	64.800	22.965	-266.901	-165.743
1100	38.085	68.404	26.747	-266.150	-155.653

$\text{MnSO}_4 \cdot \text{H}_2\text{O}(\alpha, c)$
 α -Manganese sulfate monohydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	33.000	35.000	0	-344.455	-298.652
300	33.167	35.205	.061	-344.458	-298.368
400	42.168	45.979	3.828	-344.212	-283.021
500	51.169	56.355	8.495	-343.183	-267.823

*Data except enthalpy of formation at 298 K estimated.

$\text{MnSO}_4 \cdot 4\text{H}_2\text{O}(c)$
Manganese sulfate tetrahydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	61.000	65.000	0	-555.155	-468.468
300	61.266	65.378	.113	-555.165	-467.929
400	75.668	84.976	6.960	-554.985	-438.843
500	90.069	103.408	15.247	-553.529	-409.947

*Data except enthalpy of formation at 298 K estimated.

$\text{MnSO}_4 \cdot 5\text{H}_2\text{O}(c)$
Manganese sulfate pentahydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	78.000	75.000	0	-625.655	-525.339
300	78.333	75.484	.145	-625.652	-524.716
400	96.332	100.484	8.878	-624.635	-491.180
500	114.331	123.913	19.411	-621.998	-458.085

*Data except enthalpy of formation and heat capacity at 298 K estimated.

$\text{MnSO}_4 \cdot 7\text{H}_2\text{O}(c)$
Manganese sulfate heptahydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	91.000	94.000	0	-765.755	-637.885
300	91.444	94.564	.169	-765.768	-637.091
400	115.442	124.158	10.513	-765.238	-594.218
500	139.441	152.496	23.257	-762.518	-551.730

*Data except enthalpy of formation at 298 K estimated.

$\text{Na}_2\text{SO}_4(c, l)$
Sodium sulfate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	30.627	35.754	0	-347.051	-313.031
400	34.680	45.340	3.332	-348.283	-301.309
458	36.647	50.169	5.402	-348.158	-294.503
458	36.647	50.302	5.463	-348.097	-294.503
514	38.411	54.630	7.565	-347.879	-287.962
514	40.806	59.726	10.185	-345.259	-287.962
600	41.905	66.121	13.734	-344.615	-278.433
800	44.760	78.556	22.392	-342.777	-256.639
1000	47.875	88.880	31.657	-340.437	-235.365
1157	50.279	96.033	39.370	-338.259	-219.012
1157	47.092	100.960	45.070	-332.559	-219.012
1200	47.092	102.678	47.088	-378.552	-213.903
1400	47.092	109.938	56.506	-375.474	-186.705
1600	47.092	116.226	65.925	-372.464	-159.946
1800	47.092	121.773	75.343	-369.516	-133.558
2000	47.092	126.734	84.761	-366.626	-107.495

458 K, transition point; ΔH° = 0.061

514 K, transition point; ΔH° = 2.620

1157 K, melting point; ΔH° = 5.700

$\text{Na}_2\text{SO}_4(g)$
Sodium sulfate (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	25.244	82.874	0	-262.395	-242.423
400	28.769	90.818	2.762	-264.197	-235.414
600	32.726	103.332	8.961	-264.732	-220.876
800	34.644	113.040	15.720	-264.792	-206.242
1000	35.668	120.891	22.760	-264.678	-191.617
1200	36.267	127.452	29.959	-311.025	-176.105
1400	36.644	133.073	37.253	-310.070	-153.690
1600	36.896	137.893	44.608	-309.125	-131.274
1800	37.071	142.340	52.006	-308.197	-109.260
2000	37.198	146.252	59.433	-307.297	-87.203

$\text{NiSO}_4(c)$
Nickel sulfate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	23.330	24.210	0	-224.065	-191.807
400	27.510	31.710	2.610	-223.971	-180.794
600	31.910	43.790	8.600	-223.283	-159.339
800	34.570	53.360	15.260	-222.176	-138.181
1000	36.380	61.280	22.370	-220.741	-117.343
1200	37.530	68.020	29.770	-219.188	-96.795

$\text{NiSO}_4 \cdot \text{H}_2\text{O}(\text{c})$
Nickel sulfate monohydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	32.597	32.700	0	-299.955	-253.619
300	32.763	32.902	.060	-299.960	-253.331
400	41.757	43.559	3.786	-299.754	-237.799
500	50.750	53.843	8.412	-298.778	-222.407

*Data except enthalpy of formation and entropy at 298 K estimated.

$\text{NiSO}_4 \cdot 4\text{H}_2\text{O}(\text{c})$
Nickel sulfate tetrahydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	60.500	61.000	0	-514.755	-427.027
300	60.767	61.375	.112	-514.766	-426.482
400	75.180	80.830	6.910	-514.635	-397.039
500	89.593	99.155	15.148	-513.240	-367.776

*Data except enthalpy of formation at 298 K estimated.

$\text{NiSO}_4 \cdot 6\text{H}_2\text{O}(\alpha, \text{c})$
α-Nickel sulfate hexahydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	78.361	79.935	0	-656.695	-541.393
300*	78.730	80.421	.145	-656.712	-540.678
400	96.579	105.615	8.946	-656.676	-501.960
500	110.227	128.710	19.321	-655.274	-463.420

*Data above 298 K estimated.

$\text{NiSO}_4 \cdot 7\text{H}_2\text{O}(\text{c})$
Nickel sulfate heptahydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	87.142	90.570	0	-726.755	-598.014
300*	87.503	91.110	.162	-726.775	-597.214
304	88.277	92.274	.513	-726.812	-595.487
400	103.728	118.660	9.777	-726.974	-553.959
500	113.477	142.974	20.691	-726.097	-510.792

*Data above 298 K estimated except temperature of dissociation.

304 K, dissociates to $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}(\text{c})$ and saturated solution.

$\text{VOSO}_4(\text{c})$
Vanadyl sulfate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	29.001	26.000	0	-328.255	-289.293
300	29.066	26.180	.054	-328.251	-289.050
400	32.344	35.001	3.128	-327.965	-276.021
500	35.174	42.531	6.508	-327.461	-263.087
600	37.555	49.161	10.148	-326.783	-250.273
700	39.487	55.101	14.004	-325.966	-237.585
800	40.970	60.475	18.030	-325.048	-225.023
900	42.005	65.365	22.183	-324.063	-212.577
1000	42.591	69.825	26.416	-323.052	-200.246
1100	42.728	73.894	30.686	-322.055	-188.011

*Data except enthalpy of formation and entropy at 298 K estimated.

$\text{VOSO}_4 \cdot \text{H}_2\text{O}(\text{c})$
Vanadyl sulfate monohydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	38.000	35.500	0	-402.905	-350.165
300	38.167	35.736	.070	-402.905	-349.838
400	47.167	47.948	4.337	-402.474	-332.192
500	56.167	59.440	9.504	-401.249	-314.746

*Data except enthalpy of formation at 298 K estimated.

$\text{VOSO}_4 \cdot 3\text{H}_2\text{O}(\text{c})$
Vanadyl sulfate trihydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	57.000	54.500	0	-549.235	-468.941
300	57.244	54.853	.106	-549.238	-468.441
400	70.444	73.129	6.490	-548.788	-441.545
500	83.644	90.266	14.195	-547.154	-414.897

*Data except enthalpy of formation at 298 K estimated.

$\text{VOSO}_4 \cdot 5\text{H}_2\text{O}(\alpha, \text{c})$
α-Vanadyl sulfate pentahydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	76.000	73.500	0	-692.045	-584.196
300	76.333	73.971	.141	-692.052	-583.526
400	94.333	98.396	8.674	-691.551	-547.381
500	112.333	121.379	19.008	-689.417	-511.550

*Data except enthalpy of formation at 298 K estimated.

$\text{VOSO}_4 \cdot 5\text{H}_2\text{O}(\text{B}, \text{c})$
 β -Vanadyl sulfate pentahydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	76.000	73.500	0	-691.555	-583.706
300	76.333	73.971	.141	-691.562	-583.036
400	94.333	98.396	8.674	-691.061	-546.891
500	112.333	121.379	19.008	-688.927	-511.060

*Data except enthalpy of formation at 298 K estimated.

$\text{VOSO}_4 \cdot 6\text{H}_2\text{O}(\text{c})$
 Vanadyl sulfate hexahydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	85.000	83.000	0	-762.275	-640.648
300	85.388	83.527	.158	-762.284	-639.893
400	106.388	110.968	9.746	-761.778	-599.120
500	127.388	136.964	21.435	-759.352	-558.695

*Data except enthalpy of formation at 298 K estimated.

$\text{ZnO} \cdot 2\text{ZnSO}_4(\text{c})$
 Zinc oxysulfate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	59.000	69.450	0	-565.665	-503.597
400	66.536	87.744	.364	-564.847	-482.496
600	74.644	116.481	20.592	-562.062	-441.889
800	79.157	138.612	36.000	-564.212	-401.496
1000	82.630	156.660	52.188	-560.792	-361.206
1200	85.694	172.000	69.025	-639.490	-320.233

$\text{ZnSO}_4(\text{c})$
 Zinc sulfate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	23.680	26.430	0	-249.615	-217.181
400	26.878	33.859	2.583	-249.513	-206.110
600	31.945	45.741	8.478	-248.734	-184.548
800	36.597	55.573	15.335	-249.094	-163.080
1000	41.128	64.227	23.109	-246.986	-141.804
1015	41.466	64.842	23.910	-246.615	-140.046
1015	34.700	69.640	28.780	-241.745	-140.046
1200	34.700	75.450	35.199	-268.184	-121.134

1015 K, transition point; $\Delta\text{H}^\circ = 4.87$

$\text{ZnSO}_4 \cdot \text{H}_2\text{O}(\text{c})$
 Zinc sulfate monohydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	36.153	33.100	0	-327.205	-280.150
300*	36.319	33.324	.067	-327.202	-279.857
400	45.320	45.005	4.149	-326.606	-264.144
500	54.320	56.085	9.131	-325.203	-248.673

*Data above 298 K estimated.

$\text{ZnSO}_4 \cdot 6\text{H}_2\text{O}(\text{c})$
 Zinc sulfate hexahydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	84.994	86.900	0	-679.255	-565.192
300*	85.456	87.427	.158	-679.258	-564.483
333	93.988	96.887	3.153	-679.160	-551.708
400	112.072	115.580	10.007	-678.140	-526.324
500	141.904	143.733	22.679	-674.370	-488.748

*Data above 298 K estimated except temperature of dissociation.

333.4 K, dissociates to $\text{ZnSO}_4 \cdot \text{H}_2\text{O}(\text{c})$ and saturated solution.

$\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}(\text{c})$
 Zinc sulfate heptahydrate

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	91.144	92.900	0	-750.905	-622.021
300*	91.620	93.465	.169	-750.917	-621.220
311	94.590	96.898	1.219	-750.959	-616.347
400	115.631	123.150	10.545	-750.320	-578.016
500	138.163	151.400	23.247	-747.586	-535.213

*Data above 298 K estimated except temperature and enthalpy of dissociation.

311.27 K, dissociates to $\text{ZnSO}_4 \cdot 6\text{H}_2\text{O}(\text{c})$ and saturated solution; $\Delta\text{H}^\circ(\text{dissociation}) = 4.017$.

Sulfides

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

All formation reaction for sulfides use $S_2(g)$. A formation table for $2S(c,l) = S_2(g)$ is included.

Sources of data from general references are listed below, with the reference(s) given immediately after each formula:

$Al_2S_3(c)$ (13), $AlS(g)$ (7), $AsS(g)$ (21), $As_2S_2(c,l)$ (23), $As_2S_3(orpiment, l)$ (21), $As_2S_3(gl,l)$ (21), $As_4S_4(realgar, l)$ (21), $As_4S_4(c,l)$ (21), $As_4S_4(g)$ (21), $BS(g)$ (4), $BaS(c)$ (3), $BaS(g)$ (3), $BeS(c)$ (3), $BeS(g)$ (3), $CaS(c)$ (4, 26), $CaS(g)$ (3), $CeS(c)$ (23), $Ce_2S_3(c)$, (23), $CuFeS_2(c)$ (19), $Cu_5FeS_4(c)$ (19), $CuS(c)$ (19), $Cu_2S(c)$ (19), $Fe_{0.877}S(c)$ (3), $FeS(c,l)$ (17, 18), $FeS(g)$ (3), $FeS_2(pyrite)$ (3), $FeS_2(marcasite)$ (3), $GeS(c,l)$ (23), $GeS(g)$ (23), $GeS_2(c)$ (23), $HS(g)$ (23), $H_2S(g)$ (3, 30), $DS(g)$ (3), $D_2S(g)$ (3), $In_2S_3(c)$ (23), $K_2S(c,l)$ (3), $La_2S_3(c)$ (23), $MgS(c)$ (3), $MgS(g)$ (3), $MnS(c,l)$ (23), $MoS_2(c)$ (3, 8), $Mo_2S_3(c,l)$ (3, 8), $Na_2S(c,l)$ (3), $NdS(c)$ (23), $NiS(c,l)$ (22), $NiS_2(c)$ (3), $Ni_3S_4(c)$ (3), $Ni_2S_3(c,l)$ (22), $PS(g)$ (7), $P_4S_3(c,l)$ (23), $P_4S_3(g)$ (7), $PbS(g)$ (6), $Pd_4S(c)$ (23), $PtS(c)$ (23), $PtS_2(c)$ (23), $SiS(g)$ (4), $SiS_2(c,l)$ (23), $SrS(c)$ (3), $SrS(g)$ (3), $TiS(g)$ (23), $US(c)$ (23), $ZnS(B)$ (23), $ZnSO_4(c)$ (10).

$Al_2S_3(c)$:

Ferrante, M. J., J. M. Stuve, H. C. Ko, and R. R. Brown. Thermodynamic Properties of Aluminum Sulfide. High Temp. Sci., v. 14, 1981, pp. 91-101.

$Ag_2S(c,l)$:

Kiukkola, K. and C. Wagner. Measurements of Galvanic Cells Involving Solid Electrolytes. J. Electrochem. Soc., v. 104, 1957, pp. 379-387.

Thompson, W. I., and S. N. Flengas. Drop Calorimetric Measurements on Some Chlorides, Sulfides, and Binary Melts. Can. J. Chem. v. 49, 1971, pp. 1550-1563.

_____. Free Energies of Formation of Silver Sulfide and Lead Sulfide by Electromotive Force Measurements at High Temperatures. J. Electrochem. Soc., v. 118, 1971, pp. 419-425.

Walsh, P. N., E. W. Art, and D. White. The Heat Capacity of the Silver Chalcogenides, $Ag_{1.99}S$, $Ag_{1.99}Se$, and $Ag_{1.88}Te$ From 16 to 300° K. J. Phys. Chem., v. 66, 1962, pp. 1546-1549.

$BiS(g)$:

Cubicciotti, D. Thermodynamics of Liquid Solutions of Bismuth and Sulfur. J. Phys. Chem., v. 67, 1963, pp. 118-123.

Oy, O. M., and J. Drowart. Mass Spectrometric Determination of the Dissociation Energies of the Molecules BiO , BiS , $BiSe$, and $BiTe$. Trans. Faraday Soc., v. 65, 1969, pp. 3221-3230.

$Bi_2S_2(g)$ and $Bi_2S_3(g)$:

Prusaczyk, J. E. Dissociation Energies of New Chalcogenide Molecules. Ph. D. Thesis, Case West. Reserve Univ., Cleveland, OH, 1971, 172 pp.; Univ. Microfilms, Ann Arbor, MI.

$\text{Bi}_2\text{S}_3(\text{c,l}):$

Mitchell, M. J. Equilibrium Vapor Pressure Study of Bi_2S_3 (Bismuthite). Ph. D. Thesis, Stanford Univ., Stanford, CA, 1976, 134 pp.; Univ. Microfilms, Ann Arbor, MI.

Prusaczyk, J. E. Dissociation Energies of New Chalcogenide Molecules. Ph. D. Thesis, Case West. Reserve Univ., Cleveland, OH, 1971, 172 pp.; Univ. Microfilms, Ann Arbor, MI.

Romanovskii, V. A., and V. V. Tarasov. Heat Capacity of the Trisulfides of Arsenic, Antimony, and Bismuth in Connection With Their Structural and Physical-Chemical Properties. Sov. Phys.-Solid State (Engl. Transl.), v. 2, 1960, pp. 1170-1175.

 $\text{CS}(\text{g}):$

Bell, S., I. L. Ng, and C. Suggitt. An Emission System of CS in the Vacuum and Near Ultraviolet. J. Mol. Spectrosc., v. 44, 1972, pp. 267-278.

Fincham, C. J. B., and R. A. Bergman. Thermodynamic Properties of CS and Solutions of Sulfur in Carbon-Saturated Liquid Iron. J. Met., 1957, pp. 690-694.

Hildenbrand, D. L. Thermochemistry of the Molecules CS and CS^+ . Chem. Phys. Lett., v. 15, 1972, pp. 379-380.

Lagerqvist, H., H. Westerlund, C. V. Wright, and R. F. Barrow. Rotational Analysis of the Ultraviolet Band System of CS. Ark. Fys., v. 14, 1959, pp. 387-408.

 $\text{CdS}(\text{c}):$

Adami, L.H., and E. G. King. Heats and Free Energies of Formation of Sulfides of Manganese, Iron, Zinc, and Cadmium. BuMines RI 6495, 1964, 10 pp.

Beyer, R. P., M. J. Ferrante, and R. V. Mrazek. An Automated Calorimeter for Heat-Capacity Measurements From 5 to 300 K. The Heat Capacity of Cadmium Sulfide From 5.37 to 301.8 K, and the Relative Enthalpy to 1103.4 K. J. Chem. Thermodyn., v. 15, 1983, pp. 827-834.

 $\text{CdS}(\text{g}):$

Marquart, J. R., and J. Berkowitz. Dissociation Energies of Some Metal Sulfides. J. Chem. Phys., v. 39, 1963, pp. 283-285.

 $\text{FeS}(\text{c,l}):$

Adami, L.H., and E. G. King. Heats and Free Energies of Formation of Sulfides of Manganese, Iron, Zinc, and Cadmium. BuMines RI 6495, 1964, 10 pp.

 $\text{HgS}(\text{g}):$

Goldfinger, P. and M. Jeunehomme. Mass Spectrometric and Knudsen-Cell Vaporization Studies of Group 2B-6B Compounds. Trans. Faraday Soc., v. 59, 1963, pp. 2851-2867.

 $\text{MnS}(\text{c,l}):$

Adami, L.H., and E. G. King. Heats and Free Energies of Formation of Sulfides of Manganese, Iron, Zinc, and Cadmium. BuMines RI 6495, 1964, 10 pp.

Coughlin, J. P. High-Temperature Heat Contents of Manganous Sulfide, Ferrous Sulfide, and Pyrite. J. Am. Chem. Soc., v. 72, 1950, pp. 5445-5447.

NS(g):

O'Hare, P. A. G. Dissociation Energies, Enthalpies of Formation, Ionization Potentials, and Dipole Moments of NS and NS⁺. J. Chem. Phys., v. 52, 1970, pp. 2992-2996.

Herzberg, G. Molecular Structure. I. Spectra of Diatomic Molecules. D. VanNostrand, 2d ed., 1950, 658 pp.

PS(g):

Dressler, K. Ultraviolett- und Schumannspektren der neutralen und ionisierten Moleküle PO, PS, NS, P₂ (Ultraviolet and Schumann Spectra of Neutral and Ionized Molecules PO, PS, NS, and P₂). Helv. Phys. Acta, v. 28, 1955, pp. 563-590.

Drowart, J., C. E. Meyers, R. Szwarc, A. Vander Auwera-Mahieu, and O. M. Uy. The Dissociation Energies of the Molecules PS, PSe, and PTe. High Temp. Sci. v. 5, 1973, pp. 482-488.

Narasimham, N. A., and T. Subramanian. Isotope Shift in the Spectra of NS and PS. J. Mol. Spectrosc. v. 29, 1969, pp. 294-304.

P₄S₁₀(c):

Clever, H. L., E. F. Westrum Jr., and A. W. Cordes. Heat Capacities and Thermodynamic Properties of Globular Molecules. XIV. Tetraphosphorus Trisulfide, Tetraphosphorus Triselenide, and Tetraphosphorus Decasulfide Between 5 and 350° K. J. Phys. Chem., v. 69, 1965, pp. 1214-1219.

Cueilleron, J., and H. Vincent. Etude des Sulfures de Phosphore P₄S₇, P₄S₈, P₄S₉, et de leurs Variétés Allotropiques (Study of the Phosphorus Sulfides P₄S₇, P₄S₈, P₄S₉, and Their Allotropes). Bull. Soc. Chim. Fr., No. 6, 1970, pp. 2118-2121.

Peters, H., and K. Muscheites. Warmehalt und Molwarmen des festen und flüssigen P₄S₁₀ im Bereich von 273° K bis 720° K (Enthalpy and Molecular Heats of Solid and Liquid P₄S₁₀ in the Range 273° K to 720° K). Monatsber. Dtsch. Akad. Wiss. Berlin, v. 9, 1967, pp. 38-40.

Vincent, H., and C. Vincent-Forat. Etude des Sulfures de Phosphore P₄S₉-P₄S₈-P₄S₇ (Study of the Phosphorus Sulfides P₄S₉, P₄S₈, and P₄S₇). Bull. Soc. Chim. Fr. No. 2, pt. 1, 1973, pp. 499-502.

PbS(c):

Kiukkola, K. and C. Wagner. Measurements of Galvanic Cells Involving Solid Electrolytes. J. Electrochem. Soc., v. 104, 1957, pp. 379-387.

Thompson, W. T., and S. N. Flengas. Drop Calorimetric Measurements on Some Chlorides, Sulfides, and Binary Melts. Can. J. Chem. v. 49, 1971, pp. 1550-1563.

_____. Free Energies of Formation of Silver Sulfide and Lead Sulfide by Electromotive Force Measurements at High Temperatures. J. Electrochem. Soc., v. 118, 1971, pp. 419-425.

SbS(g):

Prusaczyk, J. E. Dissociation Energies of New Chalcogenide Molecules. Ph. D. Thesis, Case West. Reserve Univ., Cleveland, OH, 1971, 172 pp.; Univ. Microfilms, Ann Arbor, MI.

Shimauchi, M., and Y. Nishiyama. Emission Spectra of the SbS Radical. Sci. Light (Tokyo), v. 17, 1968, pp. 76-88.

(SbS)₂(g), (SbS)₃(g), and (SbS)₄(g):

Prusaczyk, J. E. Dissociation Energies of New Chalcogenide Molecules. Ph. D. Thesis, Case West. Reserve Univ., Cleveland, OH, 1971, 172 pp.; Univ. Microfilms, Ann Arbor, MI.

$\text{Sb}_2\text{S}_3(\text{c}, \text{l})$:

Johnson, G. K., G. N. Papatheodorou, and C. E. Johnson. The Enthalpies of Formation of $\text{SbF}_5(\text{l})$ and $\text{SbS}_3(\text{c})$ and the High-Temperature Thermodynamic Functions of Sb_2S_3 and $\text{Sb}_2\text{S}_3(\text{l})$. *J. Chem. Thermodyn.*, v. 13, 1981, pp. 745-754.

King, E. G., and W. W. Weller. Low-Temperature Heat Capacities and Entropies at 298.15° K of Antimony and Indium Sulfides. BuMines RI 6040, 1962, 5 pp.

$\text{Sb}_2\text{S}_3(\text{g})$, $\text{Sb}_2\text{S}_4(\text{g})$, and $\text{Sb}_3\text{S}_2(\text{g})$:

Prusaczyk, J. E. Dissociation Energies of New Chalcogenide Molecules. Ph. D. Thesis, Case West. Reserve Univ., Cleveland, OH, 1971, 172 pp.; Univ. Microfilms, Ann Arbor, MI.

$\text{ZnS}(\text{wurtzite})$:

Adami, L.H., and E. G. King. Heats and Free Energies of Formation of Sulfides of Manganese, Iron, Zinc, and Cadmium. BuMines RI 6495, 1964, 10 pp.

Pankratz, L. B., and E. G. King. High-Temperature Heat Contents and Entropies of Two Zinc Sulfides and Four Solid Solutions of Zinc and Iron Sulfides. BuMines RI 6708, 1965, 8 pp.

Stuve, J. M. Low-Temperature Heat Capacities of Sphalerite and Wurtzite. BuMines RI 7940, 1974, 8 pp.

$\text{ZnS}(\text{g})$:

De Maria, G., P. Goldfinger, L. Malaspina, and V. Piacente. Mass-Spectrometric Study of Gaseous Molecules. *Trans. Faraday Soc.*, v. 61, 1961, pp. 2146-2152.

Piacente, V., L. Malaspina, and G. De Maria. Proprieta termodinamiche di sistemi binari alle alte temperature (Thermodynamic Properties of Binary Systems at High Temperatures). *Corsi Semin. Chim.*, v. 6, 1967, pp 17-19.

$\text{Ag}_2\text{S}(\text{c,l})$
Disilver sulfide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	18.220	34.355	0	-22.755	-18.808
400	19.484	39.899	1.925	-22.482	-17.501
450	19.910	42.220	2.910	-22.322	-16.887
450	19.800	44.337	3.863	-21.369	-16.887
600	19.800	50.034	6.833	-20.927	-15.459
800	19.800	55.730	10.793	-20.472	-13.710
860	19.800	57.162	11.981	-20.366	-13.211
860	19.800	57.370	12.160	-20.187	-13.211
1000	19.800	60.356	14.932	-19.988	-12.089
1110	19.800	62.422	17.110	-19.891	-11.224
1110	22.200	64.098	18.970	-18.031	-11.224
1200	22.200	65.829	20.968	-17.776	-10.684
1400	22.200	69.251	25.408	-22.819	-8.800

450 K, transition point; $\Delta\text{H}^\circ = 0.953$

860 K, transition point; $\Delta\text{H}^\circ = 0.179$

1110 K, melting point; $\Delta\text{H}^\circ = 1.860$

$\text{AlS}(\text{g})$
Aluminum monosulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	7.982	55.090	0	41.745	35.466
400	8.334	57.489	.832	41.562	33.347
600	8.674	60.943	2.538	41.156	29.327
800	8.827	63.462	4.290	40.640	25.458
1000	8.912	65.442	6.065	37.422	21.917
1200	8.968	67.072	7.853	36.793	18.876
1400	9.010	68.457	9.651	36.160	15.940
1600	9.043	69.663	11.456	35.520	13.093
1800	9.073	70.730	13.268	34.872	10.329
2000	9.099	71.687	15.085	34.217	7.638

$\text{Al}_2\text{S}_3(\text{c})$
Dialuminum trisulfide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	25.111	27.927	0	-201.665	-183.595
300	25.163	28.082	.047	-201.650	-183.481
400	27.473	35.678	2.692	-200.800	-177.552
500	28.768	41.958	5.509	-199.848	-171.847
600	29.669	47.287	8.433	-198.847	-166.340
700	30.384	51.916	11.437	-197.816	-161.003
800	30.999	56.014	14.507	-196.771	-155.814
900	31.558	59.698	17.635	-195.724	-150.760

$\text{AsS}(\text{g})$
Arsenic monosulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.324	57.824	0	29.845	23.275
400	8.941	60.361	.681	29.709	21.052
600	9.555	64.126	2.742	29.493	16.771
800	9.678	66.899	4.671	29.263	12.565
1000	9.632	69.055	6.603	20.886	9.582
1200	9.552	70.804	8.521	20.917	7.317

$\text{As}_2\text{S}_2(\text{c,l})$
Diarsenic disulfide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	22.480	30.300	0	-64.710	-52.404
300*	22.500	30.440	.042	-64.704	-52.328
400	23.390	37.050	2.339	-64.405	-48.251
500	24.290	42.360	4.723	-64.074	-44.245
580	25.000	46.020	6.694	-63.781	-41.098
580	35.000	48.520	8.144	-62.331	-41.098
600	35.000	49.700	8.844	-62.055	-40.366
700	35.000	55.100	12.344	-60.696	-36.863

*Data above 298 K estimated except temperature of fusion.

580 K, melting point; $\Delta\text{H}^\circ = 1.450$

$\text{As}_2\text{S}_3(\text{c})$
Diarsenic trisulfide, orpiment

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	27.781	39.000	0	-67.955	-50.118
300	27.822	39.172	.051	-67.947	-50.007
350	28.566	43.524	1.464	-67.724	-47.036
400	28.971	47.367	2.903	-67.492	-44.096
450	29.317	50.799	4.360	-67.260	-41.183
500	29.695	53.907	5.835	-67.027	-38.298
550	30.090	56.756	7.330	-66.789	-35.438

$\text{As}_2\text{S}_3(\text{gl,l})$
Diarsenic trisulfide (glass)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	27.657	40.000	0	-62.695	-45.156
300	27.689	40.171	.051	-62.687	-45.047
400	28.967	48.301	2.890	-62.255	-39.232
500	43.421	55.576	6.167	-61.435	-33.540
585	45.560	62.654	10.001	-59.745	-28.934
600	45.116	63.799	10.679	-59.448	-28.148
700	44.135	70.674	15.138	-57.561	-23.083
800	43.498	76.523	19.518	-55.794	-18.277

585 K, melting point; $\Delta\text{H}^\circ = 1.55$

$\text{As}_4\text{S}_4(\text{c})$
Tetraarsenic tetrasulfide, realgar

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	44.960	60.720	0	-94.420	-69.844
300	45.025	60.999	.083	-94.409	-69.692
350	46.129	68.015	2.360	-94.118	-65.598
400	47.183	74.244	4.693	-93.795	-61.545
450	48.140	79.858	7.077	-93.450	-57.529
500	49.037	84.977	9.506	-93.088	-53.557
550	49.894	89.691	11.980	-92.707	-49.625
580	50.397	92.367	13.491	-92.466	-47.270

$\text{As}_4\text{S}_4(\text{c},1)$
Tetraarsenic tetrasulfide, orthorhombic

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	44.960	60.720	0	-93.620	-69.044
300	45.025	60.999	.083	-93.609	-68.892
400	47.183	74.244	4.693	-92.995	-60.745
500	49.037	84.977	9.506	-92.288	-52.757
580	50.397	92.367	13.491	-91.666	-46.470
580	63.700	103.356	19.866	-85.291	-46.470
600	64.206	105.507	21.136	-84.862	-45.149
700	68.312	115.684	27.743	-82.537	-38.710
800	74.114	125.171	34.854	-79.780	-32.629

580.15 K, melting point; $\Delta \text{H}^\circ = 6.375$

$\text{As}_4\text{S}_4(\text{g})$
Tetraarsenic tetrasulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	39.240	106.590	0	-61.920	-51.020
400	41.112	118.419	4.104	-61.884	-47.304
600	42.521	135.409	12.494	-61.804	-40.032
800	43.037	147.723	21.057	-61.877	-32.767
1000	43.280	157.355	29.692	-94.476	-20.829
1200	43.413	165.259	38.362	-93.352	-6.204

$\text{BS}(\text{g})$
Baron monosulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	7.182	51.644	0	42.745	35.893
400	7.499	53.798	.747	42.764	33.546
600	8.044	56.949	2.305	42.603	28.964
800	8.379	59.313	3.950	42.318	24.462
1000	8.579	61.206	5.648	41.975	20.037
1200	8.706	62.782	7.377	41.582	15.681
1400	8.792	64.131	9.128	41.138	11.402
1600	8.854	65.309	10.892	40.634	7.180
1800	8.903	66.355	12.668	40.070	3.044
2000	8.944	67.295	14.453	39.448	-1.048

$\text{BaS}(\text{c})$
Barium monosulfide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	11.801	18.737	0	-126.155	-119.168
400	12.220	22.264	1.224	-126.075	-116.799
600	12.920	27.360	3.742	-126.418	-112.112
800	13.380	31.142	6.373	-126.574	-107.328
1000	13.780	34.169	9.088	-126.693	-102.502
1200	14.150	36.714	11.881	-128.662	-97.283
1400	14.520	38.923	14.748	-128.648	-92.054
1600	14.880	40.885	17.688	-128.576	-86.829
1800	15.250	42.660	20.701	-128.445	-81.620
2000	15.610	44.285	23.787	-128.253	-76.426

$\text{BaS}(\text{g})$
Barium monosulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.492	59.453	0	-6.325	-11.478
400	8.690	61.980	.876	-6.593	-13.203
600	8.855	65.540	2.633	-7.696	-16.299
800	8.925	68.098	4.412	-8.705	-19.024
1000	8.966	70.095	6.202	-9.749	-21.483
1200	8.997	71.732	7.998	-12.715	-23.358
1400	9.029	73.121	9.800	-13.767	-25.049
1600	9.080	74.330	11.611	-14.823	-26.588
1800	9.178	75.404	13.435	-15.881	-27.995
2000	9.356	76.380	15.287	-16.923	-29.286

$\text{BeS}(\text{c})$
Beryllium monosulfide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	8.130	8.850	0	-71.355	-65.191
400	10.170	11.547	.940	-71.264	-63.098
600	12.200	16.110	3.204	-70.883	-59.089
800	13.180	19.764	5.750	-70.377	-55.233
1000	13.840	22.781	8.455	-69.810	-51.513
1200	14.320	25.348	11.273	-69.236	-47.912
1400	14.690	27.585	14.177	-68.679	-44.394
1600	14.920	29.562	17.138	-71.666	-40.869
1800	15.130	31.331	20.143	-71.011	-37.074
2000	15.350	32.937	23.191	-70.325	-33.325
2200	15.560	34.410	26.282	-69.606	-29.662
2400	15.770	35.773	29.415	-68.854	-26.070

*Data except enthalpy of formation at 298 K estimated.

BeS(g)
Beryllium monosulfide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	7.358	50.234	0	47.645	41.470
400	7.737	52.450	.769	47.565	39.370
600	8.264	55.697	2.374	47.287	35.329
800	8.565	58.119	4.059	46.932	31.392
1000	8.834	60.058	5.798	46.533	27.553
1200	9.247	61.702	7.603	46.094	23.793
1400	9.896	63.173	9.513	45.658	20.119
1600	10.759	64.549	11.576	41.772	16.590
1800	11.722	65.871	13.823	41.669	13.434
2000	12.639	67.155	16.261	41.746	10.310
2200	13.391	68.396	18.868	41.980	7.155
2400	13.912	69.586	21.602	42.332	3.966

*Data estimated.

BiS(g)
Bismuth monosulfide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.436	61.599	0	25.445	19.248
400	8.658	64.113	.872	25.279	17.155
600	8.847	67.666	2.625	22.128	13.454
800	8.931	70.224	4.404	21.670	10.638
1000	8.982	72.222	6.196	21.253	7.929
1200	9.028	73.864	7.997	20.853	5.305
1400	9.081	75.260	9.807	20.449	2.741
1600	9.147	76.476	11.630	20.045	.243
1800	9.229	77.558	13.467	19.640	-2.218

$(\text{BiS})_2(\text{g})$
Dimeric bismuth monosulfide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.698	84.985	0	11.190	10.189
400	18.538	90.318	1.850	10.964	9.879
600	19.232	97.990	5.639	4.946	10.002
800	19.502	103.565	9.517	4.350	11.792
1000	19.632	107.932	13.431	3.845	13.710
1200	19.704	111.519	17.366	3.377	15.732
1400	19.748	114.560	21.311	2.896	17.823
1600	19.777	117.199	25.264	2.394	19.996
1800	19.797	119.529	29.221	1.868	22.208

$\text{Bi}_2\text{S}_3(\text{c,l})$
Dibismuth trisulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	29.170	47.900	0	-89.065	-70.884
400	30.559	56.682	3.047	-88.500	-64.762
600	32.377	69.440	9.352	-92.840	-52.583
800	33.654	78.938	15.961	-91.571	-39.337
1000	34.703	86.563	22.799	-90.035	-26.452
1036	34.900	87.793	24.052	-89.735	-24.168
1036	50.000	106.104	43.022	-70.765	-24.168
1200	50.000	113.452	51.222	-66.914	-17.077

1036 K, melting point; $\Delta H^\circ = 18.970$

$\text{Bi}_2\text{S}_3(\text{g})$
Dibismuth trisulfide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	24.315	103.032	0	-2.865	-1.122
400	24.944	110.277	2.513	-2.834	-.534
600	25.423	120.500	7.558	-8.433	1.187
800	25.599	127.842	12.663	-8.668	4.442
1000	25.683	133.564	17.792	-8.842	7.740
1200	25.728	138.251	22.934	-9.002	11.076
1400	25.756	142.219	28.082	-9.192	14.431
1600	25.774	145.659	33.236	-9.421	17.829
1800	25.787	148.696	38.392	-9.689	21.230

CS(g)
Carbon monosulfide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.122	50.300	0	53.145	46.683
400	7.401	52.431	.739	53.230	44.460
600	7.938	55.538	2.276	53.236	40.068
800	8.293	57.875	3.902	53.112	35.694
1000	8.512	59.751	5.584	52.917	31.360
1200	8.652	61.316	7.301	52.674	27.071
1400	8.746	62.657	9.041	52.392	22.825
1600	8.814	63.829	10.798	52.079	18.625
1800	8.865	64.871	12.566	51.737	14.461
2000	8.905	65.807	14.343	51.370	10.340
2200	8.937	66.657	16.127	50.981	6.254
2400	8.965	67.436	17.918	50.573	2.206
2600	8.989	68.154	19.713	50.148	-1.806
2800	9.010	68.821	21.513	49.708	-5.786
3000	9.031	69.444	23.317	49.255	-9.736

$\text{CS}_2(\text{g})$
Carbon disulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	10.914	56.852	0	-2.760	-3.050
400	11.873	60.202	1.164	-2.656	-3.166
600	13.053	65.262	3.667	-2.522	-3.453
800	13.743	69.120	6.353	-2.451	-3.774
1000	14.169	72.236	9.147	-2.418	-4.112
1200	14.448	74.846	12.011	-2.413	-4.451
1400	14.643	77.088	14.921	-2.438	-4.789
1600	14.787	79.053	17.864	-2.492	-5.121
1800	14.899	80.802	20.834	-2.574	-5.445
2000	14.991	82.376	23.823	-2.683	-5.757
2200	15.068	83.809	26.829	-2.814	-6.061
2400	15.135	85.123	29.849	-2.966	-6.350
2600	15.195	86.337	32.882	-3.134	-6.626
2800	15.249	87.465	35.927	-3.316	-6.886
3000	15.299	88.519	38.982	-3.511	-7.135

$\text{CaS}(\text{c})$
Calcium monosulfide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	11.339	13.528	0	-130.655	-123.599
400	11.800	16.941	1.184	-130.504	-121.211
600	12.200	21.801	3.584	-130.269	-116.620
800	12.600	25.365	6.064	-130.353	-112.066
1000	13.000	28.220	8.624	-130.434	-107.496
1200	13.400	30.626	11.264	-132.506	-102.732
1400	13.800	32.721	13.984	-132.099	-97.799
1600	14.200	34.590	16.784	-131.626	-92.938
1800	14.600	36.286	19.664	-127.628	-87.197
2000	15.000	37.845	22.624	-126.621	-78.315

$\text{CaS}(\text{g})$
Calcium monosulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.318	55.564	0	14.185	8.708
400	8.580	58.049	.862	14.014	6.863
600	8.807	61.578	2.604	13.592	3.374
800	8.924	64.129	4.378	12.801	.077
1000	9.097	66.136	6.177	11.959	-3.018
1200	9.489	67.825	8.031	9.102	-5.763
1400	10.192	69.336	9.994	8.751	-8.209
1600	11.163	70.758	12.126	8.556	-10.625
1800	12.252	72.136	14.467	-27.985	-12.084
2000	13.270	73.481	17.022	-27.383	-10.349

$\text{CdS}(\text{c})$
Cadmium monosulfide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	11.370	17.295	0	-51.055	-44.395
400	11.964	20.727	1.191	-50.916	-42.142
500	12.355	23.440	2.408	-50.777	-39.964
600	12.665	25.721	3.659	-52.123	-37.796
700	12.938	27.694	4.940	-51.982	-35.422
800	13.195	29.439	6.246	-51.822	-33.066
900	13.450	31.008	7.579	-51.639	-30.729
1000	13.709	32.438	8.936	-51.435	-28.415
1100	13.977	33.757	10.321	-74.888	-24.762
1200	14.255	34.985	11.732	-74.424	-20.226

$\text{CdS}(\text{g})$
Cadmium monosulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.600	58.930	0	29.645	23.892
400	8.772	61.484	.886	29.479	21.950
600	8.920	65.073	2.657	27.576	18.291
800	8.991	67.650	4.449	27.082	15.268
1000	9.040	69.662	6.252	26.581	12.377
1200	9.078	71.313	8.064	2.607	13.213
1400	9.112	72.715	9.883	2.520	14.987
1600	9.144	73.934	11.709	2.425	16.774
1800	9.174	75.013	13.541	2.321	18.575
2000	9.203	75.981	15.378	2.210	20.384

$\text{CeS}(\text{c})$
Cerium monosulfide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	11.940	18.700	0	-124.455	-116.777
400	12.600	22.310	1.251	-124.282	-114.181
600	13.870	27.660	3.898	-123.892	-109.212
800	15.150	31.820	6.801	-123.423	-104.380
1000	16.430	35.340	9.959	-123.588	-99.689
1200	17.710	38.450	13.373	-124.177	-94.816
1400	18.990	41.280	17.042	-123.224	-90.000
1600	20.260	43.890	20.967	-122.028	-85.324
1800	21.540	46.350	25.148	-120.590	-80.820
2000	22.820	48.690	29.584	-118.910	-76.496

$\text{Ce}_2\text{S}_3(\text{c})$
Dicerium trisulfide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	30.770	43.100	0	-330.065	-308.282
400*	31.080	52.200	3.153	-329.474	-300.935
600	31.680	64.920	9.429	-328.551	-286.878
800	32.290	74.110	15.827	-327.885	-273.084
1000	32.900	81.380	22.346	-328.896	-259.450
1200	33.510	87.440	28.987	-331.161	-245.286
1400	34.120	92.650	35.749	-330.742	-231.001
1600	34.720	97.240	42.633	-330.244	-216.788
1800	35.330	101.370	49.639	-329.667	-202.652
2000	35.940	105.120	56.766	-329.006	-188.564

*Data above 298 K estimated.

$\text{CuFeS}_2(\text{c})$
Copper monosulfide, chalcocite

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	22.888	29.873	0	-76.210	-64.559
400	25.290	36.970	2.466	-75.798	-60.639
600	27.459	47.719	7.782	-74.814	-53.270
800	32.565	56.055	13.599	-73.679	-46.244
830	34.834	57.293	14.609	-73.407	-45.219
830	36.207	60.192	17.015	-71.001	-45.219
930	41.218	65.094	21.355	-69.215	-42.186
1000	41.218	68.085	24.240	-68.242	-40.189
1200	41.218	75.600	32.484	-65.755	-34.809

830 K, transition point; ΔH° = 2.406

930 K, transition point; ΔH° = 0

$\text{Cu}_5\text{FeS}_4(\text{c})$
Pentacopper monosulfide, bornite

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	58.706	86.600	0	-152.320	-131.881
400	62.946	104.452	6.198	-151.408	-125.033
485	66.254	116.892	11.690	-150.492	-119.521
485	85.082	119.840	13.120	-149.062	-119.521
540	99.534	129.742	18.195	-147.013	-116.278
600	79.308	138.160	22.986	-145.579	-112.940
800	77.518	160.348	38.611	-141.528	-102.696
1000	79.172	178.959	54.223	-138.243	-93.383
1200	84.269	192.892	70.509	-135.139	-84.687

485 K, transition point; ΔH° = 1.43

540 K, transition point; ΔH° = 0

$\text{CuS}(\text{c})$
Copper monosulfide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.324	16.053	0	-27.955	-22.253
300	11.339	16.124	.021	-27.952	-22.218
400	12.018	19.488	1.192	-27.774	-20.333
500	12.562	22.231	2.422	-27.570	-18.496
600	13.100	24.571	3.707	-27.335	-16.702
700	13.595	26.628	5.042	-27.069	-14.950

$\text{Cu}_2\text{S}(\text{c}, \text{l})$
Dicopper monosulfide, chalcocite

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.382	27.761	0	-34.755	-30.181
376	20.190	32.210	1.497	-34.488	-29.015
376	23.960	34.510	2.362	-33.623	-29.015
400	23.710	35.990	2.934	-33.437	-28.729
600	21.930	45.250	7.490	-32.194	-26.665
720	21.090	49.170	10.070	-31.668	-25.610
720	19.830	49.560	10.350	-31.388	-25.610
800	19.770	51.650	11.935	-31.196	-24.980
1000	19.620	56.040	15.875	-30.817	-23.467
1200	19.480	59.610	19.785	-30.620	-22.023
1400	19.330	62.590	23.665	-30.947	-20.392
1400	21.430	64.790	26.735	-33.877	-20.392
1600	21.430	67.650	31.025	-33.634	-18.479

376 K, transition point; ΔH° = 0.865

720 K, transition point; ΔH° = 0.280

1400 K, melting point; ΔH° = 3.070

$\text{Fe}_{0.877}\text{S}(\text{c})$
Iron sulfide, pyrrhotite

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.922	14.531	0	-40.555	-35.057
400*	13.420	18.244	1.291	-40.229	-33.227
598	16.350	24.194	4.240	-39.340	-29.937
598	13.910	24.353	4.335	-39.245	-29.937
600	13.890	24.400	4.363	-39.239	-29.906
800	12.870	28.238	7.026	-38.897	-26.859
1000	12.430	31.052	9.546	-39.101	-23.843
1200	14.130	33.465	12.198	-39.586	-20.737
1400	16.060	35.776	15.202	-38.952	-17.640
1600	18.920	38.097	18.685	-37.924	-14.659
1800	22.590	40.524	22.812	-36.604	-11.823

*Data above 350 K estimated except temperature and enthalpy of transition.

580 K, transition point; ΔH° = 0.095

FeS(c,l)
Iron monosulfide, troilite

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	12.080	14.410	0	-39.165	-33.392
400	16.740	18.574	1.455	-38.753	-31.472
411	17.250	19.035	1.642	-38.683	-31.273
411	17.370	20.417	2.210	-38.115	-31.273
598	17.370	26.934	5.460	-36.981	-28.393
598	14.270	27.135	5.580	-36.861	-28.393
600	14.260	27.180	5.607	-36.857	-28.365
800	14.010	31.237	8.427	-36.563	-25.587
1000	14.220	34.378	11.242	-36.730	-22.839
1200	14.880	37.021	14.144	-37.279	-20.004
1400	15.990	39.392	17.222	-36.776	-17.163
1470	16.480	40.179	18.352	-36.569	-16.187
1470	16.960	45.436	26.080	-28.841	-16.187
1600	16.960	46.878	28.291	-28.376	-15.088
1800	16.960	48.875	31.683	-28.052	-13.445
2000	16.960	50.662	35.075	-31.108	-11.494

411 K, transition point; ΔH° = 0.568

598 K, transition point; ΔH° = 0.120

1470 K, melting point; ΔH° = 7.728

FeS(g)
Iron monosulfide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	9.277	60.785	0	73.260	65.206
400	9.599	63.566	.965	73.182	62.466
600	9.598	67.471	2.891	72.852	57.169
800	9.466	70.214	4.797	72.231	52.026
1000	9.366	72.314	6.679	71.132	47.086
1200	9.304	74.016	8.546	69.547	42.429
1400	9.267	75.447	10.403	68.830	37.966
1600	9.247	76.683	12.254	68.012	33.612
1800	9.238	77.772	14.102	66.791	29.385
2000	9.236	78.745	15.950	62.191	25.639
2200	9.241	79.625	17.797	60.874	22.047
2400	9.250	80.430	19.646	59.549	18.574

*Data except enthalpy of formation at 298 K estimated.

FeS₂(c)
Iron disulfide, marcasite

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	14.912	12.874	0	-70.710	-56.353
400	16.532	17.506	1.609	-70.550	-51.473
600	17.822	24.492	5.063	-70.190	-42.014
800	18.802	29.773	8.740	-69.905	-32.667
1000	19.781	34.073	12.599	-69.911	-23.367
1200	20.760	37.766	16.653	-70.207	-14.024
1400	21.740	41.040	20.903	-69.444	-4.719

FeS₂(c)
Iron disulfide, pyrite

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	14.848	12.647	0	-71.710	-57.286
400	16.455	17.259	1.602	-71.557	-52.381
600	17.760	24.210	5.040	-71.213	-42.868
800	18.727	29.451	8.688	-70.957	-33.461
1000	19.706	33.735	12.531	-70.979	-24.097
1200	20.685	37.414	16.570	-71.290	-14.685
1400	21.664	40.676	20.805	-70.542	-5.308

GeS(c,l)
Germanium monosulfide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298*	11.420	15.770	0	-33.555	-27.916
300	11.430	15.840	.021	-33.551	-27.882
400	11.910	19.200	1.190	-33.356	-26.023
500	12.400	21.910	2.405	-33.145	-24.212
600	12.880	24.210	3.669	-32.904	-22.442
700	13.360	26.230	4.980	-32.631	-20.723
800	13.840	28.050	6.340	-32.321	-19.046
900	14.320	29.710	7.748	-31.979	-17.407
938	14.500	30.300	8.296	-31.840	-16.788
938	14.500	36.300	13.924	-26.212	-16.788
1000	14.500	37.230	14.823	-25.989	-16.181

*Data estimated except temperature and enthalpy of fusion.

938 K, melting point; ΔH° = 5.628

GeS(g)
Germanium monosulfide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.040	56.260	0	7.845	1.412
400	8.400	58.680	.840	7.694	-.765
600	8.650	62.150	2.550	7.377	-4.925
800	8.750	64.650	4.291	7.031	-8.975
1000	8.810	66.610	6.048	6.636	-12.936
1200	8.850	68.220	7.815	6.170	-16.802
1400	8.890	69.590	9.589	-3.120	-19.205
1600	8.910	70.780	11.369	-3.588	-21.476
1800	8.940	71.830	13.154	-4.064	-23.676
2000	8.960	72.770	14.944	-4.549	-25.814

$\text{GeS}_2(\text{c})$
Germanium disulfide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	15.700	20.900	0	-68.210	-55.975
300*	15.720	21.000	.030	-68.204	-55.900
400	16.460	25.630	1.640	-67.967	-51.837
500	17.200	29.380	3.323	-67.701	-47.831
600	17.940	32.580	5.080	-67.392	-43.880
700	18.680	35.400	6.911	-67.029	-39.993
800	19.430	37.950	8.816	-66.609	-36.163
900	20.170	40.280	10.796	-66.135	-32.383
1000	20.910	42.440	12.850	-65.610	-28.663

*Data above 298 K estimated.

$\text{H}_2\text{S}(\text{g})$
Dihydrogen sulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.172	49.151	0	-20.285	-17.510
400	8.504	51.597	.849	-20.549	-16.520
600	9.306	55.193	2.628	-21.007	-14.402
800	10.162	57.968	4.575	-21.333	-12.148
1000	10.943	60.342	6.687	-21.534	-9.827
1200	11.584	62.396	8.943	-21.639	-7.473
1400	12.092	64.221	11.312	-21.684	-5.109
1600	12.491	65.863	13.772	-21.696	-2.741
1800	12.808	67.353	16.303	-21.691	-.370
2000	13.063	68.716	18.891	-21.677	1.998

$\text{HS}(\text{g})$
Monohydrogen sulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	7.755	46.730	0	17.945	16.790
400	7.578	48.984	.781	17.966	16.391
600	7.464	52.023	2.279	17.927	15.609
800	7.611	54.186	3.784	17.862	14.847
1000	7.843	55.909	5.329	17.809	14.099
1200	8.069	57.359	6.920	17.771	13.361
1400	8.263	58.618	8.554	17.741	12.628
1600	8.422	59.732	10.223	17.710	11.899
1800	8.553	60.732	11.921	17.675	11.175
2000	8.661	61.639	13.643	17.632	10.456
2200	8.750	62.469	15.384	17.581	9.738
2400	8.827	63.234	17.142	17.524	9.029

$\text{D}_2\text{S}(\text{g})$
Dideuterium sulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.547	51.428	0	-21.065	-17.951
400	9.082	54.013	.897	-21.285	-16.852
600	10.199	57.908	2.826	-21.598	-14.561
800	11.173	60.981	4.967	-21.759	-12.187
1000	11.909	63.560	7.281	-21.813	-9.787
1200	12.440	65.781	9.719	-21.813	-7.381
1400	12.828	67.729	12.248	-21.788	-4.978
1600	13.118	69.462	14.843	-21.755	-2.579
1800	13.342	71.020	17.490	-21.722	-.183
2000	13.520	72.435	20.177	-21.694	2.210

$\text{DS}(\text{g})$
Monodeuterium sulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	7.772	48.130	0	17.745	16.681
400	7.669	50.397	.786	17.769	16.314
600	7.770	53.514	2.324	17.767	15.586
800	8.034	55.785	3.904	17.764	14.860
1000	8.277	57.605	5.536	17.770	14.132
1200	8.467	59.131	7.211	17.777	13.405
1400	8.611	60.448	8.919	17.776	12.674
1600	8.722	61.605	10.653	17.765	11.947
1800	8.810	62.638	12.407	17.742	11.221
2000	8.881	63.570	14.176	17.704	10.498

$\text{HgS}(\text{g})$
Mercury monosulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	8.675	60.745	0	16.645	12.068
400	8.821	63.317	.892	16.458	10.534
600	8.950	66.922	2.671	16.099	7.649
800	9.016	69.506	4.468	1.840	8.683
1000	9.063	71.524	6.276	1.771	10.400
1200	9.103	73.180	8.093	1.696	12.133
1400	9.139	74.586	9.917	1.613	13.879
1600	9.173	75.808	11.748	1.523	15.637
1800	9.205	76.890	13.586	1.427	17.408
2000	9.238	77.862	15.430	1.322	19.189

$\text{In}_2\text{S}_3(\text{c})$
Diindium trisulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	28.190	39.100	0	-131.065	-110.105
400	28.540	47.620	2.954	-130.681	-103.012
600	30.580	59.830	8.984	-131.535	-88.705
660	30.750	62.750	10.824	-131.309	-84.433
660	32.110	63.150	11.085	-131.048	-84.433
800	33.960	69.490	15.710	-130.204	-74.618
1000	36.610	77.360	22.767	-128.579	-60.908
1100	37.930	80.910	26.494	-127.585	-54.185
1100	38.100	81.780	27.451	-126.628	-54.185
1200	38.100	85.090	31.261	-125.561	-47.641
1400	38.100	90.970	38.881	-123.460	-34.830

660 K, transition point; $\Delta H^\circ = 0.261$ 1100 K, transition point; $\Delta H^\circ = 0.957$

$\text{K}_2\text{S}(\text{c,l})$
Potassium monosulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.850	27.500	0	-112.435	-103.292
400	18.480	32.833	1.850	-113.645	-99.944
600	19.720	40.561	5.670	-113.601	-93.088
800	20.970	46.406	9.739	-113.254	-86.297
1000	37.300	52.169	14.962	-111.780	-79.667
1050	46.600	54.200	17.040	-148.702	-77.860
1200	34.020	59.021	22.445	-145.464	-67.972
1221	34.020	59.612	23.160	-145.052	-66.620
1221	24.130	62.773	27.020	-141.192	-66.620
1400	24.130	66.073	31.339	-139.469	-55.805
1600	24.130	69.295	36.165	-137.560	-43.984
1800	24.130	72.138	40.991	-135.667	-32.404
2000	24.130	74.680	45.817	-133.796	-21.029

1050 K, transition point; $\Delta H^\circ = 0$ 1221 K, melting point; $\Delta H^\circ = 3.860$

$\text{La}_2\text{S}_3(\text{c})$
Dilanthanum trisulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	28.890	39.430	0	-338.065	-317.335
400*	29.250	47.990	2.965	-337.646	-310.327
600	29.950	59.980	8.885	-337.044	-296.812
800	30.650	68.690	14.945	-336.354	-283.506
1000	31.350	75.600	21.145	-335.831	-270.346
1200	32.050	81.380	27.485	-340.051	-257.175
1400	32.750	86.370	33.965	-339.590	-243.405
1600	33.450	90.790	40.585	-339.032	-229.688
1800	34.150	94.770	47.345	-338.376	-216.078
2000	34.850	98.410	54.245	-337.618	-202.516

*Data above 298 K estimated.

$\text{MgS}(\text{c})$
Magnesium monosulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	10.890	12.030	0	-97.985	-91.118
400*	11.380	15.304	1.136	-97.876	-88.789
600	11.930	20.034	3.473	-97.681	-84.287
800	12.190	23.505	5.887	-97.549	-79.847
1000	12.400	26.248	8.347	-99.641	-75.250
1200	12.620	28.529	10.849	-99.668	-70.377
1400	12.830	30.490	13.394	-129.870	-64.677
1600	13.020	32.216	15.979	-129.206	-55.411
1800	13.220	33.761	18.604	-128.516	-46.226
2000	13.390	35.162	21.264	-127.803	-37.119

*Data above 298 K estimated.

$\text{MgS}(\text{g})$
Magnesium monosulfide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.269	53.866	0	19.355	13.749
400	9.075	56.399	.880	19.208	11.857
600	11.567	60.533	2.936	19.122	8.217
800	13.169	64.125	5.441	19.344	4.551
1000	13.102	67.078	8.088	17.440	1.000
1200	12.361	69.405	10.638	17.461	-2.300
1400	11.612	71.253	13.033	-12.890	-4.766
1600	11.033	72.763	15.295	-12.550	-3.630
1800	10.618	74.037	17.457	-12.323	-2.530
2000	10.328	75.140	19.550	-12.178	-1.449

$\text{MnS}(\text{c,l})$
Manganese monosulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.940	19.200	0	-66.555	-61.873
400	12.428	22.790	1.245	-66.380	-60.303
600	12.613	27.878	3.756	-66.146	-57.320
800	12.679	31.514	6.285	-66.084	-54.396
1000	12.871	34.361	8.837	-66.677	-51.460
1200	13.251	36.738	11.445	-66.789	-48.405
1400	13.839	38.822	14.151	-67.404	-45.313
1600	14.644	40.720	16.996	-71.002	-41.898
1800	15.670	42.502	20.023	-71.117	-38.244
1803	15.687	42.528	20.070	-71.117	-38.190
1803	16.000	45.967	26.270	-64.917	-38.190
1900	16.000	46.805	27.822	-64.893	-36.761

1803 K, melting point; $\Delta H^\circ = 6.200$

$\text{MoS}_2(\text{c})$
Molybdenum disulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	15.190	14.955	0	-96.710	-82.876
400	16.470	19.622	1.621	-96.499	-78.181
600	17.590	26.543	5.042	-95.985	-69.130
800	18.220	31.695	8.626	-95.419	-60.261
1000	18.700	35.813	12.320	-94.821	-51.541
1200	19.120	39.260	16.102	-94.218	-42.941
1400	19.520	42.237	19.966	-93.626	-34.441
1600	19.900	44.869	23.908	-93.054	-26.027
1800	20.270	47.234	27.925	-92.515	-17.680
2000	20.640	49.389	32.017	-92.022	-9.392

$\text{Mo}_2\text{S}_3(\text{c,l})$
Dimolybdenum trisulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	26.122	27.480	0	-143.365	-123.097
400	28.074	35.454	2.768	-143.011	-116.227
600	30.449	47.319	8.637	-142.118	-103.018
800	32.305	56.338	14.916	-141.010	-90.144
1000	34.010	63.732	21.549	-139.685	-77.580
1200	35.656	70.078	28.516	-138.178	-65.294
1400	37.275	75.697	35.810	-136.514	-53.276
1600	38.878	80.779	43.425	-134.712	-41.507
1800	40.473	85.450	51.360	-132.792	-29.969
2000	42.062	89.797	59.614	-130.782	-18.653
2080	42.697	91.459	63.004	-129.956	-14.185
2080	37.500	106.363	94.004	-98.956	-14.185

2080 K, melting point; $\Delta H^\circ = 31.0$

$\text{NS}(\text{g})$
Nitrogen monosulfide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	7.599	53.057	0	47.945	47.075
400	7.742	55.306	.780	47.964	46.774
600	8.146	58.523	2.370	48.008	46.171
800	8.433	60.909	4.030	48.068	45.550
1000	8.613	62.812	5.736	48.123	44.914
1200	8.730	64.393	7.471	48.165	44.268
1400	8.810	65.745	9.225	48.191	43.616
1600	8.869	66.925	10.993	48.199	42.962
1800	8.914	67.973	12.772	48.190	42.307
2000	8.950	68.914	14.558	48.167	41.654
2200	8.980	69.768	16.351	48.132	41.005
2400	9.006	70.551	18.150	48.088	40.359
2600	9.028	71.272	19.953	48.034	39.717
2800	9.049	71.942	21.761	47.976	39.080
3000	9.068	72.567	23.572	47.912	38.445

$\text{Na}_2\text{S}(\text{c,l})$
Disodium monosulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	19.790	23.000	0	-102.855	-94.254
400	20.150	28.867	2.034	-103.939	-91.248
600	20.850	31.171	6.135	-103.599	-81.364
800	21.550	43.266	10.375	-103.028	-78.834
1000	22.190	48.140	14.747	-102.299	-72.866
1200	38.120	53.124	20.261	-146.958	-66.191
1400	32.780	59.544	28.562	-141.555	-53.183
1445	32.000	60.556	30.002	-140.770	-50.355
1445	22.000	63.745	34.610	-136.162	-50.355
1600	22.000	65.987	38.020	-135.013	-41.213
1800	22.000	68.578	44.420	-131.543	-27.577
2000	22.000	70.896	46.820	-132.085	-18.103

1445 K, melting point; $\Delta H^\circ = 4.608$

$\text{NdS}(\text{c})$
Neodymium monosulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	11.640	18.600	0	-123.355	-115.677
400	11.840	22.050	1.197	-123.247	-113.070
600	12.240	26.930	3.605	-123.127	-108.015
800	12.640	30.510	6.093	-123.136	-102.982
1000	13.040	33.370	8.661	-123.322	-97.923
1200	13.440	35.780	11.309	-124.410	-92.768
1400	13.840	37.880	14.037	-126.418	-87.328
1600	14.240	39.760	16.845	-126.641	-81.745
1800	14.640	41.460	19.733	-126.799	-76.120
2000	15.040	43.020	22.701	-126.889	-70.474

*Enthalpy of formation at 298 K and heat capacities 400-1300 K estimated.

$\text{NiS}(\text{c,l})$
Nickel monosulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	11.260	12.660	0	-37.455	-30.975
400	12.140	16.100	1.200	-37.325	-28.776
600	13.450	21.280	3.760	-37.095	-24.562
623	13.590	21.790	4.070	-37.077	-24.080
623	13.640	22.910	4.770	-36.377	-24.080
800	14.950	26.480	7.300	-35.956	-20.633
1000	16.430	29.980	10.440	-35.209	-16.890
1067	16.920	31.050	11.550	-34.912	-15.666
1067	17.000	37.610	18.550	-27.912	-15.666
1200	17.000	39.620	20.820	-27.302	-14.177
1400	17.000	42.240	24.220	-26.465	-12.057
1600	17.000	44.510	27.620	-25.729	-10.049
1800	17.000	46.510	31.020	-29.199	-7.951

623 K, transition point; $\Delta H^\circ = 0.700$

1066.5 K, melting point; $\Delta H^\circ = 7.0$

$\text{NiS}_2(\text{c})$
Nickel disulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	16.880	17.200	0	-62.110	-48.858
400	17.385	22.231	1.745	-61.841	-44.375
600	18.377	29.468	5.321	-61.432	-35.741
800	19.369	34.890	9.096	-60.924	-27.238
1000	20.361	39.319	13.069	-60.228	-18.900
1200	21.353	43.119	17.240	-59.428	-10.701

$\text{Ni}_3\text{S}_2(\text{c,l})$
Trinickel disulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	28.120	32.000	0	-82.810	-69.713
400	30.430	40.610	2.990	-82.624	-65.270
600	33.350	53.520	9.380	-82.385	-56.665
800	37.600	63.630	16.430	-81.672	-48.146
840	38.810	65.480	17.950	-81.395	-46.475
840	45.980	81.400	31.320	-68.025	-46.475
1000	44.840	89.320	38.580	-65.819	-42.592
1064	44.390	92.080	41.430	-65.028	-41.102
1064	45.200	96.500	46.130	-60.328	-41.102
1200	45.200	101.940	52.280	-58.638	-38.760
1400	45.200	108.910	61.320	-56.374	-35.637
1600	45.200	114.940	70.360	-54.400	-32.800
1800	45.200	120.270	79.400	-65.030	-29.698

840 K, transition point; $\Delta H^\circ = 13.37$ 1064 K, melting point; $\Delta H^\circ = 4.70$

$\text{Ni}_3\text{S}_4(\text{c})$
Trinickel tetrasulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	39.390	44.570	0	-133.388	-107.788
300	39.454	44.814	.073	-133.379	-107.628
400	42.887	56.634	4.190	-132.814	-99.132
500	46.321	66.573	8.650	-132.138	-90.788
600	49.754	75.322	13.454	-131.376	-82.596
700	53.188	83.249	18.601	-130.345	-74.522

*Data except enthalpy of formation at 298 K estimated.
630 K, decomposition point

$\text{PS}(\text{g})$
Phosphorus monosulfide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.422	55.973	0	21.045	15.410
400	8.603	58.476	.868	20.720	13.551
600	8.788	62.004	2.609	17.539	10.289
800	8.877	64.546	4.377	17.490	7.880
1000	8.928	66.533	6.158	17.421	5.485
1200	8.963	68.164	7.947	17.336	3.104
1400	8.989	69.547	9.742	17.237	.740
1600	9.010	70.749	11.542	17.125	-1.609
1800	9.029	71.811	13.346	17.002	-3.942
2000	9.046	72.764	15.154	16.868	-6.263

$\text{P}_4\text{S}_3(\text{c,l})$
Tetraphosphorus trisulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	38.850	48.600	0	-82.965	-61.367
300	39.260	48.840	.072	-82.958	-61.234
314	40.690	50.670	.632	-82.878	-60.227
314	43.200	58.520	3.096	-80.414	-60.227
400	44.370	69.120	6.866	-80.465	-54.596
446	45.000	73.990	8.921	-80.134	-51.643
446	55.000	84.790	13.738	-75.317	-51.643
500	55.000	91.070	16.703	-74.385	-48.831

313.9 K, transition point; $\Delta H^\circ = 2.464$ 446 K, melting point; $\Delta H^\circ = 4.817$

$\text{P}_4\text{S}_3(\text{g})$
Tetraphosphorus trisulfide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298*	37.000	76.280	0	-65.113	-51.768
400	37.000	87.153	3.768	-65.711	-47.056
600	37.000	102.155	11.168	-77.163	-36.717
800	37.000	112.800	18.568	-76.162	-23.388
1000	37.000	121.056	25.968	-75.280	-10.298
1200	37.000	127.802	33.368	-74.479	2.619
1400	37.000	133.505	40.768	-73.743	15.409
1600	37.000	138.446	48.168	-73.061	28.097
1800	37.000	142.804	55.568	-72.430	40.707
2000	37.000	146.702	62.968	-71.840	53.247

*Data estimated.

$P_4S_{10}(c,l)$
Tetraphosphorus decasulfide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	70.740	91.240	0	-227.450	-161.687
300	70.877	91.678		-227.433	-161.278
350	74.348	102.870	3.763	-227.624	-150.225
400	77.501	113.006	7.561	-227.097	-139.200
450	80.469	122.307	11.510	-226.458	-128.246
500	83.323	130.934	15.606	-225.703	-117.372
550	86.102	139.006	19.841	-224.840	-106.641
561	86.706	140.717	20.792	-236.191	-104.048
561	141.457	158.222	30.612	-226.371	-104.048
600	141.457	167.729	36.129	-223.244	-95.646
650	141.457	179.051	43.202	-219.257	-85.173
700	141.457	189.535	50.274	-215.292	-75.009
750	141.457	199.294	57.347	-211.344	-65.123

561 K, melting point; ΔH° = 9.820

$PbS(c)$
Lead monosulfide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.820	21.838	0	-38.855	-32.622
400	12.063	25.346	1.217	-38.699	-30.516
600	12.502	30.321	3.673	-38.438	-26.488
800	12.944	33.978	6.218	-39.357	-22.152
1000	13.399	36.915	8.852	-39.024	-17.890
1200	13.861	39.398	11.578	-38.585	-13.698

$PbS(g)$
Lead monosulfide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.386	60.067	0	16.145	10.980
400	8.622	62.568	.868	15.952	9.246
600	8.823	66.109	2.615	15.504	5.981
800	8.909	68.660	4.389	13.814	3.273
1000	8.958	70.654	6.176	13.300	.694
1200	8.993	72.290	7.972	12.809	-1.774
1400	9.020	73.679	9.773	12.325	-4.178
1600	9.044	74.885	11.579	11.836	-6.524
1800	9.067	75.751	13.390	11.337	-8.762
2000	9.094	76.908	15.206	10.832	-10.970

$Pd_4S(c)$
Tetrapalladium sulfide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	27.470	43.180	0	-31.855	-25.855
300*	27.500	43.350	.051	-31.855	-25.816
400	28.660	51.430	2.863	-31.954	-23.789
500	29.830	57.960	5.787	-32.015	-21.743
600	31.000	63.500	8.829	-32.029	-19.687
700	32.160	68.360	11.986	-31.987	-17.630
800	33.330	72.730	15.261	-31.884	-15.585
900	34.490	76.730	18.652	-31.716	-13.559
1000	35.660	80.420	22.160	-31.492	-11.551

*Data above 298 K estimated.

$PtS(c)$
Platinum monosulfide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.370	13.160	0	-35.255	-28.087
400*	11.160	16.330	1.100	-35.199	-25.646
600	12.230	21.070	3.444	-34.982	-20.913
800	13.140	24.710	5.983	-34.651	-16.265
1000	14.010	27.740	8.699	-34.208	-11.720
1200	14.850	30.370	11.585	-33.661	-7.274
1400	15.690	32.720	14.639	-33.014	-2.923

*Data above 298 K estimated.

$PtS_2(c)$
Platinum disulfide

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	15.750	17.850	0	-57.110	-43.214
400*	16.920	22.670	1.671	-56.889	-38.503
600	18.220	29.790	5.195	-56.330	-29.422
800	19.160	35.170	8.936	-55.662	-20.554
1000	20.000	39.530	12.853	-54.902	-11.856
1200	20.800	43.250	16.934	-54.059	-3.327
1400	21.590	46.520	21.174	-53.138	5.052

*Data above 298 K estimated.

SbS(g)
Antimony monosulfide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	8.285	59.656	0	29.045	22.628
400	8.572	62.135	.860	28.876	20.463
600	8.962	65.686	2.614	28.526	16.329
800	9.323	68.315	4.443	28.144	12.318
1000	9.608	70.428	6.338	22.936	8.917
1200	9.787	72.197	8.279	22.479	6.159
1400	9.874	73.713	10.247	22.034	3.481
1600	9.898	75.034	12.225	21.584	.858
1800	9.886	76.199	14.203	21.120	-1.712

$(\text{SbS})_2(\text{g})$
Dimeric antimony monosulfide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	17.130	81.283	0	9.990	8.494
400	18.144	86.475	1.802	9.734	8.026
600	19.025	94.028	5.534	9.257	7.270
800	19.377	99.556	9.378	8.679	6.688
1000	19.550	103.900	13.273	-1.631	7.286
1200	19.646	107.474	17.193	-2.508	9.157
1400	19.705	110.507	21.129	-3.398	11.183
1600	19.744	113.141	25.074	-4.308	13.322
1800	19.770	115.468	29.025	-5.240	15.570

$(\text{SbS})_3(\text{g})$
Trimeric antimony monosulfide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	27.247	92.047	0	-13.165	-6.501
400	29.055	100.338	2.878	-13.374	-4.186
600	30.502	112.446	8.860	-13.705	.471
800	31.052	121.307	15.023	-14.176	5.259
1000	31.315	128.267	21.262	-29.244	11.715
1200	31.460	133.991	27.541	-30.161	20.001
1400	31.548	138.847	33.842	-31.099	28.452
1600	31.605	143.064	40.158	-32.065	37.017
1800	31.645	146.789	46.483	-33.065	45.694

$(\text{SbS})_4$
Tetrameric antimony monosulfide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	40.873	123.176	0	-32.020	-23.268
400	42.074	135.379	4.232	-31.904	-20.292
600	42.967	152.642	12.753	-31.801	-14.527
800	43.291	165.054	21.384	-32.014	-8.750
1000	43.444	174.732	30.059	-51.749	-.847
1200	43.527	182.661	38.757	-52.645	9.430
1400	43.578	189.375	47.468	-53.586	19.871
1600	43.610	195.196	56.187	-54.577	30.421
1800	43.633	200.334	64.911	-55.619	41.084

$\text{Sb}_2\text{S}_3(\text{c,l})$
Diantimony trisulfide

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	28.637	43.540	0	-79.955	-62.072
300	28.663	43.717	.053	-79.945	-61.958
400	29.645	52.113	2.974	-79.445	-56.039
500	30.467	58.813	5.978	-78.936	-50.244
600	31.436	64.453	9.072	-78.394	-44.565
700	32.379	69.371	12.264	-77.811	-38.966
800	33.342	73.754	15.548	-77.206	-33.464
823	33.639	74.703	16.318	-77.063	-32.209
823	47.985	86.505	26.032	-67.349	-32.209
900	46.120	90.716	29.656	-65.857	-28.987
1000	43.563	95.443	34.140	-73.702	-23.980

823 K, melting point; $\Delta H^\circ = 9.714$

$\text{Sb}_2\text{S}_3(\text{g})$
Diantimony trisulfide (ideal gas)

T	C_p°	S°	$H^\circ - H_{298}^\circ$	ΔH_f°	ΔG_f°
298	23.789	97.921	0	-17.465	-15.796
400	24.618	105.043	2.470	-17.459	-15.225
600	25.265	115.171	7.471	-17.504	-14.107
800	25.508	122.477	12.551	-17.713	-12.950
1000	25.623	128.183	17.666	-27.686	-10.704
1200	25.687	132.861	22.797	-28.251	-7.249
1400	25.726	136.824	27.939	-28.848	-3.691
1600	25.751	140.261	33.087	-29.482	-.060
1800	25.768	143.295	38.239	-30.155	3.647

$\text{Sb}_2\text{S}_4(\text{g})$
Diantimony tetrasulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	29.328	103.282	0	-39.020	-30.824
400	30.337	112.061	3.045	-38.845	-28.049
600	31.117	124.538	9.205	-38.569	-22.721
800	31.408	133.536	15.461	-38.467	-17.461
1000	31.545	140.561	21.758	-48.142	-11.189
1200	31.621	146.319	28.075	-48.419	-3.766
1400	31.667	151.197	34.405	-48.741	3.713
1600	31.697	155.428	40.741	-49.115	11.224
1800	31.717	159.163	47.083	-49.539	18.780

$\text{Sb}_2\text{S}_2(\text{g})$
Triantimony disulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	23.461	97.101	0	6.890	3.922
400	24.430	104.148	2.445	6.654	2.949
600	25.180	114.224	7.420	6.153	1.192
800	25.460	121.512	12.488	5.454	-3.666
1000	25.593	127.209	17.595	-9.863	-1.195
1200	25.666	131.882	22.721	-11.034	1.858
1400	25.710	135.842	27.859	-12.222	4.116
1600	25.739	139.277	33.004	-13.432	6.525
1800	25.758	142.310	38.154	-14.665	9.075

$\text{Sb}_4\text{S}_3(\text{g})$
Tetraantimony trisulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	35.273	115.465	0	-8.465	-5.539
400	36.326	125.998	3.653	-8.522	-4.526
600	37.104	140.905	11.011	-8.744	-2.499
800	37.386	151.623	18.464	-9.270	-1.351
1000	37.519	159.982	25.956	-29.304	4.000
1200	37.591	166.829	33.468	-30.488	10.785
1400	37.635	172.628	40.991	-31.703	17.780
1600	37.663	177.655	48.521	-32.956	24.924
1800	37.683	182.092	56.056	-34.246	32.213

$\text{SiS}(\text{g})$
Silicon monosulfide (ideal gas)

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	7.728	53.462	0	9.965	3.492
400	8.115	55.791	.808	9.851	1.296
600	8.528	59.171	2.478	9.566	-2.922
800	8.718	61.654	4.205	9.230	-7.034
1000	8.821	63.611	5.960	8.854	-11.049
1200	8.884	65.225	7.731	8.445	-15.000
1400	8.928	66.598	9.512	8.007	-18.869
1600	8.960	67.793	11.301	7.537	-22.692
1800	8.986	68.850	13.096	-4.966	-25.604
2000	9.008	69.798	14.895	-5.341	-27.883

$\text{SiS}_2(\text{c,l})$
Silicon disulfide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	18.520	19.200	0	-81.710	-69.842
400	18.790	24.680	1.900	-81.138	-65.880
600	19.530	32.423	5.725	-80.106	-58.474
800	19.870	38.071	9.653	-79.106	-51.413
1000	20.410	42.563	13.681	-78.093	-44.599
1200	20.952	46.332	17.817	-77.035	-38.007
1363	21.392	49.027	21.267	-76.134	-32.760
1363	21.750	50.494	23.267	-74.134	-32.760
1400	21.750	51.077	24.072	-73.913	-31.640
1600	21.750	53.982	28.422	-72.749	-25.696
1800	21.750	56.544	32.772	-83.639	-19.046
2000	21.750	58.835	37.122	-82.417	-11.939

*Data except enthalpy of formation at 298 K and temperature of fusion estimated.
1363 K, melting point; $\Delta \text{H}^\circ = 2.000$

$\text{SnS}(\text{c,l})$
Tin monosulfide

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	11.770	18.400	0	-41.155	-34.867
400	12.080	21.900	1.213	-41.027	-32.740
600	13.270	27.010	3.742	-42.420	-28.331
800	14.650	31.010	6.533	-41.860	-23.707
875	15.190	32.350	7.652	-41.580	-22.020
875	13.050	32.530	7.812	-41.420	-22.020
1000	13.520	34.310	9.473	-41.163	-19.271
1153	14.090	36.270	11.585	-40.777	-15.943
1153	17.900	42.820	19.137	-33.225	-15.943
1200	17.900	43.540	19.978	-32.917	-15.251

875 K, transition point; $\Delta \text{H}^\circ = 0.160$
1153 K, melting point; $\Delta \text{H}^\circ = 7.552$

SnS(g)
Tin monosulfide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.230	57.900	0	11.545	6.056
400	8.520	60.370	.856	11.316	4.215
600	8.730	63.070	2.584	9.122	1.095
800	8.810	66.390	4.338	8.645	-1.506
1000	8.860	68.360	6.105	8.169	-3.989
1200	8.890	69.980	7.879	7.684	-6.378
1400	8.910	71.350	9.660	7.193	-8.678
1600	8.940	72.550	11.445	6.690	-10.926
1800	8.960	73.600	13.234	6.177	-13.091
2000	8.980	74.540	15.028	5.658	-15.195

SnS₂(c)
Tin disulfide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	16.760	20.900	0	-67.410	-53.742
300	16.770	21.000	.031	-67.405	-53.656
400	17.190	25.890	1.731	-67.170	-49.110
500	17.610	29.780	3.471	-66.968	-44.624
600	18.030	33.020	5.253	-68.408	-39.854
700	18.450	35.830	7.077	-68.129	-35.116
800	18.870	38.320	8.948	-67.809	-30.414
900	19.290	40.570	10.851	-67.466	-25.769
1000	19.710	42.630	12.801	-67.083	-21.162

SrS(c)
Strontium monosulfide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	11.640	16.350	0	-127.355	-120.377
400*	12.000	19.820	1.203	-127.229	-118.014
600	12.710	24.832	3.680	-127.031	-113.453
800	13.120	28.548	6.266	-126.950	-108.944
1000	13.440	31.509	8.921	-127.155	-104.401
1200	13.700	33.982	11.635	-129.003	-99.557
1400	13.960	36.113	14.401	-128.831	-94.662
1600	14.210	37.994	17.218	-128.621	-89.795
1800	14.450	39.681	20.084	-160.609	-82.092
2000	14.700	41.217	22.999	-159.650	-73.420

*Data above 298 K estimated.

SrS(g)
Strontium monosulfide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.479	58.078	0	10.505	5.041
400	8.686	60.602	.875	10.303	3.205
600	8.861	64.163	2.633	9.783	-.239
800	8.942	66.724	4.414	9.059	-3.476
1000	9.037	68.728	6.211	7.995	-6.469
1200	9.267	70.393	8.038	5.260	-8.987
1400	9.758	71.855	9.935	4.564	-11.307
1600	10.567	73.207	11.962	3.983	-13.532
1800	11.637	74.511	14.179	-28.654	-12.831
2000	12.821	75.799	16.625	-28.163	-11.098

TiS(g)
Titanium monosulfide (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.060	58.890	0	62.645	55.395
400	8.420	61.320	.843	62.455	52.948
600	8.680	64.790	2.558	62.026	48.284
800	8.770	67.310	4.304	61.504	43.778
1000	8.820	69.270	6.064	60.884	39.423
1200	8.860	70.880	7.833	59.197	35.233
1400	8.880	72.250	9.606	58.595	31.280
1600	8.900	73.440	11.384	57.903	27.420
1800	8.920	74.480	13.166	57.102	23.673
2000	8.930	75.420	14.950	52.744	20.103

US(c)
Uranium monosulfide

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	12.080	18.640	0	-88.555	-82.409
400	12.690	22.290	1.266	-88.393	-80.336
600	13.310	27.570	3.873	-88.156	-76.367
800	13.730	31.460	6.579	-88.137	-72.447
1000	14.100	34.560	9.363	-89.021	-68.454
1200	14.430	37.160	12.216	-90.088	-64.179
1400	14.760	39.410	15.136	-89.910	-59.874
1600	15.080	41.400	18.120	-92.345	-55.267
1800	15.400	43.200	21.168	-92.564	-50.627
2000	15.720	44.840	24.280	-92.732	-45.960

ZnS(c)
Zinc monosulfide, wurtzite

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.016	14.060	0	-61.255	-54.355
400	11.627	17.393	1.157	-61.133	-52.015
600	12.202	22.230	3.546	-60.888	-47.512
800	12.556	25.792	6.024	-62.476	-42.812
1000	12.846	28.625	8.565	-62.318	-37.914
1200	13.110	30.991	11.161	-89.636	-32.582

ZnS(b)
Zinc monosulfide, sphalerite

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	10.840	13.800	0	-64.355	-57.377
400	11.550	17.100	1.146	-64.244	-55.009
600	12.200	21.930	3.529	-64.005	-50.449
800	12.600	25.490	6.011	-65.589	-45.683
1000	12.910	28.340	8.563	-65.420	-40.730
1200	13.200	30.720	11.175	-92.722	-35.343
1293	13.330	31.710	12.408	-92.373	-30.911

1293 K, transition point to wurtzite.

ZnS(g)
Zinc monosulfide (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.456	56.835	0	33.245	27.392
400	8.674	59.354	.874	33.084	25.417
600	8.859	62.912	2.630	32.697	21.663
800	8.942	65.473	4.411	30.411	18.330
1000	8.993	67.474	6.205	29.822	15.378
1200	9.030	69.117	8.007	1.710	13.013
1400	9.061	70.512	9.816	1.612	14.903
1600	9.089	71.723	11.631	1.506	16.808
1800	9.114	72.795	13.452	1.391	18.728
2000	9.138	73.757	15.277	1.268	20.658

Tellurides

Units: T is in K; C_p° and S° are in cal/mol·K; $H^\circ - H_{298}^\circ$, ΔH_f° and ΔG_f° are in kcal/mol.

All formation reactions for tellurides use $Te_2(g)$. A formation table for $2Te(c,l) = Te_2(g)$ is included.

Most data were from reference 23.

Additional sources:

$As_2Te_3(c)$:

Medzhidov, R. A., and S. M. Rasulov. Bysokotemperaturnye Entalpiya, Teploemkost, Entropiya i Izobarno - Izotermicheskii Potentsial As_2Te_3 (High-Temperature Enthalpy, Heat Capacity, Entropy, and Gibbs Free Energy of As_2Te_3). Vses. Inst. Nauchnoi i Tekh. Inf., Moscow, Doc. 3343-74, 1974, 7 pp.

Zhdanov, V. M., and A. K. Mal'tsev. Low Temperature Heat Capacity, Enthalpy, and Entropy of Crystalline and Vitreous Arsenic Sesquiselenide and of Crystalline Arsenic Sesquitelluride. Russ. J. Phys. Chem. (Engl. Transl.), v. 42, 1968, pp. 1078-1080.

$CuTe(c)$ and $Cu_2Te(c)$:

Abbasov, A. S., I. Kh. Azizov, N. A. Alieva, I. Ya. Aliev, F. M. Mustafaev, and A. N. Mamedov. Thermodynamic Properties of Copper Tellurides. Russ. J. Phys. Chem. (Engl. Transl.), v. 50, 1976, p. 1309.

Mills, K. C., and M. J. Richardson. Heat Capacity of Copper(I) Telluride(c), Copper(II) Telluride, and Silver Telluride(c) ($Ag_{1.64}Te$). Thermochem. Acta, v. 6, 1973, pp. 427-438.

$EuTe(c)$:

McMasters, O. D., K. A. Gschneidner, Jr., E. Kaldis, and G. Sampietro. High-Temperature Enthalpies and Standard Gibbs Free Energies of Formation of the Europium Chalcogenides: EuO , EuS , $EuSe$, and $EuTe$. J. Chem. Thermodyn., v. 6, 1974, pp. 845-857.

$GaTe(c,l)$:

Kerimov, I. G., K. K. Mamedov, M. I. Mekhtiev, and V. N. Kostyukov. Low-Temperature Specific Heats of Gallium and Indium Tellurides. Russ. J. Phys. Chem. (Engl. Transl.), v. 45, 1971, pp. 1118-1119.

Said, H., and R. Castanet. Thermodynamic Investigations of Liquid and Solid Ga-Te Alloys. J. Less-Common Met., v. 68, 1979, pp. 213-221.

$GeTe(c,l)$:

Castanet, R., and C. Bergman. Capacite Calorifique Du Compose $Ge_{0.5}Te_{0.5}$ A L'Etat Liquide et Solide (Heat Capacity of $Ge_{0.5}Te_{0.5}$ in the Solid and Liquid State). J. Less-Common Met., v. 68, 1979, pp. 119-124.

Zhdanov, V. M. Low-Temperature Heat Capacity, Enthalpy, and Entropy of Germanium Telluride. Russ. J. Phys. Chem. (Engl. Transl.), v. 45, 1971, p. 1357.

MnTe(c) :

Gronvold, F., N. J. Kveseth, F. D. S. Marques, and J. Tichy. Thermophysical Properties of Manganese Monotelluride From 298 to 700 K. Lattice Constants, Magnetic Susceptibility, and Antiferromagnetic Transition. J. Chem. Thermodyn., v. 4, 1972, pp. 795-806.

Kelley, K. K. Specific Heats at Low Temperatures of Manganese, Manganous Selenide, and Manganous Telluride. J. Am. Chem. Soc., v. 61, 1939, p. 203.

 $\text{RuTe}_2(\text{c})$:

Svendsen, S. R. Decomposition Pressures and Thermodynamic Properties of RuTe_2 . J. Chem. Thermodyn., v. 9, 1977, pp. 789-800.

 SnTe(c,l) :

Medzhidov, R. A., and S. M. Rasulov. Entalpiya i Teploemkost SnTe pri Vysokikh Temperatura v Tverdom i Shidkom Sostoyaniyakh (Enthalpy and Heat Capacity of SnTe at High Temperatures in the Solid and Liquid State). Prikl. Fiz. Tverd. Tela, 1973, pp. 127-133.

$\text{Ag}_2\text{Te}(\text{c})$
Silver telluride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	20.320	36.700	0	-27.765	-23.419
300	20.360	36.840	.040	-27.755	-23.394
400	22.670	43.000	2.189	-27.270	-22.008
421	23.180	44.180	2.671	-27.141	-21.736
421	20.840	47.920	4.248	-25.564	-21.736
500	20.310	51.460	5.871	-25.282	-21.044
600	20.080	55.130	7.884	-24.995	-20.219
700	20.080	58.220	9.892	-24.754	-19.440
800	20.080	60.900	11.900	-24.555	-18.696

421 K, transition point; $\Delta\text{H}^\circ = 1.577$

$\text{As}_2\text{Te}_3(\text{c}, \text{l})$
Diarsenic tritelluride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	30.470	54.100	0	-66.495	-49.866
300	30.564	54.289	.056	-66.485	-49.766
358	38.407	60.222	2.010	-65.987	-46.570
358	26.571	60.222	2.010	-65.987	-46.570
400	29.588	63.350	3.195	-65.865	-44.299
500	33.286	70.385	6.355	-65.275	-38.966
600	37.808	76.810	9.885	-64.368	-33.779
655	41.855	80.291	12.070	-63.647	-31.007
655	69.000	99.100	24.390	-51.327	-31.007
700	69.000	103.685	27.495	-49.432	-29.675
800	69.000	112.898	34.395	-45.257	-27.141
900	69.000	121.025	41.295	-57.662	-24.676

358 K, transition point; $\Delta\text{H}^\circ = 0$

655 K, melting point; $\Delta\text{H}^\circ = 12.320$

$\text{AuTe}_2(\text{c})$
Gold ditelluride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.330	33.870	0	-42.780	-31.054
300	18.340	33.980	.034	-42.773	-30.981
400	19.030	39.360	1.903	-42.397	-27.108
500	19.830	43.690	3.845	-41.974	-23.332
600	20.670	47.380	5.870	-41.496	-19.645
700	21.540	50.630	7.981	-40.960	-16.044

$\text{Bi}_2\text{Te}_3(\text{c}, \text{l})$
Dibismuth tritelluride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	29.740	62.400	0	-76.295	-59.144
300	29.750	62.580	.055	-76.286	-59.036
400	31.090	71.340	3.102	-75.800	-53.362
500	32.410	78.420	6.277	-75.285	-47.807
600	33.730	84.450	9.584	-80.163	-41.817
700	35.050	89.750	13.023	-79.504	-35.477
800	36.370	94.510	16.594	-78.708	-29.232
850	37.030	96.740	18.429	-78.259	-26.169
850	40.000	130.340	46.989	-49.699	-26.169
900	40.000	132.630	48.989	-49.088	-24.806
1000	40.000	136.840	52.989	-47.873	-22.158

850 K, melting point; $\Delta\text{H}^\circ = 28.560$

$\text{CdTe}(\text{c})$
Cadmium monotelluride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.920	22.800	0	-43.265	-37.148
300	11.940	22.870	.022	-43.262	-37.109
400	12.730	26.420	1.257	-43.102	-35.084
500	13.520	29.350	2.569	-42.902	-33.104
600	14.310	31.880	3.961	-44.139	-31.143
700	15.100	34.150	5.431	-43.844	-29.007
800	15.890	36.220	6.981	-43.477	-26.913
900	16.680	38.130	8.609	-43.039	-24.859
1000	17.470	39.930	10.317	-42.530	-22.865

$\text{CuTe}(\text{c})$
Copper monotelluride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	13.012	20.500	0	-24.765	-19.291
300	13.028	20.581	.024	-24.760	-19.258
400	13.882	24.448	1.371	-25.507	-15.602
500	14.897	27.644	2.804	-26.727	-11.411
600	17.796	30.555	4.406	-26.369	-9.016

$\text{Cu}_2\text{Te}(\text{c})$
Dicopper telluride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	18.554	28.800	0	-28.265	-22.903
300	18.584	28.915	.034	-28.261	-22.871
400	20.215	34.484	1.974	-27.949	-21.117
440	20.868	36.441	2.796	-27.790	-20.441
440	23.064	36.714	2.916	-27.670	-20.441
500	23.064	39.661	4.299	-27.296	-19.482
526	23.064	40.832	4.900	-27.135	-19.079
526	25.552	41.060	5.020	-27.015	-19.079
600	31.013	44.625	7.028	-26.275	-18.005
600	31.190	45.422	7.506	-25.797	-18.005
625	31.190	46.695	8.285	-25.451	-17.688
625	24.498	47.690	8.907	-24.829	-17.688
700	24.140	50.445	10.731	-24.315	-16.861
750	23.901	52.100	11.932	-23.997	-16.340
750	22.706	52.739	12.410	-23.519	-16.340
800	22.706	54.204	13.545	-23.276	-15.870

440 K, transition point; $\Delta\text{H}^\circ = 0.120$ 526 K, transition point; $\Delta\text{H}^\circ = 0.120$ 600 K, transition point; $\Delta\text{H}^\circ = 0.478$ 625 K, transition point; $\Delta\text{H}^\circ = 0.622$ 750 K, transition point; $\Delta\text{H}^\circ = 0.478$

$\text{EuTe}(\text{c})$
Europium monote telluride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298*	11.780	27.170	0	-112.365	-105.697
400	12.150	30.690	1.220	-112.270	-103.432
600	12.670	35.720	3.710	-112.072	-99.047
800	13.120	39.430	6.280	-111.948	-94.740
1000	13.540	42.400	8.950	-111.939	-90.435
1200	13.950	44.900	11.700	-114.243	-85.891
1400	14.370	47.090	14.530	-114.269	-81.177
1600	14.770	49.030	17.450	-114.215	-76.441

*Entropy at 298 K estimated.

$\text{FeTe}_{0.90}(\text{c})$
Iron telluride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	11.870	19.140	0	-22.799	-18.260
400*	12.450	22.720	1.242	-22.596	-16.742
600	12.980	27.880	3.791	-22.280	-13.886
800	13.290	31.660	6.419	-22.156	-11.117
1000	13.550	34.650	9.105	-22.441	-8.334
1200	13.780	37.140	11.838	-23.162	-5.438

*Data above 298 K estimated.

$\text{FeTe}_2(\text{c})$
Iron ditelluride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	17.620	23.940	0	-55.630	-42.377
300*	17.640	24.050	.032	-55.625	-42.297
400	18.620	29.270	1.849	-55.313	-37.899
500	19.340	33.500	3.748	-54.992	-33.581
600	19.950	37.090	5.714	-54.676	-29.328
700	20.520	40.200	7.737	-54.377	-25.123
800	21.060	42.980	9.816	-54.109	-20.970
900	21.580	45.490	11.948	-53.900	-16.842
933	21.750	46.270	12.663	-53.860	-15.483

*Data above 298 K estimated.

933 K, melting point

$\text{GaTe}(\text{c}, \text{l})$
Gallium monote telluride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	11.813	20.410	0	-97.965	-91.918
400*	12.619	24.003	1.247	-99.173	-89.442
600	13.646	29.327	3.880	-98.727	-84.662
800	14.476	33.368	6.694	-98.122	-80.062
1000	15.249	36.602	9.667	-97.388	-75.630
1107	15.652	38.253	11.320	-96.946	-73.324
1107	41.000	46.726	20.700	-87.566	-73.324
1200	41.000	50.033	24.513	-84.814	-72.239

*Data extrapolated between 298 K and 1107 K.

1107 K, melting point; $\Delta\text{H}^\circ = 9.380$

$\text{GeTe}(\text{c}, \text{l})$
Germanium monote telluride

T	Cp°	S°	$\text{H}^\circ - \text{H}_{298}^\circ$	ΔHf°	ΔGf°
298	12.400	21.250	0	-30.765	-25.662
400	12.910	24.970	1.290	-30.508	-23.962
600	14.930	30.520	4.040	-29.852	-20.810
680	16.290	32.470	5.290	-29.458	-19.630
680	12.250	32.470	5.290	-29.458	-19.630
800	12.780	34.500	6.790	-29.261	-17.913
990	13.620	37.310	9.300	-28.874	-15.264
990	21.100	46.790	18.680	-19.494	-15.264
1000	21.020	47.000	18.890	-19.398	-15.223
1200	19.550	50.700	22.950	-17.675	-14.543

680 K, transition point; $\Delta\text{H}^\circ = 0$ 990 K, melting point; $\Delta\text{H}^\circ = 9.380$

GeTe(g)
Germanium monotelluride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.590	61.100	0	15.635	8.857
400	8.740	63.650	.885	15.487	6.561
600	8.850	67.220	2.646	15.154	2.176
800	8.880	69.770	4.419	14.768	-2.100
1000	8.900	71.760	6.198	14.310	-6.275
1200	8.910	73.380	7.979	13.754	-10.329
1400	8.910	74.750	9.761	4.352	-12.903
1600	8.920	75.950	11.544	3.771	-15.349
1800	8.920	77.000	13.328	3.194	-17.694
2000	8.920	77.940	15.113	2.627	-19.973

H₂Te(g)
Hydrogen telluride (ideal gas)

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	8.500	54.700	0	4.635	6.854
400	9.170	57.300	.904	4.384	7.653
600	10.000	61.190	2.826	4.003	9.374
800	10.670	64.160	4.894	3.726	11.207
1000	11.290	66.610	7.090	3.523	13.098
1200	11.880	68.720	9.408	3.377	15.033
1400	12.470	70.600	11.844	3.278	16.978
1600	13.060	72.300	14.397	3.243	18.939
1800	13.640	73.870	17.067	3.288	20.907
2000	14.220	75.340	19.853	3.421	22.855

HgTe(c)
Mercury monotelluride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	13.100	27.000	0	-26.765	-20.183
300*	13.100	27.080	.025	-26.760	-20.142
400	13.320	30.880	1.346	-26.540	-17.968
500	13.540	33.880	2.688	-26.298	-15.856
600	13.750	36.360	4.053	-26.038	-13.785
700	13.970	38.500	5.439	-39.809	-10.194
800	14.190	40.380	6.846	-39.372	-5.996
900	14.400	42.060	8.276	-38.919	-1.847

*Data above 298 K estimated.

InTe(c,l)
Indium monotelluride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	11.410	25.260	0	-36.365	-30.553
400*	11.880	28.680	1.186	-36.303	-28.579
600	12.810	33.670	3.655	-36.924	-24.432
800	13.730	37.480	6.310	-36.605	-20.312
965	14.500	40.130	8.640	-36.220	-16.992
965	14.500	49.020	17.220	-27.640	-16.992
1000	14.500	49.540	17.727	-27.548	-16.610
1200	14.500	52.180	20.627	-27.040	-14.463

*Data above 298 K estimated except T and ΔH° fusion, 965 K, melting point; ΔH° = 8.580

La₂Te₃(c)
Dilanthanum tritelluride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	31.580	55.370	0	-244.995	-225.724
400*	31.910	64.700	3.233	-244.433	-219.235
600	32.550	77.760	9.679	-243.506	-206.846
800	33.190	87.210	16.253	-242.516	-194.784
1000	33.830	94.680	22.955	-241.749	-182.934
1200	34.470	100.910	29.785	-245.788	-171.112
1400	35.110	106.270	36.743	-245.209	-158.724
1600	35.750	111.000	43.829	-244.536	-146.408

*Data above 298 K estimated.

MnTe(c)
Manganese monotelluride

T	Cp°	S°	H°-H° ₂₉₈	ΔHf°	ΔGf°
298	18.000	22.400	0	-45.765	-40.939
300	18.451	22.512	.033	-45.752	-40.911
305	20.315	22.831	.129	-45.709	-40.831
400	13.239	26.664	1.466	-45.411	-39.362
500	13.012	29.585	2.774	-45.249	-37.869
600	13.236	31.975	4.084	-45.137	-36.404
700	13.645	34.044	5.427	-45.041	-34.960

305 K, transition point; ΔH° = 0

NiTe_{1.10}(c)
Nickel telluride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	13.090	20.090	0	-34.782	-28.497
300	13.110	20.170	.024	-34.778	-28.459
400	13.750	24.050	1.372	-34.566	-26.387
500	14.130	27.160	2.767	-34.374	-24.365
600	14.420	29.760	4.195	-34.230	-22.376
700	14.660	32.000	5.650	-34.084	-20.404
800	14.880	33.970	7.126	-33.865	-18.469
900	15.080	35.740	8.624	-33.644	-16.564
1000	15.270	37.340	10.142	-33.425	-14.682

PbTe(c)
Lead monotelluride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	12.080	26.300	0	-35.565	-29.565
300*	12.090	26.380	.022	-35.563	-29.530
400	12.360	29.890	1.244	-35.424	-27.538
500	12.630	32.680	2.493	-35.288	-25.585
600	12.890	35.000	3.769	-35.161	-23.653
700	13.160	37.010	5.072	-35.195	-21.555
800	13.430	38.780	6.402	-35.063	-19.466
900	13.700	40.380	7.758	-35.899	-17.404
1000	13.970	41.840	9.142	-35.710	-15.365

*Data above 298 K estimated.

PbTe(g)
Lead monotelluride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.780	64.900	0	17.935	12.427
400	8.850	67.500	.899	17.731	10.573
600	8.900	71.100	2.676	17.246	7.094
800	8.920	73.660	4.458	15.493	4.185
1000	8.930	75.650	6.242	14.890	1.425
1200	8.930	77.280	8.028	14.285	-1.206
1400	8.930	78.660	9.814	13.667	-3.756
1600	8.930	79.850	11.601	13.042	-6.222
1800	8.940	80.900	13.388	12.420	-8.558
2000	8.940	81.840	15.175	11.807	-10.853

RuTe₂(c)
Ruthenium ditelluride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	17.700	21.400	0	-71.830	-57.725
400	18.230	26.690	1.835	-71.490	-52.959
600	18.470	34.140	5.511	-70.878	-43.826
800	18.730	39.480	9.228	-70.369	-34.888
1000	19.250	43.720	13.022	-69.909	-26.082
1200	20.050	47.290	16.947	-69.440	-17.347
1400	21.140	50.460	21.061	-68.906	-8.710

Sb₂Te₃(c,l)
Diantimony tritelluride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	30.770	58.900	0	-70.995	-54.398
300*	30.790	59.090	.057	-70.984	-54.295
400	32.060	68.120	3.199	-70.385	-48.819
500	33.330	75.410	6.467	-69.713	-43.500
600	34.600	81.600	9.865	-68.966	-38.330
700	35.870	87.030	13.389	-68.154	-33.283
800	37.140	91.900	17.039	-67.295	-28.371
892	38.310	96.000	20.510	-66.471	-23.934
892	47.000	122.550	44.190	-42.791	-23.934
900	47.000	122.980	44.566	-42.649	-23.776
1000	47.000	127.930	49.266	-50.414	-20.769

*Data above 298 K estimated except T and ΔH° fusion.
892 K, melting point; ΔH° = 23.680

SiTe(g)
Silicon monotelluride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.250	58.200	0	33.335	26.548
400	8.530	60.670	.857	33.228	24.242
600	8.730	64.180	2.587	32.936	19.808
800	8.810	66.700	4.343	32.558	15.490
1000	8.860	68.670	6.110	32.108	11.283
1200	8.880	70.290	7.884	31.599	7.155
1400	8.910	71.660	9.663	31.038	3.129
1600	8.920	72.850	11.446	30.446	-0.834
1800	8.940	73.910	13.233	17.835	-3.882
2000	8.960	74.850	15.022	17.372	-6.268

SnTe(c,l)
Tin monotelluride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298*	11.612	24.000	0	-33.965	-28.249
400	12.149	27.489	1.211	-33.881	-26.309
600	12.991	32.584	3.729	-35.352	-22.242
800	13.551	36.405	6.388	-34.995	-17.925
1000	13.827	39.464	9.131	-34.581	-13.706
1068	13.857	40.374	10.072	-34.439	-12.289
1068	14.876	49.461	19.777	-24.734	-12.289
1200	14.876	51.195	21.741	-24.333	-10.774

*Entropy at 298 K estimated.

1068 K, melting point; ΔH° = 9.705

SnTe(g)
Tin monotelluride (ideal gas)

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	8.690	62.700	0	19.135	13.312
400	8.800	65.280	.893	18.901	11.357
600	8.880	68.860	2.662	16.681	8.025
800	8.910	71.420	4.441	16.159	5.216
1000	8.920	73.410	6.224	15.612	2.541
1200	8.920	75.040	8.008	15.034	-.021
1400	8.930	76.410	9.793	14.426	-2.474
1600	8.930	77.610	11.579	13.808	-4.864
1800	8.930	78.660	13.366	13.194	-7.153
2000	8.930	79.600	15.153	12.589	-9.377

Hl₂Te(c,l)
Dithallium telluride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	18.190	41.600	0	-38.365	-32.398
300*	18.200	41.710	.034	-38.363	-32.360
400	18.850	47.040	1.886	-38.233	-30.383
500	19.500	51.310	3.804	-38.117	-28.429
600	20.150	54.930	5.786	-40.259	-26.381
700	20.800	58.080	7.834	-40.096	-24.069
726	20.970	58.850	8.376	-40.045	-23.480
726	21.000	66.560	13.976	-34.445	-23.480
800	21.000	68.590	15.530	-34.293	-22.376

*Data above 298 K estimated except T and ΔH° of fusion.
726 K, melting point; ΔH° = 5.600

ZnTe(c)
Zinc monotelluride

T	Cp°	S°	H°-H ₂₉₈ °	ΔHf°	ΔGf°
298	11.880	18.600	0	-47.665	-41.021
400	12.330	22.160	1.234	-47.508	-38.776
600	13.230	27.330	3.790	-47.162	-34.481
800*	14.120	31.260	6.525	-48.565	-30.042
1000	15.020	34.510	9.440	-48.119	-25.463
1200	15.920	37.320	12.533	-47.043	-20.505

*Data above 780 K extrapolated.

REFERENCES

1. Barin, I., O. Knacke, and O. Kubaschewski. Thermochemical Properties of Inorganic Substances. Springer-Verlag, 1977, 861 pp.
2. Brewer, L. (ed.). Molybdenum: Physico-Chemical Properties of Its Compounds and Alloys. At. Energy Rev. Spec. Issue No. 7, 1980, 714 pp.
3. Chase, M. W., Jr., J. L. Curnutt, J. R. Downey, R. A. McDonald, A. N. Syverud, and E. A. Valenzuela. JANAF Thermochemical Tables, 1982 Supplement. J. Phys. and Chem. Ref. Data, v. 11, 1982, pp. 695-940.
4. Chase, M. W., J. L. Curnutt, A. T. Hu, H. Prophet, A. N. Syverud, and L. C. Walker. JANAF Thermochemical Tables, 1974 Supplement. J. Phys. and Chem. Ref. Data, v. 3, 1974, pp. 311-480.
5. Chase, M. W., Jr., J. L. Curnutt, R. A. McDonald, and A. N. Syverud. JANAF Thermochemical Tables, 1978 Supplement. J. Phys. and Chem. Ref. Data, v. 7, 1978, pp. 793-940.
6. Chase, M. W., J. L. Curnutt, H. Prophet, R. A. McDonald, and A. N. Syverud. JANAF Thermochemical Tables, 1975 Supplement. J. Phys. and Chem. Ref. Data, v. 4, 1975, pp. 1-175.
7. Dow Chemical Co., Thermal Research Laboratory. JANAF Thermochemical Tables. NSRDS-NBS 37, 2d ed., 1971, 1141 pp.
8. _____. JANAF Thermochemical Tables, Supplement 53. Sept. 1978; available from Dow Chemical Co., Thermal Res. Lab., Midland, MI.
9. _____. JANAF Thermochemical Tables, Supplement 54. Dec. 1978; available from Dow Chemical Co., Thermal Res. Lab., Midland, MI.
10. _____. JANAF Thermochemical Tables, Supplement 55. Mar. 1979; available from Dow Chemical Co., Thermal Res. Lab., Midland, MI.
11. _____. JANAF Thermochemical Tables, Supplement 56. June 1979; available from Dow Chemical Co., Thermal Res. Lab., Midland, MI.
12. _____. JANAF Thermochemical Tables, Supplement 57. Sept. 1979; available from Dow Chemical Co., Thermal Res. Lab., Midland, MI.
13. _____. JANAF Thermochemical Tables, Supplement 58. Dec. 1979; available from Dow Chemical Co., Thermal Res. Lab., Midland, MI.
14. Gurvich, L. V., I. V. Veits, V. A. Medvedev, G. A. Khachkuvuzov, V. S. Yungman, G. A. Gergman, V. F. Baibuz, V. S. Iorish, G. N. Yurkov, S. I. Gorbov, I. I. Nazarenko, O. V. Dorofeeva, L. F. Kuratova, E. L. Osina, A. V. Gusarov, V. Ya. Leonidov, I. N. Przhevalskii, L. Rugatskii, Yu. M. Efremov, V. G. Ryabova, V. Yu. Zitzerman, Yu. G. Khait, E. A. Shenyavskan, M. E. Efimov, V. A. Kulemza, Yu. S. Khodoev, S. E. Tomberg, V. N. Vdovin, A. Ya. Yakobson, and M. S. Demidova. Termodinamicheski Svoistva Individual'nykh Veshchestv, Tom 2: Elementy C, Si, Ge, Sn, Pb i Ikh Soedineniya, Kniga 2: Tablitsy Termodinamicheskikh Svoistv (Thermodynamic Properties of Individual Substances, v. 2: The Elements C, Si, Ge, Sn, Pb, and Their Compounds, Book 2: Tables of Thermodynamic Properties). Nauka, Moscow, 3d ed., 1979, 344 pp.

REFERENCES--Continued

15. Gurvich, L. V., I. V. Veits, V. A. Medvedev, V. S. Yungman, G. A. Bergman, V. F. Baily, V. S. Iorish, A. V. Gusarov, S. I. Gorbov, I. I. Nazarenko, V. Ya. Leonidov, V. G. Ryabova, O. V. Dorofeeva, E. L. Osina, M. E. Efimov, E. A. Shenyavskan, P. I. Tolmach, M. F. Moskovskan, Yu. S. Knodeev, V. Yu. Zitzerman, L. M. Gorokhov, M. E. Khandamirova, I. V. Sidorova, and M. S. Demidova. *Termodinamicheski Svoistva Individual'nykh Veshchestv, Tom 3: Elementy B, Al, Ga, In, Tl, Be, Mg, Ca, Sr, Ba i Ikh Soedineniya, Kniga 2: Tablitsy Termodinamicheskikh Svoistv* (Thermodynamic Properties of Individual Substances, v. 3: The Elements B, Al, Ga, In, Tl, Be, Mg, Ca, Sr, Ba, and Their Compounds, Book 2: Tables of Thermodynamic Properties). Nauka, Moscow, 3d ed., 1981, 472 pp.
16. Hultgren, R., P. D. Desai, D. I. Hawkins, M. Gleiser, and K. K. Kelley. *Selected Values of the Thermodynamic Properties of Binary Alloys*. ASM, 1973, 1439 pp.
17. Kelley, K. K. *Contributions to the Data on Theoretical Metallurgy. XIII. High-Temperature Heat-Content, Heat-Capacity, and Entropy Data for the Elements and Inorganic Compounds*. BuMines B 584, 1960, 232 pp.
18. Kelley, K. K., and E. G. King. *Contributions to the Data on Theoretical Metallurgy. XIV. Entropies of the Elements and Inorganic Compounds*. BuMines B 592, 1961, 149.
19. King, E. G., A. D. Mah, and L. B. Pankratz. *INCRA Series on the Metallurgy of Copper. Monograph II. Thermodynamic Properties of Copper and Its Inorganic Compounds*. Int. Copper Res. Assoc., 1973, 257 pp.
20. Kubaschewski, O., and D. B. Alcock. *Metallurgical Thermochemistry*. Pergamon, 5th ed., 1979, 449 pp.
21. Mah, A. D. *Thermodynamic Data for Arsenic Sulfide Reactions*. BuMines RI 8671, 1982, 85 pp.
22. Mah, A. D., and L. B. Pankratz. *Contributions to the Data on Theoretical Metallurgy. XVI. Thermodynamic Properties of Nickel and Its Inorganic Compounds*. BuMines B 668, 1976, 125 pp.
23. Mills, K. C. *Thermodynamic Data for Inorganic Sulphides, Selenides, and Tellurides*. Butterworth, 1974, 845 pp.
24. Pankratz, L. B. *Thermodynamic Properties of Elements and Oxides*. BuMines B 672, 1982, 509 pp.
25. Pankratz, L. B. *Thermodynamic Properties of Halides*. BuMines B 674, 1984, 841 pp.
26. Parker, V. B., D. D. Wagman, and W. H. Evans. *Selected Values of Chemical Thermodynamic Properties. Tables for the Alkaline Earth Elements (Elements 92 Through 97 in the Standard Order of Arrangement)*. NBS Tech. Note 270-6, 1971, 119 pp.
27. Parker, V. B., D. D. Wagman, and D. Garvin. *Selected Thermochemical Data Compatible With the CODATA Recommendations*. NBSIR 75-968, 1976, 34 pp.
28. Schick, J. L. *Thermodynamics of Certain Refractory Compounds*. Academic Press, v. 2, 1966, 775 pp.
29. Schumm, R. H., D. D. Wagman, S. M. Bailey, W. H. Evans, and V. B. Parker. *Selected Values of Chemical Thermodynamic Properties. Tables for the Lanthanide (Rare Earth) Elements (Elements 62 Through 76 in the Standard Order of Arrangement)*. NBS Tech. Note 270-7, 1973, 93 pp.

REFERENCES--Continued

30. Wagman, D. D., W. H. Evans, V. B. Parker, I. Halow, S. M. Bailey, and R. H. Schumm. Selected Values of Chemical Thermodynamic Properties. Tables for the First Thirty-Four Elements in the Standard Order of Arrangement. NBS Tech. Note 270-3, 1968, 264 pp.
31. _____. Selected Values of Chemical Thermodynamic Properties. Tables for Elements 35 Through 53 in the Standard Order of Arrangement. NBS Tech. Note 270-4, 1968, 152 pp.
32. Wagman, D. D., W. H. Evans, V. B. Parker, I. Halow, S. M. Bailey, R. H. Schumm, and K. L. Churney. Selected Values of Chemical Thermodynamic Properties. Tables for Elements 54 Through 61 in the Standard Order of Arrangement. NBS Tech. Note 270-5, 1971, 49 pp.
33. Wagman, D. D., W. H. Evans, V. B. Parker, R. H. Schumm, and R. L. Nuttall. Selected Values of Chemical Thermodynamic Properties. Compounds of Uranium, Protactinium, and the Alkali Metals. NBS Tech. Note 270-8, 1981, 149 pp.



REPORT DOCUMENTATION PAGE		1. REPORT NO. BuMines B 677	2.	3. REPORT'S ACCESSION NO.
4. Title and Subtitle Thermodynamic Data for Mineral Technology			5. Report Date 1985	
7. Author(s) L. B. Pankratz, J. M. Stuve, and N. A. Gokcen			6. Performing Organization Report No.	
8. Performing Organization Name and Address U.S. Bureau of Mines Albany Research Center P.O. Box 70 Albany, OR 97321			10. Project/Task/Work Unit No.	
			11. Contract/Grant/Order No. (C) (G)	
12. Submitting Organization Name and Address Office of Assistant Director--Minerals & Materials Research Bureau of Mines U.S. Department of the Interior Washington, DC 20241			13. Type of Report & Period Covered Bulletin 3/82--3/84	
14. Supplementary Notes			14.	
16. Abstract (Limit 200 words) Thermodynamic data on the elements, oxides, sulfides, halides, and selected hydrides, carbides, nitrides, carbonates, sulfates, silicates, and miscellaneous compounds were reviewed, evaluated, and compiled at the Bureau of Mines. Values for C_p , S° , H_{298}° , ΔH_f° , and ΔG_f° are given in tabular form. A brief thermodynamic background and a number of examples and applications are presented.				
17. Document Analysis & Descriptors Thermodynamic data b. Keywords/Descriptors/Topic Terms c. OCSAT Field/Group				
1		19. Security Class (This Record) Unclassified		21. No. of Pages 355
		20. Security Class (This Page) Unclassified		22. Price

