4j. Temperatures, Pressures, and Heats of Transition, Fusion and Vaporization

D. D. WAGMAN, T. L. JOBE, E. S. DOMALSKI, AND R. H. SCHUMM

The National Bureau of Standards

Table 4j-1 summarizes the data on the temperatures, pressures, and heats for the processes of transition, fusion, and vaporization for a selected list of substances. The table comprises data on stoichiometric inorganic compounds and a small number of organic compounds containing one carbon atom. We have included all the chemical elements for which data are available. We have also included data for halides, oxides, and some nitrates, sulfates, sulfides, and other miscellaneous salts. In some cases, thermodynamic data for vaporization have not been given because of vapor dissociation or decomposition. Noncongruent melting data have also not been included.

Symbols in Table 4j-1

c	crystal
liq	liquid
g	gas
tr	transition
fus	fusion
vap	vaporization
sub	sublimation
equil.	equilibrium mixture of molecular species
g, std.	gas in the standard state (ideal gas at 1 atm)
orthorh.	orthorhombic
monocl.	monoclinic

Units in Table 4j-1

The units of energy in Table 4j-1 are the kilojoule (kJ) and the kilocaloric (kcal), connected by the relation

$$1 \text{ kcal} = 4.1840 \text{ kJ}$$

The unit of mass is the mole (mol) based on the mass in grams corresponding to the formula as written in the column headed "Substance." The atomic weights are taken from A. E. Cameron and E. Wichers, *J. Am. Chem. Soc*, **84**, 4175 (1962).

The equilibrium saturation pressure is given in mm Hg (1 mm Hg = 133.322 N/m^2). When needed, exponents of the base 10 are indicated in parentheses. For example, 2.66 (E-9) means 2.66×10^{-9}. The equilibrium temperature is given in kelvins (K) on the International Temperature Scale (1948).

Sources of the Data

The data on transition properties of inorganic substances were summarized in *NBS Circ.* 500 (see ref. 320). Selected references to data published since 1950 are indicated in Table 4j-2, in which the numbers following the chemical formulas refer to the bibliography. We have also made considerable use of such reviews as those by Hultgren et al. [164] and Glushko [129].

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
Ac.....	fus	c	liq	.....	1323		
	vap	liq	g	760	3473		
Ag.....	fus	c	liq	.....	1234	2.70	11.30
	vap	liq	g	760	2436	59.90	250.63
AgBr.....	fus	c	liq	.....	697	2.32	9.707
	vap	liq	g	760	1778	44.0	184.1
AgCN.....	fus	c	liq	.....	619		
AgCl.....	fus	c	liq	.....	728.6	3.04	12.72
	vap	liq	g	760	1818	45.5	190.4
AgF.....	fus	c	liq	.....	708		
	vap	liq	g				
AgI.....	tr	c, β	c, α	.....	423	1.45	6.067
	fus	c, α	liq	.....	831	2.25	9.41
	vap	liq	g	760	1777	34.4	143.9
$AgNO_3$.....	tr	c	c	.....	432.5	0.57	2.38
	fus	c	liq	.....	483	2.89	12.09
Ag_2S.....	tr	c, β	c, α	.....	450	1.0	4.18
Ag_2SO_4.....	tr	c	c	.....	703	1.9	7.95
	fus	c	liq	.....	933	4	16.7
Ag_2Se.....	tr	c	c	.....	406	1.68	7.029
	fus	c	liq	0.11	1163		
Al.....	fus	c	liq	2.66(E − 9)	933.2	2.58	10.79
	vap	liq	g	760	2793	70.13	293.43
Al_2Br_6.....	fus	c	liq	4.38	371.1	5.4	22.6
	sub	c	g	4.38	371.1	18.4	76.98
	vap	liq	g	760	528	11.0	46.53
Al_2Cl_6.....	fus	c	liq	1,690	465.6		
	sub	c	g	1,690	465.6	27.1	113.4
AlF_3.....	tr	c	c	.....	728	0.135	0.5648
AlI_3.....	fus	c	liq	.....	461.4		
Al_2O_3.....	fus	c	liq	.....	2323		
$AlPO_4$.....	tr	c	c	.....	978	0.26	1.098
Am.....	fus	c	liq	1.4(E − 3)	1268	2.9	12.1
Ar.....	fus	c	liq	516.8	83.81	0.284	1.188
	vap	liq	g	760	87.29	1.555	6.506
As.....	sub	c	g, equil.	760	885		
$AsCl_3$.....	fus	c	liq	.....	257	2.44	10.21
	vap	liq	g	760	404.5	8.20	34.31
AsF_3.....	fus	c	liq	.....	267.21	2.486	10.401
	vap	liq	g	142.6	292.50	8.566	35.840
	vap	liq	g	760	331	8.00	33.472

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
AsF_5	fus	c	liq	149	192.9	2.71	11.34
	vap	liq	g	149	192.9		
	vap	liq	g	760	220.6	4.96	20.75
AsF_3O	fus	c	liq	.....	204.9		
	vap	liq	g	760	248	5.0	20.92
AsH_3	tr	c, III	c, II	.....	32	0.024	0.100
	tr	c, II	c, I	.....	105.55	0.131	0.5481
	fus	c, I	liq	22.38	156.23	0.286	1.197
	vap	liq	g	22.38	156.23		
	vap	liq	g	760	210.68	3.998	16.728
AsI_3	fus	c	liq	1.1	413.6	5.21	21.80
	vap	liq	g	760	643.7	13.45	56.28
As_4O_6	fus	c, octahed.	liq	28	551	11.9	49.79
	sub	c, octahed.	g	28	551	26.1	109.2
	fus	c, monocl.	liq	67	587	8.8	36.8
	vap	liq	g	760	731	13.40	56.06
Au	fus	c	liq	2.15(E − 5)	1336	2.955	
	vap	liq	g	760	3081	80.88	335.03
B	fus	c	liq	.....	2340	5	20.9
	vap	liq	g	760	4075		
BBr_3	fus	c	liq	0.686	227.3		
	vap	liq	g	760	363.1	7.72	32.30
$B(CH_3)_3$	fus	c	liq	46.5	199.92	0.777	3.250
	vap	liq	g	46.5	199.92	5.52	23.09
BCl_3	fus	c	liq	.....	165.16	1.627	6.807
	vap	liq	g	760	285.7	5.727	23.962
BF_3	fus	c	liq	61	144.79	1.10	4.602
	vap	liq	g	61	144.79	4.48	18.74
	vap	liq	g	760	173.2	4.16	17.40
B_2H_6	fus	c	liq	.....	108.30	1.069	4.473
	vap	liq	g	760	180.57	3.412	14.276
B_5H_9	tr	c	c	.....	136.7	0.45	1.88
	fus	c	liq	.....	226.34	1.466	6.134
	vap	liq	g	190.2	296	7.259	30.372
B_2O_3	fus	c	liq	.....	723	5.85	24.48
	vap	liq	g	0.020	1500	94	393
Ba	tr	c, α	c, β	58.(E − 6)	648		
	fus	c, β	liq	0.0107	1002		
	sub	c, β	g	1.1(E − 3)	900	40.5	169.5
$BaBr_2$	fus	c	liq	.....	1130	7.63	31.92
	vap	liq	g	0.0037	1200	67.1	280.7
	vap	liq	g	760	2120		
$BaCO_3$	tr	c, orthorh.	c, hexag.	.....	1079	4.5	18.8
	tr	c, hexag.	c, cubic	.....	1241	0.7	2.9
$BaCl_2$	tr	c	c	.....	1193	4.10	17.2
	fus	c	liq	.....	1233	3.90	16.3
	vap	liq	g	760	2450		

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
BaF_2	fus	c	liq	1.58(E − 4)	1617	6.8	28.5
	sub	c	g	1.58(E − 4)	1617	86	360
BaI_2	fus	c	liq	1.18(E − 4)	984	6.34	26.53
	vap	liq	g	0.016	1200	53.6	224.3
$Ba(NO_3)_2$	fus	c	liq	.....	865	9.9	41.4
BaO	fus	c	liq	.....	2190		
	sub	c	g	0.0030	1700	103	431
$BaTiO_3$	tr	c	c	.....	201.6	0.012	0.050
	tr	c	c	.....	285	0.024	0.100
	tr	c	c	.....	390	0.050	0.209
	tr	c, cubic	c, tetrag.	.....	1548		
	fus	c	liq	.....	1970		
Be	tr	c, α	c, β	.....	1527	0.611	2.556
	fus	c, β	liq	0.037	1560	2.92	12.21
	vap	liq	g	760	2745	69.89	292.41
$BeCl_2$	tr	c, β	c, α	.....	676	1.32	5.523
	fus	c, α	liq	.....	688	2.07	8.661
	sub	c, β	g	7.6(E − 4)	504	33.0	138.1
	vap	liq	g	760	754	28.9	120.9
BeF_2	fus	c	liq	1.3(E − 3)	825	1.13	4.728
	sub	c	g	9.8(E − 3)	880	52.9	221.3
BeO	tr	c	c	.....	2323	1.25	5.23
	fus	c	liq	.....	2820		
$BeSO_4$	tr	c, α	c, β	.....	861	1.2	5.02
	tr	c, β	c, γ	.....	912	0.5	2.1
Bi	fus	c	liq	.....	544.52	2.70	11.30
	vap	liq	g, equil.	760	1837		
$BiBr_3$	tr	c	c	.....	431	0.74	3.10
	fus	c	liq	2.59	492.0	5.10	21.34
	vap	liq	g	987	741	17.26	72.22
$BiCl_3$	fus	c	liq	.....	506	5.64	23.60
	vap	liq	g	760	713	17.0	71.13
BiF_3	fus	c	liq	.....	1033		
Bi_2O_3	tr	c, monocl.	c, cubic	.....	1003	7.31	30.58
	fus	c, cubic	liq	.....	1100	3.99	16.69
Bi_2S_3	fus	c	liq	.....	1036	19.0	79.50
Br_2	fus	c	liq	45.83	265.90	2.527	10.573
	vap	liq	g	760	332.35	7.06	29.45
BrF_3	fus	c	liq	.....	281.92	2.875	12.029
	vap	liq	g, equil.	760	398.90	9.65	40.376
BrF_5	fus	c	liq	.....	212.6		
	vap	liq	g	760	314.44	6.96	29.12
C	sub	c, graphite	g, std.	760	298.15	171.291	716.682
	sub	c, graphite	g, equil.	760	4100		

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
CBr_4	tr	c, II	c, I	.....	320.1	1.41	5.90
	fus	c, I	liq	.....	365.7	0.94	3.93
	vap	liq	g	760	460	10.4	43.5
CCl_4	tr	c, II	c, I	.....	225.5	1.09	4.56
	fus	c, I	liq	.....	250.28	0.59	2.47
	vap	liq	g	.....	349.9	7.17	30.00
CF_4	tr	c, II	c, I	.....	76.23	0.35	1.46
	fus	c, I	liq	.....	89.57	0.167	0.699
	vap	liq	g	760	145.14	3.01	12.59
CH_4	tr	c, II	c, I	.....	20.44	0.0181	0.0757
	fus	c, I	liq	87.7	90.68	0.225	0.941
	vap	liq	g	760	111.66	1.955	8.18
CH_3Br	tr	c, II	c, I	.....	173.80	0.113	0.473
	fus	c, I	liq	.....	179.49	1.429	5.98
	vap	liq	g	760	276.71	5.715	23.911
CH_3Cl	fus	c	liq	65.66	175.43	1.537	6.431
	vap	liq	g	760	248.93	5.14	21.50
CH_3F	fus	c	liq	.....	131.4		
	vap	liq	g	760	195.0	4.06	16.99
CH_3I	fus	c	liq	.....	206.70		
	vap	liq	g	760	315.65	6.73	28.16
CH_3OH	tr	c, III	c, I	.....	157.6	0.17	0.71
	fus	c, I	liq	.....	175.4	0.755	3.159
	vap	liq	g	760	337.8	8.43	35.27
	vap	liq	g. std.	760	298.15	9.08	37.99
CH_2Cl_2	fus	c	liq	.....	176	1.1	4.60
	vap	liq	g	.....	312.94	6.69	27.99
CH_2F_2	vap	liq	g	760	221.46	5.0	20.92
CH_2I_2	fus	c, II	liq	.....	278.75	3.00	12.55
	fus	c, I	liq	.....	279.25	2.87	12.01
	vap	liq	g	15	340.7	10.2	
CH_2O (formaldehyde)	fus	c	liq	.....	154.9		
	vap	liq	g	760	253.9	5.7	23.8
$CHBr_3$	fus	c	liq	.....	281.2	2.65	11.09
	vap	liq	g	760	422.7	8.7	36.4
$CHCl_3$	fus	c	liq	.....	209.7	2.27	9.50
	vap	liq	g	760	334.4	7.10	29.71
CHF_3	fus	c	liq	0.456	117.97	0.970	4.058
	vap	liq	g	760	190.97	3.994	16.711
CO	tr	c, II	c, I	.....	61.57	0.151	0.632
	fus	c, I	liq	115.3	68.10	0.200	0.837
	vap	liq	g	760	81.66	1.444	6.042
CO_2	sub	c	g	760	194.640	6.031	25.234
	fus	c	liq	.....	217.0	1.99	8.33
$COBr_2$	vap	liq	g	760	333	7.2	30.1

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
$COCl_2$	fus	c, III	liq	.....	139.19	1.131	4.732
	fus	c, II	liq	.....	142.09	1.336	5.590
	fus	c, I	liq	.....	145.37	1.371	5.736
	vap	liq	g	760	280.66	5.832	24.401
COF_2	fus	c	liq	.....	161.89	1.603	6.707
	vap	liq	g	760	188.58	4.368	18.276
CS_2	fus	c	liq	.....	161.2	1.05	4.39
	vap	liq	g	760	319.37	6.390	26.736
COS	fus	c	liq	0.8	134.31	1.130	4.728
	vap	liq	g	760	222.87	4.423	18.506
Ca	tr	c, α	c, β	.....	720	0.22	0.920
	fus	c, β	liq	6.0(E − 5)	1112	2.04	8.54
	vap	liq	g	760	1757	36.72	153.64
CaB_2O_4	fus	c	liq	.....	1435	17.67	73.93
$Ca_2B_2O_5$	tr	c, α	c, β	.....	804	1.10	4.60
	fus	c, β	liq	.....	1585	24.09	100.79
$CaBr_2$	fus	c	liq	.....	1014	6.90	28.87
	vap	liq	g	0.079	1250	56.6	236.8
	vap	liq	g	760	2088		
CaC_2	tr	c, tetrag.	c, cubic	.....	720	1.33	5.565
	fus	c, cubic	liq	.....	2430		
$CaCO_3$	tr	c, aragon.	c, calcite	.....	753	0.05	0.21
$CaCl_2$	fus	c	liq	7.3(E − 3)	1055	6.78	28.37
	vap	liq	g	.....	1195	62.1	259.8
CaF_2	tr	c, α	c, β	.....	1424	1.14	4.77
	fus	c, β	liq	0.08	1691	7.1	29.7
	sub	c, β	g	0.029	1625	92.0	384.9
CaO	fus	c	liq	.....	2887	12	50
	sub	c	g	2.6(E − 7)	1675	125	523
$CaSO_4$	tr	c, α	c, β	.....	1486	5.0	20.9
	fus	c, β	liq	.....	1738	6.7	28.0
$CaSiO_3$	tr	c	c	.....	1398		
	fus	c	liq	.....	1817	13.4	56.1
Ca_2SiO_4	tr	c, β	c, α'	.....	970	0.44	1.84
	tr	c, γ	c, α'	.....	1120	3.44	14.39
	tr	c, α'	c, α	.....	1710	3.39	14.18
	fus	c, α	liq	.....	2403		
$CaTiO_3$	tr	c, II	c, I	.....	1530	0.55	2.30
	fus	c, I	liq	.....	2188		
Cd	fus	c	liq	0.109	594.18	1.48	6.19
	vap	liq	g	760	1040	23.79	99.54
$CdBr_2$	fus	c	liq	12.8	841.2	7.97	33.35
	vap	liq	g	53.2	921	27.5	115.1
$CdCl_2$	tr	c	c	.....	733		
	fus	c	liq	2.04	842	7.22	30.21
	vap	liq	g	17.5	950	31.7	132.6

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
CdF_2	fus	c	liq	.....	1322		
	sub	c	g	0.024	1185	64.5	269.9
	vap	liq	g	760	2021	52.3	218.8
CdI_2	fus	c	liq	0.52	661.2	4.95	20.71
	vap	liq	g	760	1013	26.4	110.46
Ce	tr	c, α	c, β	.....	125		
	tr	c, β	c, γ	.....	350		
	tr	c, γ	c, δ	.....	999	0.715	2.992
	fus	c, δ	liq	.....	1071	1.305	5.460
	vap	liq	g	760	3699	99	414
CeO_2	fus	c	liq	1.2(E − 3)	2670		
	sub	c	g	1.2(E − 3)	2670	88	368
Ce_2O_3	fus	c	liq	.....	2415		
Cl_2	fus	c	liq	10.1	172.12	1.531	6.406
	vap	liq	g	760	239.05	4.878	20.410
ClF	fus	c	liq	.....	119		
	vap	liq	g	760	172.9	5.34	22.34
ClF_3	tr	c	c	.....	190.50	0.36	1.51
	fus	c	liq	.....	196.84	1.819	7.611
	vap	liq	g	760	284.90	6.580	27.531
ClO_2	fus	c	liq	20.8	214		
	vap	liq	g	760	282.8	6.2	25.9
Co	tr	c, α	c, β	.....	700	0.108	0.452
	fus	c, β	liq	.....	1768	3.87	16.19
	vap	liq	g	760	3201	90.0	376.6
$CoCl_2$	fus	c	liq	.....	1000	7.4	30.9
	vap	liq	g	760	1323	27.2	113.8
CoF_2	fus	c	liq	3.01	1400	10.72	44.85
	sub	c	g	3.01	1400	68.1	284.9
CoO	fus	c	liq	.....	2078		
Cr	fus	c	liq	3.25	2130	4.047	16.93
	vap	liq	g	760	2945	82.3	344.3
$CrBr_3$	sub	c	g	0.076	890	56.6	236.8
$Cr(CO)_6$	sub	c	g	724	420	15.7	65.69
CrF_3	tr	c	c	.....	45.6		
	tr	c	c	.....	69.8		
	sub	c	g	2.7(E − 3)	1000	57.8	241.8
Cr_2O_3	tr	c	c	.....	305	0.10	0.418
	fus	c	liq	.....	2548		
Cs	fus	c	liq	1.4(E − 6)	301.8	0.52	2.18
	vap	liq	g, equil.	760	955		
CsBr	fus	c	liq	0.20	909	5.64	23.60
	sub	c	g	5.9(E − 3)	800	46.6	195.0
	vap	liq	g	760	1576	36.0	150.6

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
CsCl	tr	c, II	c, I	.....	743	0.90	3.76
	fus	c, I	liq	101.1	918	4.82	20.16
	vap	liq	g	760	1573	35.4	148.1
CsF	sub	c	g	0.008	800	46.4	194.1
	fus	c	liq	.....	976	5.19	21.71
	vap	liq	g	760	1524	34.3	143.5
CsI	fus	c	liq	0.260	899	5.90	24.68
	sub	c	g	0.260	899	45.5	190.37
	vap	liq	g	760	1524	34.3	143.5
$CsNO_3$	tr	c, hexag.	c, cubic	.....	424.7	0.89	3.72
	fus	c, cubic	liq	.....	678	3.37	14.10
CsOH	tr	c, α	c, β	.....	488	1.76	7.363
	fus	c, β	liq	.....	619	1.6	6.69
Cs_2SO_4	tr	c	c	.....	1005		
	fus	c	liq	.....	1286	9.6	40.17
Cu	fus	c	liq	4.49(E − 4)	1356.5	3.14	13.14
	vap	liq	g	760	2839	71.77	300.29
$(CuBr)_2$	tr	c, γ	c, β	.....	658	4.2	17.57
	tr	c, β	c, α	.....	743	2.1	8.79
	fus	c, α	liq	0.276	756		
	sub	c, α	g	0.276	756	29	121
$(CuCl)_3$	fus	c	liq	.....	703		
	sub	c	g	2.54(E − 4)	550	35.4	148.1
CuF_2	fus	c	liq	7.9(E − 6)	1058		
	sub	c	g	8.85(E − 3)	060	50.5	248.9
$(CuI)_3$	tr	c, γ	c, β	.....	644	5.1	21.3
	tr	c, β	c, α	.....	682	2.3	9.62
	fus	c, α	liq	.....	871		
Cu_2O	tr	c	c	.....	329		
	fus	c	liq	.....	1515	15.35	64.224
Cu_2S	tr	c, III	c, II	.....	376	0.92	3.85
	tr	c, II	c, I	.....	.....	0.20	0.837
Dy	tr	c, α	c, β	.....	1657	0.955	3.996
	fus	c, β	liq	0.591	1682	2.64	11.06
	vap	liq	g	760	2835	55.0	230.1
Er	fus	c	liq	0.317	1795	4.76	19.92
	vap	liq	g	760	3136	62.47	261.37
$ErCl_3$	fus	c	liq	.....	1049	7.8	32.6
	vap	liq	g	2.07	1250	53.6	224.3
ErF_3	tr	c	c	.....	1369		
	fus	c	liq	.....	1413		
Eu	fus	c	liq	0.72	1090	2.20	9.21
	vap	liq	g	760	1870	34.30	143.49
$EuCl_3$	fus	c	liq	.....	891		
	vap	liq	g	1.0	1140	31	130

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
Eu_2O_3	tr	c	c	.....	1373		
	fus	c	liq	.....	2510		
F_2	tr	c	c	.....	45.55	0.174	0.728
	fus	c	liq	1.66	53.54	0.122	0.5104
	vap	liq	g	760	85.02	1.562	6.535
F_2O	fus	c	liq	.....	49.4		
	vap	liq	g	760	128.1	2.41	10.08
Fe	tr	c, α	c, β	.....	1033	0.0	0.0
	tr	c, β	c, γ	.....	1184	0.215	0.8996
	tr	c, γ	c, δ	.....	1665	0.200	0.837
	fus	c, δ	liq	0.026	1809	3.30	13.81
	vap	liq	g	760	3135	83.55	349.56
$FeBr_2$	fus	c	liq	21	962		
	vap	liq	g	102	1073	31.6	132.2
$Fe(CO)_5$	fus	c	liq	.....	252.88		
	vap	liq	g	760	378	8.7	36.4
$FeCl_2$	fus	c	liq	8.84	950	10.28	43.011
	vap	liq	g	760	1299	30.2	126.4
$(FeCl_3)_2$	sub	c	g	126	550	30.6	128.0
	fus	c	liq	547	577	18.3	76.57
	vap	liq	g	610	583	12.3	51.46
	vap	liq	g	760	592	12.1	50.63
FeF_2	tr	c	c	.....	78.35		
	fus	c	liq	6.0	1373		
	sub	c	g	2.1(E − 3)	1060	72.4	302.9
FeF_3	sub	c	g	9.6(E − 3)	880	52.7	220.5
FeI_2	fus	c	liq	5.8	867	13.3	55.65
	vap	liq	g	5.8	867	35.6	148.9
	vap	liq	g	760	1208		
$Fe_{0.947}O$	tr	c	c	.....	189	0.06	0.25
	fus	c	liq	.....	1650	7.5	31.4
Fe_2O_3	tr	c, III	c, II	.....	960	0.16	0.669
	tr	c, II	c, I	.....	1050	0.0	0.0
Fe_3O_4	tr	c, II	c, I	.....	880	0.0	0.0
	fus	c, I	liq	.....	1867	33	138
FeS	tr	c, III	c, II	.....	411	0.57	2.38
	tr	c, II	c, I	.....	598	0.12	0.502
	fus	c, I	liq	.....	1468	7.73	32.34
Ga	fus	c	liq	.....	302.9	1.335	5.585
	vap	liq	g	760	2520	61.46	257.16
$(GaCl_3)_2$	fus	c	liq	10.4	350.9	5.2	21.8
	sub	c	g	10.4	350.9	17.4	72.80
	vap	liq	g	760	474.4	10.5	43.93
GaI_3	fus	c	liq	17.2	485	3.1	13.0
	vap	liq	g	760	619	16.5	69.04

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
Gd	tr	c, α	c, β	.....	1533	0.935	3.912
	fus	c, β	liq	.....	1585	2.40	10.04
	vap	liq	g	760	3530	85.9	359.4
$GdBr_3$	fus	c	liq	.....	1058	8.7	36.4
$GdCl_3$	fus	c	liq	.....	875	9.6	40.2
	vap	liq	g	0.37	1183	44.0	184.1
GdF_3	tr	c	c	.....	1280		
	fus	c	liq	.....	1301		
Gd_2O_3	tr	c, monocl.	c, cubic	.....	1473		
	fus	c	liq	.....	2595		
Ge	fus	c	liq	.....	1210.4	8.83	36.94
	vap	liq	g	760	3107	79.1	330.9
$GeBr_4$	fus	c	liq	.....	299.3		
	vap	liq	g	760	462	9.4	39.3
$GeCl_4$	fus	c	liq	0.59	221.6	1.8	7.53
	sub	c	g	0.59	221.6	10.9	45.61
	vap	liq	g	760	356.4	7.2	30.12
GeF_4	sub	c	g	760	236.6	7.8	32.6
	fus	c	liq	3032	258.1		
GeH_4	tr	c, III	c, II	.....	73.2	0.050	0.209
	tr	c, II	c, I	.....	76.6	0.086	0.360
	fus	c, I	liq	.....	107.25	0.200	0.8367
	vap	liq	g	760	184.79	3.361	14.062
GeI_4	sub	c	g	0.22	380	19.5	81.6
	fus	c	liq	.....	417		
GeO_2	tr	c, II	c, I	.....	1306	5.05	21.13
	fus	c, I	liq	.....	1380	3.59	15.02
H_2	fus	c	liq	54.0	13.957	0.028	0.117
	vap	liq	g	54.0	13.957	0.219	0.9163
	vap	liq	g	760	20.38	0.219	0.9163
HBr	tr	c, III	c, rhombic	.....	89.8		
	tr	c, rhombic	c, cubic	.....	116.9		
	fus	c, cubic	liq	285	186.24	0.575	2.406
	vap	liq	g	760	206.38	4.210	17.615
HCN	tr	c, II	c, I	170.42	0.004		
	fus	c, I	liq	140.4	259.91	2.009	8.4057
	vap	liq	g	760	298.85	6.027	25.217
HCl	tr	c, rhomb.	c, cubic	.....	98.36	0.284	1.188
	fus	c, cubic	liq	103.4	158.91	0.476	1.992
	vap	liq	g	760	188.07	3.860	16.150
HF	fus	c	liq	4.03	189.79	0.939	3.929
	vap	liq	g, equil.	760	292.67	1.790	7.4894
HI	tr	c, III	c, II	.....	70.1		
	tr	c, II	c, I	.....	125.7		
	fus	c, I	liq	371	222.31	0.686	2.870
	vap	liq	g	760	237.75	4.724	19.765

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
HNO_3.....	fus	c	liq	.....	231.55	2.503	10.473
	vap	liq	g	48	293.1	9.42	39.41
H_2O.....	fus	c	liq	4.58	273.16	1.436	6.0082
	vap	liq	g	4.58	273.16	10.767	45.0491
	vap	liq	g	23.75	298.15	10.514	43.9906
	vap	liq	g, std.	760	298.15	10.520	44.0157
	vap	liq	g	760	373.15	9.717	40.656
H_2S.....	tr	c, II	c, I	.....	103.50	0.365	1.527
	fus	c, I	liq	174	187.61	0.568	2.377
	vap	liq	g	174	187.61	4.67	19.54
	vap	liq	g	760	212.80	4.463	18.673
H_2SO_4.....	fus	c	liq	.....	283.5	2.560	10.711
H_2Se.....	tr	c, II	c, I	.....	82.3	0.309	1.293
	fus	c, I	liq	205.4	207.46	0.601	2.514
	vap	liq	g	205.4	207.46	5.48	22.93
	vap	liq	g	760	231.8	4.76	19.91
H_2Te.....	fus	c	liq	70	222	1.0	4.18
	vap	liq	g	760	270.9	5.6	23.4
H_3PO_4.....	fus	c	liq	.....	315.5	3.07	12.84
$^1H^2H$.....	fus	c	liq	93	16.62	0.038	0.159
	vap	liq	g	760	22.14	0.257	1.075
$^1H^2HO$.....	vap	liq	g	22.0	298.15	10.65	44.56
	vap	liq	g	760	374.0		
^2H_2O.....	fus	c	liq	5.01	276.96	1.508	6.309
	vap	liq	g	5.01	276.96	11.105	46.463
	vap	liq	g	760	374.58	9.933	41.559
He.....	fus	c	liq	22.5(E + 3)	1.764	0.002	0.0084
	tr	liq, II	liq, I	37.8	2.172		
	vap	liq, I	g	760	4.214	0.020	0.084
Hf.....	tr	c, α	c, β	.....	2013	1.61	6.736
	fus	c, β	liq	1.1(E − 3)	2500	5.75	24.06
	vap	liq	g	760	4876	137	573.2
$HfBr_4$.....	sub	c	g	83.3	531	23.5	98.40
	fus	c	liq	15,270	693		
$HfCl_4$.....	fus	c	liq	2.2(E − 4)	705		
	sub	c	g	2.2(E − 4)	705	23.8	99.58
	vap	liq	g	2.2(E − 4)	705	14.1	58.99
HfF_4.....	sub	c	g	54.1	1112	56.9	238.1
	sub	c	g	760	1240		
HfI_4.....	tr	c, α	c, β	.....	697	14.4	60.25
	tr	c, β	c, γ		745	5.4	22.6
	sub	c, γ	g	760	667	28.2	118.0
HfO_2.....	fus	c	liq	.....	3026		
Hg.....	fus	c	liq	.....	234.29	0.548	2.292
	vap	liq	g	760	629.73	14.172	59.296
$HgBr_2$.....	fus	c	liq	.....	511.2	4.28	17.91
	vap	liq	g	760	592	14.08	58.91

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
$HgCl_2$	tr	c	c	.....	428	0.077	0.322
	fus	c	liq	.....	553.2	4.55	19.04
	vap	liq	g	760	575.0	14.08	58.91
HgF_2	sub	c	g	178	575	16	66.9
	fus	c	liq	.....	918		
HgI_2	tr	c, red	c, yellow	0.20	404.6	0.65	2.72
	sub	c, yellow	g	8.8	530	19.95	83.47
	fus	c, yellow	liq	8.8	530	4.53	18.95
	vap	liq	g	760	627	14.26	59.664
HgS	tr	c, red	c, black	.....	659	1.0	4.18
Ho	tr	c, α	c, β	.....	1701	1.12	4.686
	fus	c, β	liq	.....	1743	2.91	12.17
	vap	liq	g	760	2968	57.6	241.0
$HoCl_3$	fus	c	liq	.....	993	7.0	29.3
	vap	liq	g	0.25	1143	62.7	262.3
HoF_3	fus	c	liq	1.57(E − 3)	1416		
	sub	c	g	1.57(E − 3)	1416	105.0	439.32
	vap	liq	g	1.57(E − 3)	1416	85.1	356.1
Ho_2O_3	fus	c	liq	.....	2640		
I_2	sub	c	g	0.31	298.15	14.93	62.467
	fus	c	liq	92.0	386.75	3.71	15.52
	vap	liq	g	760	458.39	9.99	41.80
ICl	fus	c	liq	32.62	300.53	2.76	11.55
	sub	c	g	32.62	300.53	12.62	52.80
IF_5	fus	c	liq	10.45	282.58		
	vap	liq	g	760	374	9.04	37.82
IF_7	tr	c	c	.....	153		
	sub	c	g	760	277	7.46	31.21
In	fus	c	liq	.....	429.76	0.78	
	vap	liq	g	760	2343	55.4	231.8
$InBr_3$	fus	c	liq	392	709		
	sub	c	g	9.9(E − 4)	460	33.5	140.2
InCl	tr	c, II	c, I	.....	393		
	fus	c, I	liq	0.038	498		
	vap	liq	g	6.63	656	21.2	88.70
	vap	liq	g	760	926		
$InCl_3$	fus	c	liq	.....	859		
	sub	c	g	6.3(E − 4)	510	37.0	154.8
InI_3	fus	c	liq	0.26	480		
	vap	liq	g	0.26	480	19.2	80.33
In_2O_3	fus	c	liq	.....	2183		
Ir	fus	c	liq	.....	2716	6.3	2.64
	vap	liq	g	.....	4662	146.3	612.3
IrF_6	tr	c	c	61.7	273.5	1.70	7.11
	fus	c	liq	531.3	316.9	0.7	2.93
	vap	liq	g	531.3	316.9	7.65	32.01

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
K	fus	c	liq	.....	336.4	0.562	2.351
	vap	liq	g	760	1031	19.18	80.23
KBr	fus	c	liq	.....	1007	6.1	25.5
	vap	liq	g, equil.	760	1657	30.8	128.9
KCN	tr	c, II	c, I	.....	168.3	0.30	1.26
	fus	c, I	liq	.....	908	3.5	14.6
KCl	fus	c	liq	0.40	1044	6.282	26.284
	vap	liq	g, equil.	760	1700	28.7	120.1
KF	fus	c	liq	.....	1130	6.75	28.24
	vap	liq	g	760	1775		
KI	fus	c	liq	0.36	954	5.7	23.8
	vap	liq	g, equil.	760	1617	26.9	112.5
KNO_3	tr	c, II	c, I	.....	401.1	1.22	5.104
	fus	c, I	liq	.....	610	2.413	10.096
KOH	tr	c, II	c, I	.....	522	1.52	6.360
	fus	c, I	liq	.....	677	1.8	7.53
	vap	liq	g	760	1600	30.8	128.9
K_2SO_4	tr	c, II	c, I	.....	856	1.94	8.12
	fus	c, I	liq	.....	1342	8.76	36.65
Kr	fus	c	liq	549	115.78	0.392	1.640
	vap	liq	g	760	119.93	2.162	9.046
KrF_2	sub	c	g	29	273	9.9	41.42
KrF_4	sub	c	g	760	341	8.3	34.73
La	tr	c, α	c, β	.....	550	0.087	0.364
	tr	c, β	c, γ	.....	1134	0.746	3.121
	fus	c, γ	liq	.....	1193	1.481	6.190
	vap	liq	g	760	3730	98.9	413.7
$LaBr_3$	sub	c	g	0.0032	1026	70.7	295.8
	fus	c	liq	0.0102	1061	13.0	54.39
$LaCl_3$	sub	c	g	0.0010	1067	72.3	302.5
	fus	c	liq	0.0072	1131	13.0	54.39
LaF_3	sub	c	g	8.9(E − 3)	1495	99.4	415.9
	fus	c	liq	1.46	1763		
LaI_3	fus	c	liq	9.0(E − 3)	1034		
	sub	c	g	9.0(E − 3)	1034	69.9	292.5
La_2O_3	fus	c	liq	.....	2490		
Li	tr	c, II	c, I	.....	77		
	fus	c, I	liq	.....	453.69	0.717	3.000
	vap	liq	g	760	1597	35.40	148.13
LiBr	fus	c	liq	.....	823	4.22	17.65
	vap	liq	g, equil.	760	1555	27.0	113.0
LiCl	fus	c	liq	.....	883	4.74	19.83
	vap	liq	g	760	1656		
LiF	fus	c	liq	.....	1121	6.474	27.087
	vap	liq	g, equil.	760	1966		

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
LiI	fus	c	liq	.....	742	3.50	14.64
	vap	liq	g. equil.	760	1415	26.4	110.4
$LiNO_3$	fus	c	liq	.....	525	6.1	25.5
LiOH	fus	c	liq	.....	744.3	5.01	20.96
Li_2SO_4	tr	c, II	c, I	.....	859	6.5	27.2
	fus	c, I	liq	.....	1132	1.8	7.53
Lu	fus	c	liq	0.011	1036	4.46	18.65
	vap	liq	g	760	3668	85.06	355.89
$LuCl_3$	fus	c	liq	.....	1165		
	vap	liq	g	0.89	915	57.2	239.3
LuF_3	tr	c	c	.....	1200		
	sub	c	g	1.1(E − 3)	1368	96.1	402.1
	fus	c	liq	.....	1455		
Lu_2O_3	fus	c	liq	.....	2740		
Mg	fus	c	liq	3.10	922	2.140	8.954
	vap	liq	g	760	1363	30.45	127.40
$MgBr_2$	sub	c	g	0.017	842	50.3	210.5
	fus	c	liq	.....	984	8.3	34.7
$MgCl_2$	fus	c	liq	0.120	987	10.30	43.095
	sub	c	g	0.120	987	57.7	241.4
	vap	liq	g	30.7	1310	43.08	180.25
MgF_2	fus	c	liq	0.077	1525	13.00	58.158
	vap	liq	g	0.077	1525	72.6	303.8
MgI_2	sub	c	g	0.015	757	45.0	188.3
Mg_3N_2	tr	c, III	c, II	.....	823	0.22	0.920
	tr	c, II	c, I	.....	10.61	0.26	1.09
MgO	fus	c	liq	.....	3125	18.5	77.40
$MgSO_4$	tr	c, II	c, I	.....	1283		
	fus	c, I	liq	.....	1400	3.5	14.6
Mn	tr	c, α	c, β	.....	980	0.532	2.226
	tr	c, β	c, γ	.....	1360	0.507	2.121
	tr	c, γ	c, δ	.....	1410	0.449	1.879
	fus	c, δ	liq	1.03	1517	2.88	12.05
	vap	liq	g	760	2335	54.0	225.9
$MnBr_2$	fus	c	liq	.....	971		
$MnCl_2$	fus	c	liq	0.24	923	8.97	37.53
	vap	liq	g	0.24	923	40.0	167.4
	vap	liq	g	760	1511		
MnF_2	fus	c	liq	0.031	1203		
	sub	c	g	0.031	1203	72.0	301.2
MnI_2	fus	c	liq	.....	911		
MnO	fus	c	liq	.....	2088		
Mn_3O_4	tr	c, II	c, I	.....	1445	4.97	20.79
	fus	c, I	liq	.....	1840		

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
Mo.....	fus	c	liq	0.031	2890	6.65	27.82
	vap	liq	g	760	4880	141.6	592.45
$Mo(CO)_6$.....	sub	c	g	48	375	16.3	68.20
MoF_3.....	fus	c	liq	2.67	340.1		
	vap	liq	g	760	486.7	11.9	49.79
MoF_6.....	tr	c, II	c, I	.....	263.50	1.953	8.171
	fus	c, I	liq	408.5	290.76	1.034	4.326
	vap	liq	g	760	307.2	6.75	28.242
MoO_3.....	fus	c	liq	1.76(E − 2)	1074	11.69	48.911
N_2.....	tr	c, II	c, I	.....	35.61	0.055	0.230
	fus	c, I	liq	93.9	63.15	0.172	0.719
	vap	liq	g	93.9	63.15	1.446	6.050
	vap	liq	g	760	77.35	1.335	5.586
NH_3.....	fus	c	liq	45.37	195.40	1.351	5.652
	vap	liq	g	45.37	195.40	6.061	25.359
	vap	liq	g	760	239.73	5.581	23.351
N_2H_4.....	fus	c	liq	.....	274.69	3.025	12.656
	vap	liq	g	764	386.7	9.70	40.58
NH_4Br.....	tr	c, II	c, I	.....	411.0	0.77	3.22
	fus	c, I	liq	.....	815		
NH_4Cl.....	tr	c, III	c, II	.....	243	0.27	1.13
	tr	c, II	c, I	.....	457.7	1.0	4.18
	fus	c, I	liq	2.62(E + 4)	793		
NH_4F.....	tr	c, II	c, I	.....	289.1	0.81	3.39
NH_4I.....	tr	c, II	c, I	.....	260	0.70	2.93
	fus	c, I	liq	.....	824		
NH_4NO_3.....	tr	c, V	c, IV	.....	256.2	0.111	0.464
	tr	c, IV	c, III	.....	305.4	0.410	1.715
	tr	c, III	c, II	.....	357.4	0.32	1.34
	tr	c, II	c, I	.....	398.4	1.01	4.23
	fus	c, I	liq	.....	442.8	1.3	5.44
NO.....	fus	c	liq	164.4	109.50	0.550	2.301
	vap	liq	g	164.4	109.50	3.43	14.35
	vap	liq	g	760	121.4	3.293	13.778
N_2O.....	fus	c	liq	659	182.1	1.56	6.527
	vap	liq	g	659	182.1	3.97	16.61
	vap	liq	g	760	184.6	3.958	16.560
Na.....	fus	c	liq	.....	370.98	0.622	2.601
	vap	liq	g	760	1156	23.43	98.01
NaBr.....	fus	c	liq	0.4	1020	6.25	26.15
	vap	liq	g, equil.	760	1665		
NaCN.....	tr	c, III	c, II	.....	172.1	0.15	0.628
	tr	c, II	c, I	.....	288.5	0.70	2.93
	fus	c, I	liq	.....	836	4	17
	vap	liq	g	760	1770	37	155
NaCl.....	fus	c	liq	.....	1074	6.73	28.16
	vap	liq	g, equil.	760	1730		

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
NaF.....	fus	c	liq	.....	1269	7.92	33.14
	vap	liq	g, equil.	760	1977		
NaI.....	fus	c	liq	.....	933	5.64	23.60
	vap	liq	g, equil.	760	1577		
Na_2MoO_4....	tr	c, II	c, I	.....	713	14.6	61.09
	fus	c, I	liq	.....	960	3.6	15.1
$NaNO_3$.....	tr	c, II	c, I	.....	549	0.94	3.93
	fus	c, I	liq	.....	579.5	3.696	15.464
NaOH.....	tr	c, II	c, I	.....	566.0	1.520	6.3597
	fus	c, I	liq	.....	592.3	1.52	6.360
Na_2SO_4.....	tr	c, V	c, III	.....	450	0.74	3.10
	tr	c, III	c, I	.....	515	1.79	7.489
	fus	c, I	liq	.....	1157	5.70	23.85
Na_2TiO_3.....	tr	c, II	c, I	.....	560	0.4	1.7
	fus	c, I	liq	.....	1303	16.8	70.29
Nb.....	fus	c	liq	.....	2740	6.30	26.36
	vap	liq	g	760	5017	163	682.0
$NbCl_5$.....	fus	c	liq	260	478.9	8.09	33.85
	sub	c	g	260	478.9	21.3	89.12
	vap	liq	g	760	520.5	12.6	52.72
NbF_5.....	fus	c	liq	2.44	350.7	2.92	12.217
	vap	liq	g	58.0	423	12.9	53.97
NbO_2.....	tr	c, α	c, β	.....	1090	0.72	3.01
	tr	c, β	c, γ	.....	1200	0.0	0.0
	fus	c, γ	liq	5.0(E − 4)	1900	21	87.9
Nb_2O_5.....	fus	c	liq	.....	1780	24.69	103.30
Nd.....	tr	c, α	c, β	.....	1128	0.72	3.01
	fus	c, β	liq	.....	1289	1.71	7.15
	vap	liq	g	760	3341	65.2	272.8
$NdBr_3$.....	fus	c	liq	1.06(E − 4)	955	10.8	45.19
	sub	c	g	1.06(E − 4)	955	67.6	282.8
$NdCl_3$.....	fus	c	liq	2.2(E − 3)	1032	12.0	50.21
	sub	c	g	2.2(E − 3)	1032	69.1	289.1
NdF_3.....	sub	c	g	0.012	1460	85.7	358.6
	fus	c	liq	0.35	1647		
NdI_3.....	tr	c	c	.....	847	3.4	14.2
	sub	c	g	4.5(E − 3)	978	66.3	277.4
	fus	c	liq	0.063	1060	9.7	40.6
Nd_2O_3.....	tr	c, α	c, β	.....	1395	0.14	0.586
	fus	c, β	liq	.....	2485		
Ne.....	fus	c	liq	324	24.544	0.08	0.33
	vap	liq	g	324	24.544	0.431	1.803
	vap	liq	g	760	27.15	0.429	1.795
Ni.....	fus	c	liq	3.1(E − 3)	1726	4.176	17.472
	vap	liq	g	760	3187	88.5	370.3

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
$NiBr_2$	sub	c	g	0.044	823	52.5	219.7
	sub	c	g	760	1193		
	fus	c	liq	.....	1236		
$Ni(CO)_4$	fus	c	liq	46.6	253.86	3.306	13.832
	vap	liq	g	760	315.4	7.0	29.3
$NiCl_2$	sub	c	g	0.045	850	53.0	221.7
	sub	c	g	760	1243		
	fus	c	liq	.....	1303	18.47	77.28
NiF_2	sub	c	g	2.5(E − 3)	1080	77.3	323.4
NiI_2	sub	c	g	0.43	750	36.5	152.7
	fus	c	liq	.....	1070		
NiO	tr	c, III	c, II	.....	525	0.0	0.0
	tr	c, II	c, I	.....	565	0.0	0.0
	fus	c, I	liq	87	2263		
Np	tr	c, III	c, II	.....	533	2	4.4
	tr	c, II	c, I	.....	850		
	fus	c, I	liq	.....	910		
NpF_6	fus	c	liq	748.6	327.92	4.180	17.527
	vap	liq	g	748.6	327.92	7.133	29.844
	vap	liq	g	760	328.33		
O_2	tr	c, III	c, II	.....	23.85	0.022	0.0920
	tr	c, II	c, I	.....	43.77	0.178	0.745
	fus	c, I	liq	1.14	54.363	0.106	0.4435
	vap	liq	g	1.14	54.363	1.828	7.648
	vap	liq	g	760	90.180	1.630	6.820
Os	fus	c	liq	0.86	80.65	0.5	2.1
	vap	liq	g	760	161.3	3.58	14.98
Os	fus	c	liq	.....	3323		
	sub	c	g	6.2(E − 6)	2550	187.4	784.1
OsF_6	fus	c	liq	0.566	343.1		
	vap	liq	g	15.1	400	15.69	65.647
	vap	liq	g	760	499.0		
OsF_6	tr	c	c	81.3	272.7	2.0	8.37
	fus	c	liq	463.6	306.5	1.6	6.69
	sub	c	g	463.6	306.5	8.40	35.15
	vap	liq	g	760	320.6	6.70	28.03
$OsOF_5$	tr	c, II	c, I	.....	305.6		
	fus	c, I	liq	175.6	332.3	1.62	6.778
	vap	liq	g	394.6	354.0	8.74	36.57
P_4	tr	c, IV	c, III	.....	195.35	0.500	2.092
	fus	c, III	liq	.....	317.30	0.628	2.628
	vap	liq	g	.....	317.30	13.32	55.731
	vap	liq	g	760	530	12.48	52.216
PBr_3	fus	c	liq	.....	232.7		
	vap	liq	g	760	446.4	9.33	39.04
PCl_3	fus	c	liq	.....	183		
	vap	liq	g	760	348.3	7.17	30.00

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
PCl_5	fus	c	liq		437.7	6.1	25.5
	sub	c	g, equil.	760	432	18.1	75.73
PF_3	tr	c, III	c, II		83.7	0.060	0.251
	tr	c, II	c, I		110.6	0.55	2.30
	fus	c, I	liq	9.80	121.8	0.224	0.9372
	vap	liq	g	760	171.8	3.48	14.56
PF_5	fus	c	liq	427	179.4	2.7	11.3
	vap	liq	g	427	179.4	4.2	17.6
	vap	liq	g	760	188.7	4.1	17.2
PH_3	tr	c, IV	c, III		30.31	0.0196	0.08200
	tr	c, III	c, II		49.46	0.186	0.7782
	tr	c, II	c, I		88.15	0.115	0.4812
	fus	c, I	liq	27.2	139.40	0.270	1.130
	vap	liq	g	760	185.43	3.486	14.585
P_4O_6	fus	c	liq	1.7	297.1	3.36	14.06
	vap	liq	g	1.7	297.1	11.14	46.610
	vap	liq	g	760	448.5	10.38	43.430
P_4O_{10}	fus	c, hexag.	liq	3690	693	5.0	20.9
	sub	c, hexag.	g	3690	693	13.9	58.16
	fus	c, rhomb.	liq	570	844	16.1	67.36
	sub	c, rhomb.	g	570	844	36.4	152.3
Pb	fus	c	liq		600.45	1.147	4.7990
	vap	liq	g	760	2023	42.5	177.8
$PbBr_2$	tr	c, II	c, I		617		
	fus	c, I	liq	0.011	643.1	5.0	20.9
	vap	liq	g	760	1166	30.2	126.4
$Pb(CH_3)_4$	fus	c	liq		242.92	2.58	10.79
	vap	liq	g	760	383.2	7.87	32.93
$PbCl_2$	tr	c, α	c, β		695		
	fus	c, β	liq		773	5.25	21.97
	vap	liq	g	760	1227	30.4	127.2
PbF_2	tr	c, rhomb.	c, cubic		723		
	fus	c, cubic	liq		1099	3.0	12.6
	vap	liq	g	760	1566	38.4	160.7
PbI_2	tr	c, II	c, I		645		
	fus	c, I	liq	0.23	685	3.9	16.3
	sub	c, I	g	0.23	685	36.8	154.0
PbO	tr	c, red	c, yellow		762	0.394	1.648
	fus	c	liq	0.35	1158	6.57	27.49
	vap	liq	g, equil.	760	1813		
PbS	fus	c	liq		1382	4.2	17.6
$PbSO_4$	tr	c, II	c, I		1139	4.06	16.99
	fus	c, I	liq		1360	9.6	40.2
Pd	fus	c	liq	0.031	1825	4.20	17.56
	vap	liq	g	760	3237	85.4	357.3
$PdCl_2$	fus	c	liq		953	5	21

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
Po	tr	c, II	c, I	.....	327		
	fus	c, I	liq	.....	527	3.0	12.5
	vap	liq	g	760	1235		
Pr	tr	c, α	c, β	.....	1068	0.76	3.18
	fus	c, β	liq	.....	1204	1.65	6.904
	vap	liq	g	760	3785	70.9	296.6
$PrBr_3$	fus	c	liq	.....	966	11.3	47.28
	sub	c	g	.....	966	68.1	284.9
$PrCl_3$	fus	c	liq	3.5(E − 3)	1059	12.1	50.62
	sub	c	g	3.5(E − 3)	1059	70.3	294.1
	vap	liq	g	23	1523	54.7	228.9
PrF_3	fus	c	liq	.....	1668		
	sub	c	g	1.3(E − 3)	1400	82.3	344.3
PrI_3	fus	c	liq	.....	1011	12.7	53.14
	sub	c	g	.....	1011	66.5	278.2
Pt	fus	c	liq	.....	2043	4.7	19.7
	vap	liq	g	760	4097	121.8	509.6
PtF_6	tr	c, orthorh.	c, cubic	.....	276.15	2.14	8.954
	fus	c, cubic	liq	.....	334.45	1.08	4.519
	vap	liq	g	760	342.29	7.06	29.54
Pu	tr	c, VI	c, V	.....	395	0.80	3.35
	tr	c, V	c, IV	.....	480	0.14	0.586
	tr	c, IV	c, III	.....	588	0.13	0.544
	tr	c, III	c, II	.....	730	0.02	0.084
	tr	c, II	c, I	.....	753	0.44	1.84
	fus	c, I	liq	.....	913	0.68	2.85
	vap	liq	g	760	3503	82.1	343.7
$PuBr_3$	fus	c	liq	2.1(E − 3)	954	11.6	48.53
	vap	liq	g	2.1(E − 3)	954	57.3	239.7
$PuCl_3$	fus	c	liq	1.9(E − 3)	1033	13.3	55.65
	vap	liq	g	1.9(E − 3)	1033	58.6	245.2
PuF_3	fus	c	liq	0.72	1698		
	sub	c	g	2.33(E − 3)	1400	93.0	389.1
PuF_4	sub	c	g	4.3(E − 4)	1123	45.9	192.0
	fus	c	liq	8.2(E − 3)	1310		
PuF_6	fus	c	liq	533.0	324.74	4.456	18.644
	vap	liq	g	760	335.31	7.03	29.41
Ra	fus	c	liq	.....	973		
Rb	fus	c	liq	.....	312	0.54	2.26
	vap	liq	g, equil.	760	967		
RbBr	fus	c	liq	.....	965	5.57	23.30
	vap	liq	g	760	1625	37.1	155.2
RbCl	fus	c	liq	0.27	995	5.67	23.72
	vap	liq	g	760	1654	36.9	154.4
RbF	fus	c	liq	0.6	1068	5.5	23.0
	sub	c	g	0.6	1068	52.3	218.8

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
RbI	fus	c	liq	0.4	920	5.27	22.05
	sub	c	g	0.4	920	46.7	195.4
	vap	liq	g	760	1578	35.9	150.2
$RbNO_3$	tr	c, IV	c, III	.....	437	0.90	3.77
	tr	c, III	c, II	.....	501		
	tr	c, II	c, I	.....	564	0.88	3.68
	fus	c, I	liq	.....	589	1.10	4.602
RbOH	tr	c, II	c, I	.....	518	1.70	7.113
	fus	c, I	liq	.....	656		
Re	fus	c	liq	0.024	3453	7.9	33.1
	vap	liq	g	760	5960	171	715.5
$(ReBr_3)_3$	sub	c	g	.....	550	47.6	199.2
$(ReCl_3)_3$	sub	c	g	.....	550	49	205
ReF_6	fus	c	liq	0.37	321.1		
	vap	liq	g	5.61	367	13.9	58.16
	vap	liq	g	760	494		
ReF_6	tr	c, II	c, I	153.1	271.2	2.09	8.745
	fus	c, I	liq	426.5	291.8	1.10	4.602
	vap	liq	g	760	306.9	6.8	28.5
ReF_7	tr	c, II	c, I	.....	163		
	fus	c, I	liq	311.6	321.4	1.80	7.531
	vap	liq	g	311.6	321.4	7.35	30.75
Re_2O_7	fus	c	liq	72	573.5	14.7	61.50
	sub	c	g	72	573.5	32	134
	vap	liq	g	760	634	16.8	70.29
Rh	fus	c	liq	.....	2233	5.15	21.55
	vap	liq	g	760	4000	118	493.7
Rn	fus	c	liq	502	202	0.69	2.89
	vap	liq	g	760	211	4.0	16.7
Ru	fus	c	liq	.....	2700	6.2	25.9
	vap	liq	g	760	4390	141	589.9
RuF_5	fus	c	liq	5.71	379	10.4	43.51
	vap	liq	g	5.71	379	15.6	65.27
	vap	liq	g	760	500		
RuF_6	tr	c, II	c, I	.....	275.6		
	sub	c, I	g	40	281	9.1	38.1
	fus	c, I	liq	.....	327		
RuO_4	fus	c	liq	10.6	298.5	2.6	10.9
	vap	liq	g	10.6	298.5	10.6	44.35
S	tr	c, rhomb.	c, monocl.	3.8(E − 3)	368.46	0.096	0.402
	tr	c, rhomb.	c, monocl.	.....	374.15	0.0	0.0
	fus	c, monocl.	liq	.....	388.33	0.411	1.711
	vap	liq	g, equil.	760	717.75	2.2	9.20
SF_4	fus	c	liq	0.54	152.1		
	vap	liq	g	41.7	192	6.3	26.4

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
SF_6	tr	c, II	c, I	.....	94.26	0.384	1.607
	sub	c, I	g	760	209.5	5.70	23.85
	fus	c, I	liq	1,700	222.5	1.20	5.021
SO_2	fus	c	liq	12.56	197.69	1.769	7.4015
	vap	liq	g	760	263.13	5.955	24.916
Sb	fus	c	liq	.....	904	4.75	19.87
	vap	liq	g, equil.	760	1860		
$SbBr_3$	fus	c	liq	1.65	369.8	3.5	14.6
	vap	liq	g	760	562	12.6	52.72
$SbCl_3$	fus	c	liq	.....	346.4	3.0	12.5
	vap	liq	g	760	494	10.80	45.187
$SbCl_5$	fus	c	liq	.....	276.2	2.4	10.0
	vap	liq	g	30	358	11.7	48.95
SbF_5	fus	c	liq	1.47	281.4		
	vap	liq	g	1.47	281.4	11.1	46.44
	vap	liq	g	760	416		
SbH_3	fus	c	liq	.....	179		
	vap	liq	g	760	255	5.1	21.3
SbI_3	fus	c	liq	1.6	443.3		
	vap	liq	g	760	675	14.8	61.92
Sb_4O_6	tr	c, cubic	c, orthorh.	0.52	843	2.8	11.7
	fus	c, orthorh.	liq	2.5	928	27	113
	vap	liq	g	760	1729	17.8	74.48
Sc	tr	c, II	c, I	.....	1608	0.96	4.02
	fus	c, I	liq	0.084	1812	3.37	14.10
	vap	liq	g	760	3104	75.1	314.2
$ScBr_3$	sub	c	g	162	1134	63.0	263.6
	fus	c	liq	1,530	1233		
$ScCl_3$	fus	c	liq	1,260	1240		
	sub	c	g	1,260	1240	63	264
ScF_3	sub	c, II	g	1.8(E − 3)	1290	89	372
	tr	c, II	c, I	.....	1620		
	fus	c, I	liq	.....	1803		
ScI_3	sub	c	g	112	1100	61	255
	fus	c	liq	.....	1218		
Se	tr	c, II	c, I	.....	398	0.18	0.753
	fus	c, I	liq	.....	494	1.25	5.230
	vap	liq	g, equil.	760	958		
SeF_4	fus	c	liq	1.65	263.6		
	vap	liq	g	760	380	10.0	41.84
SeF_6	sub	c	g	760	226.6	6.27	26.23
	fus	c	liq	1,500	238.6	1.78	7.448
	vap	liq	g	1,500	238.6	4.30	17.99
SeO_2	sub	c	g	760	629	21.1	88.28
Si	fus	c	liq	.....	1685	21.1	50.62
	vap	liq	g, equil.	760	3540		

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
$SiBr_4$	fus	c	liq	1.83	278.0		
	vap	liq	g	760	426	9.1	38.1
$Si(CH_3)_4$	fus	c	liq	0.2	174.12	1.648	6.8952
	vap	liq	g	760	299.8	5.79	24.23
$SiCl_4$	fus	c	liq	.....	205	1.84	7.699
	vap	liq	g	760	330.4	6.81	28.49
SiF_4	fus	c	liq	1340	183.0	2.27	9.498
	sub	c	g	1340	183.0	6.33	26.48
SiH_4	tr	c, II	c, I	.....	63.5	0.147	0.6150
	fus	c, I	liq	.....	88.5	0.159	0.6653
	vap	liq	g	760	161.8	2.9	12.1
SiH_3F	vap	liq	g	760	185.1	4.3	18.0
SiO_2	tr	quartz, III	quartz, II	.....	91		
	tr	quartz, II	quartz, I	.....	846	0.15	0.628
	tr	quartz, I	tridym., I	.....	1140	0.12	0.502
	fus	quartz, I	liq	.....	1883	2.04	8.535
	tr	tridym., IV	tridym., III	.....	390	0.07	0.29
	tr	tridym., III	tridym., II	.....	436	0.04	0.18
	tr	tridym., II	tridym., I	.....	498	0.05	0.21
	tr	tridym., I	cristob., I	.....	1743	0.05	0.21
	fus	tridym., I	liq	.....	1953		
	tr	cristob., II	cristob., I	.....	522	0.20	0.837
	fus	cristob., I	liq	.....	2001	1.84	7.699
Sm	tr	c, II	c, I	.....	1190	0.74	3.10
	fus	c, I	liq	3.18	1345	2.06	8.619
	vap	liq	g	760	2064	39.8	166.5
Sm_2O_3	tr	c, monocl.	c, cubic	.....	1148		
	fus	c, cubic	liq	.....	2535		
Sn	tr	c, white	c, grey	.....	286.2	0.500	2.092
	fus	c, grey	liq	.....	505.06	1.67	6.987
	vap	liq	g	760	2896	70.8	296.2
$SnBr_2$	fus	c	liq	.....	505	1.7	7.11
	vap	liq	g	.....	911	2.2	92.1
$SnBr_4$	tr	c, II	c, I	.....	288.5	0.304	1.272
	fus	c, I	liq	0.66	302.5	2.80	11.71
	vap	liq	g	0.66	302.5	12.2	51.04
	vap	liq	g	760	477	10.7	44.77
$SnCl_2$	fus	c	liq	.....	521	3.0	12.5
	vap	liq	g	760	888	21.0	87.86
$SnCl_4$	fus	c	liq	.....	239.9	2.19	9.163
	vap	liq	g	760	386.8	8.5	35.5
SnF_2	vap	liq	g, equil.	760	1126		
SnH_4	fus	c	liq	.....	123.3		
	vap	liq	g	760	220.8	4.4	18.4
SnI_2	fus	c	liq	.....	593		
	vap	liq	g	760	1000	22.4	93.72
SnI_4	fus	c	liq	.....	417	4.53	18.95
	vap	liq	g	760	621	12.4	51.88

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
SnS	tr	c, II	c, I	.....	875	0.160	0.669
	fus	c, I	liq	.....	1153	7.55	31.59
	vap	liq	g, equil.	760	1500		
Sr	tr	c, α	c, β	.....	505		
	tr	c, β	c, γ	.....	893		
	fus	c, γ	liq	1.8	1043		
	vap	liq	g	760	1648	33.2	138.9
$SrBr_2$	tr	c, II	c, I	.....	918	2.90	12.13
	fus	c, I	liq	.....	930	2.50	10.46
	vap	liq	g	5.9(E − 3)	1200	58.2	243.5
$SrCO_3$	tr	c, III	c, II	.....	1203	4.7	19.7
	tr	c, II	c, I	.....	1689	0.8	3.3
	fus	c, I	liq	.....	1770		
$SrCl_2$	tr	c, II	c, I	1.07(E − 6)	1003	0.65	2.72
	sub	c, I	g	1.07(E − 6)	1003	71.5	299.2
	fus	c	liq	2.0(E − 4)	1146	3.80	15.90
	vap	liq	g	4.0(E − 3)	1245	66.0	276.1
SrF_2	sub	c	g	3.02(E − 6)	1270	98.4	411.7
	fus	c	liq	.....	1736	7.135	29.853
SrI_2	fus	c	liq	.....	811	4.70	19.66
	vap	liq	g	0.040	1200	56.8	237.7
$Sr(NO_3)_2$	fus	c	liq	.....	891	12.7	5.3
SrO	fus	c	liq	.....	2688		
$SrSO_4$	tr	c, II	c, I	.....	1425		
	fus	c, I	liq	.....	1878		
$SrTiO_3$	fus	c	liq	.....	2313		
$SrWO_4$	fus	c	liq	.....	1843		
Ta	fus	c	liq	.....	3250	7.5	31.4
	vap	liq	g	760	5638	182.1	761.91
$TaBr_5$	fus	c	liq	.....	528		
$TaCl_5$	fus	c	liq	.....	489.0	7.1	29.7
	vap	liq	g	760	506.0	12.8	53.56
Ta_2O_5	tr	c	c, tetrag.	.....	1633		
	fus	c, tetrag.	liq	.....	2160		
Tb	tr	c, II	c, I	.....	1560	1.20	5.021
	fus	c, I	liq	8.1(E − 4)	1630	2.58	10.79
	vap	liq	g	760	3496	79.1	331.0
$TbCl_3$	fus	c	liq	.....	855		
	vap	liq	g	0.275	1223	42.0	175.7
TbF_3	fus	c	liq	.....	1446		
Tb_2O_3	fus	c	liq	.....	2565		
Tb_4O_7	fus	c	liq	.....	2610		
Tc	sub	c	g	2.0(E − 6)	2150	164	686.2
	fus	c	liq	2.0(E − 4)	2443		

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
TcF_6	tr	c, I	c, II	.....	267.8	1.8	7.53
	fus	c, II	liq	400	310.5	1.1	4.60
	vap	liq	g	400	310.5	7.44	31.13
	vap	liq	g	760	328.4	7.22	30.21
Tc_2O_7	sub	c	g	0.7	392.6	30.2	126.4
	vap	liq	g	0.7	392.6	18.8	78.66
Te	fus	c	liq	0.176	722.95	4.18	17.49
	vap	liq	g, equil.	760	1261		
TeF_4	fus	c	liq	.....	402.7	5.5	23.0
TeO_2	fus	c	liq	0.11	1006	6.95	29.08
	vap	liq	g	0.11	1006	53.1	222.2
Th	tr	c, α	c, β	.....	1636	0.65	2.72
	fus	c, β	liq	.....	2028	3.85	16.11
	vap	liq	g	760	5061	123.0	514.63
$ThCl_4$	tr	c, α	c, β	.....	670	1.20	5.021
	fus	c, β	liq	.....	1042	14.69	61.463
ThF_4	fus	c	liq	0.52	1375	4	17
	vap	liq	g	0.52	1375	71.3	298.3
ThI_4	sub	c	g	7.2(E − 4)	623	36.1	151.0
ThO_2	sub	c	g	1.8(E − 4)	2400	162	677.8
	fus	c	liq	.....	3490		
Ti	tr	c, α	c, β	.....	1167	0.99	4.15
	fus	c, β	liq	4.4(E − 3)	1943	3.7	15.5
	vap	liq	g	760	3562	100.6	420.91
$TiBr_4$	fus	c	liq	0.411	311.4	3.08	12.89
	vap	liq	g	0.411	311.4	13.10	54.810
	vap	liq	g	760	506.6	10.60	44.350
$TiCl_4$	fus	c	liq	.....	249.9	2.23	9.330
	vap	liq	g	.....	249.9	10.34	43.263
	vap	liq	g	760	410.6	8.15	34.10
TiF_4	sub	c	g	760	456.3	21.6	90.37
TiI_4	tr	c, α	c, β	.....	379	2.37	9.916
	fus	c, β	liq	.....	428	4.68	19.58
	vap	liq	g	760	650	13.98	58.492
TiO	tr	c, II	c, I	.....	1264	0.82	3.43
TiO_2	fus	c	liq	.....	2113	11	46.0
Tl	tr	c, α	c, β	.....	507	0.09	0.38
	fus	c, β	liq	.....	577	0.98	4.10
	vap	liq	g	760	1760	39.4	164.8
TlBr	sub	c	g	1.9	733	30.5	127.6
	fus	c	liq	1.9	733	3.92	16.40
	vap	liq	g, equil.	760	1092	23.9	100.0
TlCl	fus	c	liq	.....	704	3.72	15.56
	vap	liq	g, equil.	760	1093	24	100

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
TlF.....	fus	c	liq	.....	595.4	3.315	13.870
	vap	liq	g, equil.	760	1099		
TlI.....	tr	c, II	c, I	.....	451	0.22	0.92
	fus	c, I	liq	1.0	715	3.52	14.73
	vap	liq	g	1.0	715	27.3	114.2
	vap	liq	g, equil.	760	1099		
$TlNO_3$.....	tr	c, II	c, I	.....	416	0.91	3.81
	fus	c, I	liq	.....	479.8	2.264	9.473
Tl_2O.....	fus	c	liq	.....	852	7.24	30.29
Tl_2O_3.....	fus	c	liq	.....	998	3	12.5
Tm.....	fus	c	liq	.....	1818	4.02	16.82
	vap	liq	g	760	2220	45.6	190.8
$TmCl_3$.....	fus	c	liq	.....	1103		
	vap	liq	g	0.554	1173	77.5	324.3
	vap	liq	g	760	1763		
TmF_3.....	tr	c, α	c, β	.....	1316		
	fus	c, β	liq	2.7(E − 3)	1431		
	sub	c, β	g	2.7(E − 3)	1431	88.9	372.0
Tm_2O_3.....	fus	c	liq	.....	2665		
U.....	tr	c, α	c, β	.....	941	0.667	2.791
	tr	c, β	c, γ	.....	1048	1.137	4.7572
	fus	c, γ	liq	.....	1405	2.036	8.5186
	vap	liq	g	760	4407	110.9	464.01
UBr_3.....	tr	c	liq	0.013	1003	15	62.8
UBr_4.....	fus	c	liq	5.7	792	16	66.9
	vap	liq	g	5.7	792	33.9	141.8
	vap	liq	g	760	1039	30.5	127.6
UCl_4.....	tr	c, II	c, I	.....	820		
	fus	c, I	liq	32.6	863	11	46.0
	vap	liq	g	760	1075	20.4	85.35
UCl_6.....	sub	c	g	1.8	370	17.3	72.38
UF_4.....	tr	c	c	.....	1110	3.4	14.2
	fus	c	liq	7.03	1330	10.24	42.844
	vap	liq	g	7.03	1330	57.1	238.9
UF_5.....	tr	c, II	c, I	.....	408		
	fus	c, I	liq	13.4	621	11.1	46.44
	vap	liq	g	13.4	621	25.1	105.0
	vap	liq	g	760	776	23.2	97.07
UF_6.....	sub	c	g	760	329.7	11.5	48.12
	sub	c	g	1,138	337.2	11.4	47.70
	vap	liq	g	1,138	337.2	6.9	28.9
UI_4.....	fus	c	liq	4.5	779	19.3	80.75
UO_2.....	fus	c	liq	.....	3115	18.2	76.15
V.....	fus	c	liq	2.0(E − 3)	2175	5.00	20.92
	vap	liq	g	760	3682	108.0	451.87

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
VCl_4	fus	c	liq	.....	252.6	2.3	9.62
	vap	liq	g	760	426	9.5	39.7
$VOCl_3$	fus	c	liq	.....	196	2.29	9.581
	vap	liq	g	760	400	8.45	35.35
V_2O_5	fus	c	liq	.....	947	15.6	65.27
W	fus	c	liq	0.039	3653	8.46	35.40
	vap	liq	g	760	5828	197.0	824.25
WBr_5	fus	c	liq	.....	568	4	17
	vap	liq	g	760	665	13.9	58.16
$WOBr_4$	fus	c	liq	640	595.5	14	58.6
	vap	liq	g	640	595.5	13.4	56.07
	vap	liq	g	760	604.5	13.2	55.23
WCl_6	tr	c, III	c, II	.....	458		
	tr	c, II	c, I	.....	503.1	3.39	14.18
	fus	c, I	liq	213	554.0	1.6	6.69
	vap	liq	g	213	554.6	15.0	62.76
WF_6	tr	c, II	c, I	240	264.9	1.0	4.18
	sub	c, II	g	240	264.9	8.8	36.8
	fus	c, I	liq	413	275.1	1.3	5.44
	vap	liq	g	413	275.1	7.70	32.22
	vap	liq	g	760	290.2	6.25	26.15
WOF_4	fus	c	liq	25.1	377.8	1.4	5.86
	vap	liq	g	25.1	377.8	14.8	61.92
	vap	liq	g	760	459.0	13.8	57.74
WO_3	tr	c, α	c, β	.....	1050	0.410	1.715
	fus	c, β	liq	.....	1745	17.55	73.43
Xe	fus	c	liq	611	161.36	0.548	2.293
	vap	liq	g	760	165.03	3.021	12.640
XeF_2	fus	c	liq	1412	402.2		
	sub	c	g	1412	402.2	13.0	54.39
XeF_4	fus	c	liq	811.3	390.25		
	sub	c	g	811.3	390.25	14.40	60.250
XeF_6	fus	c	liq	159	319		
	sub	c	g	159	319	15.5	64.85
Y	tr	c, α	c, β	.....	1752	1.193	4.9915
	fus	c, β	liq	2.2(E − 3)	1799	2.724	11.397
	vap	liq	g	760	3611	86.8	363.2
YCl_3	fus	c	liq	.....	973		
	vap	liq	g	.....	1100	30.9	129.3
YF_3	tr	c, II	c, I	.....	1325		
	sub	c, I	g	.....	1325	100	418.4
	fus	c, I	liq	.....	1420		
YI_3	sub	c	g	.....	890	53.6	224.3
	fus	c	liq	.....	1237		
Y_2O_3	fus	c, cubic	liq	.....	2556		

TABLE 4j-1. TEMPERATURES, PRESSURES, AND HEATS (*Continued*)

Substance	Process	State		P	T	ΔH	
		Initial	Final	mm Hg	K	kcal/mol	kJ/mol
Yb	tr	c, α	c, β	.....	1033	0.418	1.749
	fus	c, β	liq	19.8	1097	1.83	7.657
	vap	liq	g	760	1467	30.8	128.9
$YbCl_2$	fus	c	liq	.....	981		
	vap	liq	g	1.41	1573	59.8	250.2
YbF_3	sub	c	g	.....	1362	85.5	357.7
Yb_2O_3	fus	c, cubic	liq	.....	2645		
Zn	fus	c	liq	0.15	692.65	1.765	7.3848
	vap	liq	g	760	1184	27.62	115.56
$ZnBr_2$	fus	c	liq	.....	675.2	3.74	15.65
	vap	liq	g, equil.	760	928.6		
$ZnCl_2$	fus	c	liq	0.021	590	2.45	10.25
	vap	liq	g, equil.	760	989.4		
ZnO	fus	c	liq	.....	2248		
$ZnSO_4$	tr	c, α	c, β	.....	1007	4.8	20.1
Zr	tr	c, α	c, β	1.8(E − 18)	1136	0.94	3.93
	fus	c, β	liq	1.2(E − 5)	2125	4.0	16.9
	vap	liq	g	760	4682	139	581.6
	sub	c, α	g	1.8(E − 18)	1136	144.7	605.42
$ZrBr_4$	sub	c	g	40	550	27.2	113.8
ZrC	fus	c	liq	.....	3765		
$ZrCl_2$	fus	c	liq	.....	995		
$ZrCl_4$	sub	c	g	760	605	24.4	102.1
	fus	c	liq	15,800	710	6.9	28.9
	vap	liq	g	15,800	710	16.8	70.29
ZrF_4	tr	c, α	c, β	.....	678		
	sub	c, β	g	2.1(E − 3)	800	53.0	221.8
	sub	c, β	g	760	1181	50.4	210.9
	fus	c, β	liq	819	1185		
ZrI_4	sub	c	g	1.3(E − 3)	425	26.2	109.6
ZrN	fus	c	liq	.....	3225		
ZrO_2	tr	c, II	c, I	.....	1473	1.42	5.941
	sub	c, I	g	3(E − 4)	2400	165	690.4
	fus	c, I	liq	.....	2979	20.8	87.0

TABLE 4j-2. SELECTED REFERENCES*

Substance	Reference
Ac	164
Ag	164
AgBr	31, 33, 411
AgCN	294
AgCl	31, 33, 205, 209
AgF	417
AgI	15, 24, 178, 223, 239, 271, 289
$AgNO_3$	5, 84, 90, 169, 170, 204, 308, 318
Ag_2S	321, 383
Ag_2SO_4	152
Ag_2Se	10, 275, 321, 383, 412
Al	164
Al_2Br_6	97, 175, 387
Al_2Cl_6	112, 267
AlF_3	46, 93, 104, 215
AlI_3	387
Al_2O_3	48, 57, 125, 183, 270, 324, 336
$AlPO_4$	329
Am	164
Ar	129
As	164
$AsCl_3$	212, 266
AsF_3	384
AsF_5	320
AsF_3O	249
AsH_3	352, 385
AsI_3	75, 120
As_4O_6	374
Au	164
B	164, 196
BBr_3	14, 160
$B(CH_3)_3$	117
BCl_3	4, 133
BF_3	214
B_2H_6	287, 407
B_4H_9	143, 176, 408
B_2O_3	30, 262, 313, 333, 368
Ba	164
$BaBr_2$	100, 165, 171
$BaCO_3$	11, 220, 307
$BaCl_2$	100, 217, 273, 171
BaF_2	19, 150, 292, 293, 301, 317
BaI_2	100, 165
$Ba(NO_3)_2$	203
BaO	166, 260
$BaTiO_3$	105, 354, 372, 389
Be	164
$BeCl_2$	111, 116, 132, 154, 208, 231
BeF_2	130, 157, 343, 384
BeO	8, 103, 131, 182, 363
$BeSO_4$	20
Bi	164
$BiBr_3$	70, 305, 391, 410
$BiCl_3$	81, 83, 173, 246, 305, 390, 399
BiF_3	81
Bi_2O_3	76, 119, 222, 370
Bi_2S_3	71, 127
Br_2	129
BrF_3	276
BrF_5	225, 315
C	164
CBr_4	320
CCl_4	320
CF_4	320
CH_4	320
CH_3Br	320
CH_3Cl	320
CH_3F	108
CH_3I	253
CH_3OH	110, 230, 359, 398
CH_2Cl_2	320
CH_2F_2	249
CH_2I_2	320
CH_2O	320
$CHBr_3$	320
$CHCl_3$	219, 312
CHF_3	162
CO	320
CO_2	320
$COBr_2$	320
$COCl_2$	124
COF_2	284
CS_2	320
COS	320
Ca	164
CaB_2O_4	200
$Ca_2B_2O_5$	200
$CaBr_2$	100, 165, 171
CaC_2	320
$CaCO_3$	306
$CaCl_2$	58, 100, 156
CaF_2	37, 86, 301, 340
CaO	9, 270, 335
$CaSO_4$	135, 144, 394
$CaSiO_3$	126
Ca_2SiO_4	41, 70
$CaTiO_3$	66, 186
Cd	164
$CdBr_2$	33, 391
$CdCl_2$	35, 36, 391
CdF_2	28
CdI_2	33, 391

* Numbers in Reference column refer to items in the list that follows this table.

TABLE 4j-2. SELECTED REFERENCES (*Continued*)

Substance	Reference	Substance	Reference
Ce	164	$Fe_{0.947}O$	388
CeO_2	218, 254	Fe_2O_3	67
Ce_2O_3	254	Fe_3O_4	67
		FeS	68
Cl_2	129		
ClF	320	Ga	164
ClF_3	137, 232	$(GaCl_3)_2$	133
ClO_2	139	GaI_3	311, 362
		Gd	164
Co	164	$GdBr_3$	101
$CoCl_2$	325	$GdCl_3$	101
CoF_2	29, 181	GdF_3	301, 369
CoO	320	Gd_2O_3	254, 401
Cr	164	Ge	164
$CrBr_3$	357	$GeBr_4$	320
$Cr(CO)_6$	65, 309	$GeCl_4$	12
CrF_3	149, 416	GeF_4	320
Cr_2O_3	335	GeH_4	320
		GeI_4	177
Cs	164	GeO_2	236, 238, 261
CsBr	99, 332, 365		
CsCl	99, 339, 365	H_2	129
CsF	99, 332	HBr	120
CsI	99, 332, 335	HCN	62
$CsNO_3$	257	HCl	129
CsOH	319	HF	129
Cs_2SO_4	22, 291	HI	129
		HNO_3	98
Cu	164	H_2O	320
$(CuBr)_3$	151, 351	H_2S	320
$(CuCl)_3$	234, 351	H_2SO_4	129
CuF_2	145, 190	H_2Se	129
$(CuI)_3$	250, 351	H_2Te	320
Cu_2O	237	H_3PO_4	129
Cu_2S	163, 310	$^1H^2H$	129
		$^1H^2HO$	129
Dy	164	^2H_2O	129
Er	164	He	129
$ErCl_3$	101, 255, 274		
ErF_3	369	Hf	164
		$HfBr_4$	331
Eu	164	$HfCl_4$	268, 285
$EuCl_3$	255, 298	HfF_4	111
Eu_2O_3	254, 334, 401	HfI_4	376
		HfO_2	270
F_2	129		
F_2O	337	Hg	164
		$HgBr_2$	168
Fe	164	$HgCl_2$	77, 174, 391
$FeBr_2$	233	HgF_2	320
$Fe(CO)_5$	227	HgI_2	120, 234
$FeCl_2$	328	HgS	320
$(FeCl_3)_2$	243		
FeF_2	56, 192	Ho	164
FeF_3	416	$HoCl_3$	101, 255
FeI_2	326	HoF_3	27
		Ho_2O_3	254

TABLE 4j-2. SELECTED REFERENCES (*Continued*)

Substance	Reference	Substance	Reference
I_2	129	Mn	164
ICl	52	$MnBr_2$	320
IF_5	316	$MnCl_2$	235, 325
IF_7	47	MnF_2	136, 191
In	164	MnI_2	320
$InBr_3$	362	MnO	360
InCl	106, 362	Mn_3O_4	146
$InCl_3$	362		
InI_3	109, 362	Mo	164
In_2O_3	334	$Mo(CO)_6$	320
		MoF_3	51
Ir	164	MoF_6	282
IrF_6	50	MoO_3	140, 201
K	164	N_2	320
KBr	34, 99	NH_3	320
KCN	320	N_2H_4	129
KCl	18, 35, 339, 392	NH_4Br	320
KF	292, 304	NH_4Cl	129
KI	35, 99	NH_4F	129
KNO_3	204, 367	NH_4I	320
KOH	320	NH_4NO_3	129
K_2SO_4	320	NO	320
		N_2O	320
Kr	129		
KrF_2	141, 142	Na	164
KrF_4	138	NaBr	99, 118
		NaCN	320
La	164	NaCl	85, 99
$LaBr_3$	101, 353	NaF	113, 301, 304
$LaCl_3$	100, 353	NaI	99, 118
LaF_3	244, 301	Na_2MoO_4	320
LaI_3	353	$NaNO_3$	114, 204, 258
La_2O_3	254	NaOH	92
		Na_2SO_4	69, 300
Li	164	Na_2TiO_3	320
LiBr	99		
LiCl	99, 311	Nb	164
LiF	91, 301	$NbCl_5$	3, 189, 267
LiI	99	NbF_5	40, 107
$LiNO_3$	114, 204	NbO_2	199, 347
LiOH	355	Nb_2O_5	121, 281
Li_2SO_4	290, 397		
		Nd	164
Lu	164	$NdBr_3$	353, 101
$LuCl_3$	255	$NdCl_3$	100, 272, 353
LuF_3	369, 415	NdF_3	369, 418
Lu_2O_3	254	NdI_3	353, 100
		Nd_2O_3	254, 286
Mg	164		
$MgBr_2$	26	Ne	129
$MgCl_2$	155, 339		
MgF_2	155, 317	Ni	164
MgI_2	26	$NiBr_2$	229, 327
Mg_3N_2	320	$Ni(CO)_4$	371
MgO	335	$NiCl_2$	49, 229, 325
$MgSO_4$	320	NiF_2	55, 102
		NiO	197

TABLE 4j-2. SELECTED REFERENCES (*Continued*)

Substance	Reference	Substance	Reference
Np	164	RbI	42, 99
NpF_6	283, 405	$RbNO_3$	6, 115, 204
		RbOH	38
O_2	129		
O_3	129	Re	164
		$(ReBr_3)_3$	45
Os	54, 164, 395	$(ReCl_3)_3$	45
OsF_5	51	ReF_5	51
OsF_6	50	ReF_6	50, 241
$OsOF_5$	17	ReF_7	241
		Re_2O_7	128, 366
P_4	129		
PBr_3	288	Rh	164
PCl_3	288		
PCl_5	288	Rn	129
PF_3	288		
PF_5	129	Ru	164
PH_2	129	RuF_5	159
P_4O_6	129	RuF_6	61
P_4O_{10}	129	RuO_4	264
Pb	164	S	129
$PbBr_2$	32, 33	SF_4	43
$Pb(CH_3)_4$	373	SF_6	259
$PbCl_2$	13, 18, 35, 251	SO_2	320
PbF_2	13		
PbI_2	32, 96, 252	Sb	164
PbO	207	$SbBr_3$	78, 356
PbS	358	$SbCl_3$	266
$PbSO_4$	320	$SbCl_5$	279
		SbF_5	158
Pd	164	SbH_3	25
$PdCl_2$	21, 280	SbI_3	120, 356
		Sb_4O_6	288
Po	129		
		Sc	164
Pr	164	$ScBr_3$	320
$PrBr_3$	101, 353	$ScCl_3$	64
$PrCl_3$	100, 209, 353	ScF_3	193, 213
PrF_3	369, 379	ScI_3	320
PrI_3	100, 353		
		Se	288
Pt	164	SeF_4	79, 129
PtF_6	403	SeF_6	129
		SeO_2	245
Pu	164		
$PuBr_3$	296	Si	164
$PuCl_3$	296	$SiBr_4$	44, 322
PuF_3	296	$Si(CH_3)_4$	382
PuF_4	296	$SiCl_4$	288
PuF_6	296	SiF_4	288
		SiH_4	320
Ra	320	SiF_3H	378
		SiO_2	320
Rb	164		
RbBr	99	Sm	164
RbCl	99, 392	Sm_2O_3	254, 270
RbF	99, 304, 344, 365		

TABLE 4-2. SELECTED REFERENCES (*Continued*)

Substance	Reference
Sn	164
$SnBr_2$	320
$SnBr_4$	185
$SnCl_2$	122
$SnCl_4$	265, 277
SnF_2	111, 414
SnH_4	320
SnI_2	184
SnI_4	180
SnS	63, 206
Sr	164
$SrBr_2$	100, 165
$SrCO_3$	11
$SrCl_2$	100, 171, 224, 273
SrF_2	19, 293, 301
SrI_2	100, 165
$Sr(NO_3)_2$	203
SrO	320
$SrSO_4$	320
$SrTiO_3$	95
$SrWO_4$	361
Ta	164
$TaBr_5$	23
$TaCl_5$	3, 263, 345
Ta_2O_5	400
Tb	164
$TbCl_3$	255
TbF_3	369
Tb_2O_3	254
Tb_4O_7	254
Tc	216
TcF_6	341
Tc_2O_7	364
Te	164
TeF_4	179
TeO_2	247, 302, 303, 413
Th	164
$ThCl_4$	58
ThF_4	80, 301
ThI_4	123
ThO_2	1, 82
Ti	164, 396
$TiBr_4$	147, 185, 322
$TiCl_4$	226, 256, 277, 402
TiF_4	148
TiI_4	202
TiO	320
TiO_2	323
Tl	164
TlBr	16, 205, 419
TlCl	16, 72, 205, 420
TlF	188, 419
TlI	16, 73, 419
$TlNO_3$	7, 204
Tl_2O	76
Tl_2O_3	348

Substance	Reference
Tm	164
$TmCl_3$	255
TmF_3	369, 415
Tm_2O_3	254
U	164
UBr_3	134
UBr_4	134
UCl_4	134, 194, 350
UCl_6	172
UF_4	194, 198, 221
UF_5	2, 409
UF_6	195, 393
UI_4	134
UO_2	153
V	164
VCl_4	277
$VOCl_3$	277, 278
V_2O_5	161, 210
W	164, 380
WBr_5	346
$WOBr_4$	211
WCl_6	349, 375, 406
WF_6	50
WF_4O	51
WO_3	201
Xe	248
XeF_2	338
XeF_4	338
XeF_6	242, 404
Y	164
YCl_3	94, 255
YF_3	193, 301, 386
YI_3	89
Y_2O_3	270
Yb	39, 164
$YbCl_2$	297
YbF_3	415
Yb_2O_3	254
Zn	164
$ZnBr_2$	74, 187
$ZnCl_2$	74, 122, 187
ZnO	320
$ZnSO_4$	167
Zr	164
$ZrBr_4$	330
ZrC	320
$ZrCl_2$	381
$ZrCl_4$	87, 88, 269, 285
ZrF_4	53, 59, 111, 342
ZrI_4	123
ZrN	320
ZrO_2	60, 228, 270

References

1. Ackerman, R. J., R. J. Thorn, and P. W. Gilles: *J. Am. Chem. Soc.* **78,** 1767 (1956).
2. Agron, P. A.: *U.S. AEC Rept.* TID 5290, 1958.
3. Ainscough, J. B., R. J. W. Holt, and F. W. Trowse: *J. Chem. Soc.* **1957,** 1034.
4. Apple, E. F., and T. Wartik: *J. Am. Chem. Soc.* **80,** 6158 (1958).
5. Arell, A.: *Ann. Acad. Sci. Fennicae,* Ser. A, VI, **100** (1962).
6. Arell, A., and M. Varteva: *Ann. Acad. Sci. Fennicae,* Ser. A, VI, **88** (1961).
7. Arell, A., and M. Varteva: *Ann. Acad. Sci. Fennicae,* Ser. A, VI, **98** (1962).
8. Austerman, S. B.: *U.S. AEC Rept.* NAA-SR-7654, 1963.
9. Babeliowsky, T. P. J. H.: *J. Chem. Phys.* **38,** 2035 (1963).
10. Baer, Y., G. Busch, C. Frölich, and E. Steigmeier: *Z. Naturforsch.* **17a,** 886 (1962).
11. Baker, E. H.: *J. Chem Soc.* **1962,** 2525.
12. Balk, P., and D. Dong: *J. Phys. Chem.* **68,** 960 (1964).
13. Banashek, E. I., N. N. Patsakova, and I. S. Rassonskaya: *Izvest. Sektora Fiz.-Khim. Anal. Akad. Nauk S.S.S.R.* **27,** 223 (1956).
14. Barber, W. F., C. F. Boynton, and P. E. Gallagher: *PB Rept.* 148374, 1959.
15. Barrall, E. M., and L. B. Rogers: *Anal. Chem.* **36,** 1405 (1964).
16. Barrow, R. F., E. A. N. S. Jeffries, and M. Swinstead: *Trans. Faraday Soc.* **51,** 1650 (1955).
17. Bartlett, N., and N. K. Jha: *J. Chem. Soc.* **A1968,** 536.
18. Barton, J. L., and H. Bloom: *J. Phys. Chem.* **60,** 1413 (1956).
19. Bautista, R. G., and J. L. Margrave: *J. Phys. Chem.* **69,** 1770 (1965).
20. Bear, I. J., and A. G. Turnbull: *Australian J. Chem.* **19,** 751 (1966).
21. Bell, W. E., V. Merten, and M. Tagami: *J. Phys. Chem.* **65,** 510 (1961).
22. Belyaev, I. U., and N. N. Chikova: *Zhur. Neorg. Khim.* **8,** 1442 (1963).
23. Berdonosov, S. S., A. V. Lapitskii, and E. K. Bakov: *Zhur. Neorg. Khim.* **10,** 322 (1965).
24. Berger, C., M. Richard, and L. Eyrand: *Bull. soc. chim. France* **5,** 1491 (1965).
25. Berka, L., T. Briggs, M. Millard, and W. L. Jolly: *J. Inorg. Nuclear Chem.* **14,** 190 (1960).
26. Berkowitz, J., and J. R. Marquart: *J. Chem. Phys.* **37,** 1853 (1962).
27. Besenbruch, G., T. V. Charles, K. F. Zmbov, and J. L. Margrave: *J. Less-Common Metals* **12,** 335 (1967).
28. Besenbruch, G., A. S. Kana'an, and J. L. Margrave: *J. Phys. Chem.* **69,** 3174 (1965).
29. Binford, J. S., J. M. Strohmeyer, and T. H. Herbert: *J. Phys. Chem.* **71,** 2404 (1967).
30. Blackburn, P. E., and A. Buchler: *J. Phys. Chem.* **69,** 4250 (1965).
31. Blanc, M.: *Compt. rend.* **247,** 273 (1958).
32. Blanc, M., and G. Petet: *Compt. rend.* **248,** 1305 (1959).
33. Bloom, H., J. O'M. Bockris, N. E. Richards, and R. G. Taylor: *J. Am. Chem. Soc.* **80,** 2044 (1958).
34. Bloom, H., and J. W. Hastie: *Australian J. Chem.* **21,** 583 (1968).
35. Bloom, H., and S. B. Tricklebank: *Australian J. Chem.* **19,** 187 (1966).
36. Bloom, H., and B. J. Welsh: *J. Phys. Chem.* **62,** 1594 (1958).
37. Blue, G. D., J. W. Green, R. G. Bautista, and J. L. Margrave: *J. Phys. Chem.* **67,** 877 (1963).
38. Bogart, D.: *J. Phys. Chem.* **58,** 1168 (1954).
39. Bohdansky, J., and H. E. J. Schins: *J. Less-Common Metals* **12,** 248 (1967).
40. Brady, A. P., O. E. Myers, and J. K. Clauss: *J. Phys. Chem.* **64,** 588 (1960).
41. Bredig, M. A.: *J. Am. Ceram. Soc.* **33,** 188 (1950).
42. Bridgers, H. E.: Thesis, Ohio State University, 1953.
43. Brown, F., and P. L. Robinson: *J. Chem. Soc.* **1955,** 3147.
44. Brown, H. C., and W. J. Wallace: *J. Am. Chem. Soc.* **75,** 6279 (1953).
45. Büchler, A., P. E. Blackburn, and J. L. Stauffer: *J. Phys. Chem.* **70,** 685 (1966).
46. Büchler, A., E. P. Marram, and J. L. Stauffer; *J. Phys. Chem.* **71,** 4139 (1967).
47. Burbank, R. D., and F. R. Bensey: *J. Chem. Phys.* **27,** 981 (1957).
48. Burns, R. P.: *J. Chem. Phys.* **44,** 3307 (1966).
49. Busey, R. H., and W. F. Giauque: *J. Am. Chem. Soc.* **74,** 4443 (1952).
50. Cady, G. H., and G. B. Hargreaves: *J. Chem. Soc.* **1961,** 1563.
51. Cady, G. H., and G. B. Hargreaves: *J. Chem. Soc.* **1961,** 1568.
52. Calder, G. V., and W. F. Giauque: *J. Phys. Chem.* **69,** 2443 (1965).
53. Cantor, S., R. F. Newton, W. R. Grimes, and F. F. Blankenship: *J. Phys. Chem.* **62,** 96 (1958).
54. Carrera, N. J., R. F. Walker, and E. R. Plante: *J. Research NBS* **68A,** 325 (1964).
55. Catalano, E., and J. W. Stout: *J. Chem. Phys.* **23,** 1284 (1955).
56. Catalano, E., and J. W. Stout: *J. Chem. Phys.* **23,** 1803 (1955).

57. Chekovskoi, V. Ya., and V. A. Petrov: *Izmeritelnaya Tekh.* **1963,** 26.
58. Chiotti, P., G. J. Gartner, E. R. Stevens, and Y. Saito: *J. Chem. Eng. Data* **11,** 571 (1966).
59. Chretien, A., and B. Gaudreau: *Compt. rend.* **246,** 2266 (1958).
60. Chupka, W. A., J. Berkowitz, and M. G. Inghram: *J. Chem. Phys.* **26,** 1207 (1957).
61. Claasen, H. H., H. Selig, J. G. Malm, C. L. Chernick, and B. Weinstock: *J. Am. Chem. Soc.* **83,** 2390 (1961).
62. Coates, J. E., and R. H. Davies: *J. Chem. Soc.* **1950,** 1194.
63. Colin, R., and J. Drowart: *J. Chem. Phys.* **37,** 1120 (1962).
64. Corbett, J. D., and B. N. Ramsey: *Inorg. Chem.* **4,** 260 (1965).
65. Cordes, J. F., and S. Schreiner: *Z. anorg. allgem. Chem.* **299,** 87 (1959).
66. Coughanour, L. W., R. S. Roth, and V. A. DeProsse: *J. Research NBS* **52,** 37 (1954).
67. Coughlin, J. P.: *U.S. Bur. Mines Bull.* **542** (1954).
68. Coughlin, J. P.: *J. Am. Chem. Soc.* **72,** 5445 (1950).
69. Coughlin, J. P.: *J. Am. Chem. Soc.* **77,** 868 (1955).
70. Coughlin, J. P., and C. J. O'Brien: *J. Phys. Chem.* **61,** 767 (1957).
71. Cubicciotti, D.: *J. Phys. Chem.* **66,** 1205 (1962).
72. Cubicciotti, D.: *J. Phys. Chem.* **68,** 1528 (1964).
73. Cubicciotti, D.: *J. Phys. Chem.* **69,** 1410 (1965).
74. Cubicciotti, D., and H. Eding: *J. Chem. Phys.* **40,** 978 (1964).
75. Cubicciotti, D., and H. Eding: *J. Phys. Chem.* **69,** 2743 (1965).
76. Cubicciotti, D., and H. Eding: *J. Chem. Eng. Data* **12,** 548 (1967).
77. Cubicciotti, D., H. Eding, and J. W. Johnson: *J. Phys. Chem.* **70,** 2989 (1966).
78. Cushen, D. W., and R. Hulme: *J. Chem. Soc.* **1964,** 4162.
79. Dagron, C.: *Compt. rend.* **255,** 122 (1962).
80. Darnell, A. J., and F. J. Keneshea, Jr.: *J. Phys. Chem.* **62,** 1143 (1958).
81. Darnell, A. J., and W. A. McCollum: *J. Phys. Chem.* **72,** 1327 (1968).
82. Darnell, A. J., and W. A. McCollum: *U.S. AEC Rept.* NAA-SR-6498, 1961.
83. Darnell, A. J., and S. J. Yosim: *U.S. AEC Rept.* NAA-SR-3827, 1959.
84. Davis, W. J., S. E. Rogers, and A. R. Ubbelohde: *Proc. Roy. Soc.* (*London*), ser. A, **220,** 14 (1953).
85. Dawson, R., E. B. Brackett, and T. E. Brackett: *J. Phys. Chem.* **67,** 1669 (1963).
86. Delbove, F.: *Compt. rend.* **252,** 2192 (1961).
87. Denisova, N. D., E. K. Safronov, and O. N. Bystrova: *Zhur. Neorg. Khim.* **11,** 2185 (1966).
88. Denisova, N. D., E. K. Safronov, A. I. Pustilnik, and O. N. Bystrova: *Zhur. Fiz. Khim.* **41,** 59 (1967).
89. Dennison, D. H., F. H. Spedding, and A. A. Daane: *U.S. AEC Rept.* IS-57, 1959.
90. Doucet, Y., J. A. LeDuc, and G. Pannetier: *Compt. rend.* **236,** 1018 (1953).
91. Douglas, T. B., and J. L. Dever: *J. Am. Chem. Soc.* **76,** 4826 (1954).
92. Douglas, T. B., and J. L. Dever: *J. Research NBS* **53,** 81 (1954).
93. Douglas, T. B., and D. A. Ditmars: *J. Research NBS* **71A,** 185 (1967).
94. Drobst, D. V., G. P. Ankina, L. V. Dusinina, and B. G. Korshunov: *Zhur. Neorg. Khim.* **10,** 562 (1965).
95. Drys, M., and W. Trzebiatowski: *Roczniki Chem.* **31,** 489 (1957).
96. Duncan, J. F., and F. G. Thomas: *J. Chem. Soc.* **1964,** 360.
97. Dunne, T. G., and N. W. Gregory: *J. Am. Chem. Soc.* **80,** 1526 (1958).
98. Dunning, W. J., and C. W. Nutt: *Trans. Faraday Soc.* **47,** 15 (1951).
99. Dworkin, A. S., and M. A. Bredig: *J. Phys. Chem.* **64,** 269 (1960).
100. Dworkin, A. S., and M. A. Bredig: *J. Phys. Chem.* **67,** 697 (1963).
101. Dworkin, A. S., and M. A. Bredig: *J. Phys. Chem.* **67,** 2499 (1963).
102. Ehlert, T. C., R. A. Kent, and J. L. Margrave: *J. Am. Chem. Soc.* **86,** 5093 (1964).
103. Engberg, C. J., and E. H. Zehms: *J. Am. Ceram. Soc.* **42,** 300 (1959).
104. Erokhin, E. V., N. A. Zhegulskaya, L. N. Sidorov, and N. A. Akishin: *Izvest. Akad. Nauk S.S.S.R., Neorg. Mater.* **3,** 873 (1967).
105. Eru, V.: *J. Am. Ceram. Soc.* **46,** 295 (1963).
106. Fadeev, V. N., and P. I. Fedorov: *Zhur. Neorg. Khim.* **9,** 381 (1964).
107. Fairbrother, F., and W. C. Firth: *J. Chem. Soc.* **1951,** 3051.
108. Farhat-Aziz and E. A. Moelwyn-Hughes: *J. Chem. Soc.* **1961,** 1523.
109. Fedorov, P. I., A. G. Dudareva, and N. G. Drobst: *Zhur. Neorg. Khim.* **8,** 1287 (1963).
110. Feher, F., and G. Hitzemann: *Z. anorg. allgem. Chem.* **294,** 50 (1958).
111. Fischer, W., T. Petzel, and S. Lauter: *Z. anorg. allgem. Chem.* **333,** 226 (1964).
112. Foster, L. M.: *J. Am. Chem. Soc.* **72,** 1902 (1950).
113. Frank, W. B.: *J. Phys. Chem.* **65,** 2081 (1961).
114. Franzosini, P., and C. Sinistri: *Ric. Sci. Rend.* **3A,** 411 (1963).
115. Freeman, E. S., and D. A. Anderson: *Nature* **199,** 63 (1963).

116. Furby, E., and K. L. Wilkinson: *J. Inorg. & Nuclear Chem.* **14,** 123 (1960).
117. Furukawa, G. T., and R. P. Park: *NBS Rept.* 3649, 1954.
118. Gardner, T. E., and A. R. Taylor: *U.S. Bur. Mines Rept. Invest.* 7040, 1967.
119. Gattow, G., and D. Schnetze: *Z. anorg. allgem. Chem.* **328,** 44 (1964).
120. Gäumann, A.: *Helv. Chim. Acta* **51,** 543 (1968).
121. Geld, P. V., and F. G. Kasenko: *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Metallurg.* **2,** 79 (1960).
122. George, L. C., J. W. Jensen, and R. M. Doerr: *U.S. Bur. Mines Rept. Invest.* 7022, 1967.
123. Gerlach, J., J. P. Krumme, F. Pawlek, and H. Probst: *Z. physik. Chem.* [*NF*] **53,** 135 (1967).
124. Giauque, W. F., and J. B. Ott: *J. Am. Chem. Soc.* **82,** 2689 (1960).
125. Gitlesen, G., and K. Motzfeldt: *Acta Chem. Scand.* **19,** 661 (1965).
126. Glasser, F. P.: *J. Am. Ceram. Soc.* **45,** 242 (1962).
127. Glatz, A. C., and K. E. Cordo: *J. Phys. Chem.* **70,** 3757 (1966).
128. Glemser, O., A. Müller, and U. Stöcker: *Z. anorg. allgem. Chem.* **333,** 25 (1964).
129. Glushko, V. P., ed.: "Thermal Constants of Substances," vols. 1, 2, and 3, VINITI, Moscow, U.S.S.R.
130. Greenbaum, M. A., J. N. Foster, M. L. Arim, and M. Farber: *J. Phys. Chem.* **67,** 36 (1963).
131. Greenbaum, M. A., J. Weiker, and M. Farber: *J. Phys. Chem.* **69,** 4035 (1965).
132. Greenbaum, M. A., E. E. Yates, and M. Farber: *J. Phys. Chem.* **67,** 1802 (1963).
133. Greenwood, N. N., and K. Wade: *J. Chem. Soc.* **1956,** 1527.
134. Gregory, N. W.: *U.S. AEC Rept.* TID 5290, 1958.
135. Grieveson, P., and E. T. Turkdogan: *Trans. AIME* **224,** 1086 (1962).
136. Griffel, M., and J. W. Stout: *J. Am. Chem. Soc.* **72,** 4351 (1950).
137. Grisard, J. W., H. A. Bernhardt, and G. D. Oliver: *J. Am. Chem. Soc.* **73,** 5725 (1951).
138. Grosse, A. V., A. D. Kirshenbaum, A. G. Streng, and L. V. Streng: *Science* **139,** 1047 (1963).
139. Grubitsch, H., and E. Suppan: *Monatsh. Chem.* **93,** 240 (1962).
140. Gulbransen, E. A., K. F. Andrew, and F. A. Brassart: *J. Electrochem. Soc.* **110,** 242 (1963).
141. Gunn, S. R.: *J. Phys. Chem.* **71,** 2934 (1967).
142. Gunn, S. R.: *J. Am. Chem. Soc.* **88,** 5924 (1966).
143. Gunn, S. R., and L. G. Green: *J. Phys. Chem.* **65,** 2173 (1961).
144. Gutt, W., and M. A. Smith: *Trans. Brit. Ceram. Soc.* **66,** 337 (1967).
145. Haendler, H. M.: *Rept. NYO* 6121 (1953).
146. Hahn, W. C., and A. Muan: *Am. J. Sci.* **258,** 66 (1960).
147. Hall, E. H., J. M. Blocher, and I. E. Campbell: *J. Electrochem. Soc.* **105,** 271 (1958).
148. Hall, E. H., J. M. Blocher, and I. E. Campbell: *J. Electrochem. Soc.* **105,** 275 (1958).
149. Hansen, W. N., and M. Griffel: *J. Chem. Phys.* **28,** 902 (1958).
150. Hart, P. E., and A. W. Searcy: *J. Phys. Chem.* **70,** 2763 (1966).
151. Hashino, S.: *J. Phys. Soc. Japan* **7,** 560 (1952).
152. Hedvall, J. A., R. Lindner, and N. Hartler: *Acta Chem. Scand.* **4,** 1099 (1950).
153. Hein, R. A., P. N. Flagella, and J. B. Conway: *J. Am. Ceram. Soc.* **51,** 291 (1968).
154. Hildenbrand, D. L.: Private communication, 1965.
155. Hildenbrand, D. L., W. F. Hall, F. Ju, and N. D. Potter: *J. Chem. Phys.* **40,** 2882 (1964).
156. Hildenbrand, D. L., and N. D. Potter: *J. Phys. Chem.* **67,** 2231 (1963).
157. Hildenbrand, D. L., and L. P. Theard: *J. Chem. Phys.* **42,** 3230 (1965).
158. Hoffman, C. J., and W. L. Jolly: *J. Phys. Chem.* **61,** 1574 (1957).
159. Holloway, J. H., and R. D. Peacock: *J. Chem. Soc.* **1963,** 527.
160. Holmes, R. R.: *Thesis,* Purdue University, 1958.
161. Holtzberg, F., A. Reisman, M. Berry, and M. Berkenblit: *J. Am. Chem. Soc.* **78,** 1536 (1956).
162. Hou, Y. C., and J. J. Martin: *Am. Inst. Chem. Eng.* **5,** 125 (1959).
163. Hu, J. H., and H. L. Johnston: Unpublished data, Ohio State University.
164. Hultgren, R. R., R. L. Orr, P. D. Anderson, and K. K. Kelley: "Selected Values of Thermodynamic Properties of Metals and Alloys," John Wiley & Sons, Inc., New York, and supplements.
165. Hutchinson, J. F.: *U.S. AEC Rept.* IS-T-50, 1965.
166. Inghram, M. G., W. A. Chupka, and R. F. Porter: *J. Chem. Phys.* **23,** 2159 (1955).
167. Ingraham, T. R., and H. H. Kellogg: *Trans. AIME* **227,** 1419 (1963).
168. Janz, G. J., and J. Goodkin: *J. Phys. Chem.* **63,** 1975 (1959).
169. Janz, G. J., D. W. James, and J. Goodkin: *J. Phys. Chem.* **64,** 937 (1960).
170. Janz, G. J., and F. J. Kelly: *J. Phys. Chem.* **67,** 2848 (1963).

171. Janz, G. J., F. J. Kelly, and J. L. Perano: *Trans. Faraday Soc.* **59,** 2718 (1963).
172. Johnson, O., T. Butler, and A. S. Newton: *U.S. AEC Rept.* TID 5290, 1958.
173. Johnson, J. W., W. J. Silva, and D. Cubicciotti: *J. Phys. Chem.* **69,** 3916 (1965).
174. Johnson, J. W., W. J. Silva, and D. Cubicciotti: *J. Phys. Chem.* **70,** 2985 (1966).
175. Johnson, J. W., W. J. Silva, and D. Cubicciotti: *J. Phys. Chem.* **72,** 1669 (1968).
176. Johnston, H. L., H. L. Kerr, E. C. Clarke, and J. T. Hallett: *ONR Rept.* RF-309, 1949.
177. Jolly, W. L., and W. M. Latimer: *J. Am. Chem. Soc.* **74,** 5754 (1952).
178. Jost, W., H. J. Oel, and G. Schneidermann: *Z. physik. Chem.* [*NF*] **17,** 175 (1958).
179. Junkins, J. H., H. A. Bernhardt, and E. J. Barber: *J. Am. Chem. Soc.* **74,** 5749 (1952).
180. Kabesh, A., and R. S. Nyholm: *J. Chem. Soc.* **1951,** 3245.
181. Kana'an, A. S., G. Besenbruch, and J. L. Margrave: *J. Inorg. & Nuclear Chem.* **28,** 1035 (1966).
182. Kandyba, V. V., P. B. Kantor, R. M. Krasovitskaya, and E. N. Fomichev: *Doklady Akad. Nauk S.S.S.R.* **131,** 566 (1960).
183. Kantor, P. B., E. N. Fomichev, and V. V. Kandyba: *Izmeritelnayr Tekh.* **5,** 27 (1966).
184. Karnenko, N. V.: *Zhur. Neorg. Khim.* **12,** 3248 (1967).
185. Keavney, J. J., and N. O. Smith: *J. Phys. Chem.* **64,** 737 (1960).
186. Kelley, K. K., and A. D. Mah: *U.S. Bur. Mines Rept. Invest.* 5490, 1959.
187. Keneshea, F. J., and D. Cubicciotti: *J. Chem. Phys.* **40,** 191 (1964).
188. Keneshea, F. J., and D. Cubicciotti: *J. Phys. Chem.* **71,** 1958 (1967).
189. Keneshea, F. J., D. Cubicciotti, G. Withers, and H. Eding: *J. Phys. Chem.* **72,** 1272 (1968).
190. Kent, R. A., J. D. McDonald, and J. L. Margrave: *J. Phys. Chem.* **70,** 874 (1966).
191. Kent, R. A., T. C. Ehlert, and J. L. Margrave: *J. Am. Chem. Soc.* **86,** 5090 (1964).
192. Kent, R. A., and J. L. Margrave: *J. Am. Chem. Soc.* **87,** 4754 (1965).
193. Kent, R. A., K. F. Zmbov, A. S. Kana'an, G. Besenbruch, J. D. McDonald, and J. L. Margrave: *J. Inorg. & Nuclear Chem.* **28,** 1419 (1966).
194. Khripin, L. A., Yu. V. Gazarinski, and L. A. Luk'yanova: *Izvest. Sibir. Otdel. Akad. Nauk S.S.S.R., Khim. Nauk* **11,** 14 (1965).
195. Kigorski, K.: *Bull. Chim. Soc. Japan* **23,** 67 (1950).
196. Kimpel, R. F., and R. G. Moss: *J. Chem. Eng. Data* **13,** 231 (1968).
197. King, E. G., and A. U. Christensen: *J. Am. Chem. Soc.* **80,** 1800 (1958).
198. King, E. G., and A. U. Christensen: *U.S. Bur. Mines Rept. Invest.* 5709, 1961.
199. King, E. G., and A. U. Christensen: *U.S. Bur. Mines Rept. Invest.* 5789, 1961.
200. King, E. G., D. R. Torgeson, and O. A. Cook: *J. Am. Chem. Soc.* **70,** 2160 (1948).
201. King, E. G., W. W. Weller, and A. U. Christensen: *U. S. Bur. Mines Rept. Invest.* 5664, 1960.
202. King, E. G., W. W. Weller, A. U. Christensen, and K. K. Kelley: *U.S. Bur. Mines Rept. Invest.* 5799, 1961.
203. Kleppa, O. J.: *Phys. Chem. Solids,* **23,** 819 (1962).
204. Kleppa, O. J., and F. G. McCarty: *J. Chem. Eng. Data* **8,** 331 (1963).
205. Kleppa, O. J., and S. V. Meschel: *J. Phys. Chem.* **67,** 668 (1963).
206. Klushin, D. N., and V. Ya. Chernykh: *Zhur. Neorg. Khim.* **5,** 1409 (1960).
207. Knache, O., and K. E. Prescher: *Z. Erzbergbau u. Metallhüttenw.* **17,** 28 (1964).
208. Ko, H. C., M. A. Greenbaum, M. Farber, and C. C. Selph: *J. Phys. Chem.* **71,** 254 (1967).
209. Kobayashi, K.: *Sci. Repts. Tohoku Imp. Univ.* [*I*] **35,** 112 (1950).
210. Kohlmuller, R., and J. Martin: *Bull. soc. chim. France* **1961,** 748.
211. Kokovin, G. A.: *Zhur. Neorg. Khim.* **12,** 15 (1967).
212. Kolditz, L.: *Z. anorg. allgem. Chem.* **289,** 118 (1957).
213. Komissarova, L. N., and B. I. Pokrovskii: *Doklady Akad. Nauk S.S.S.R.* **149,** 599 (1963).
214. Kostryukov, V. N., O. P. Samorukov, and P. G. Strelkov: *Zhur. Fiz. Khim.* **34,** 1354 (1958).
215. Krause, R. F., and T. B. Douglas: *J. Phys. Chem.* **72,** 475 (1968).
216. Krikorian, O. H., J. H. Carpenter, and R. S. Newbury: *U.S. AEC Rept.* UCRL 1226-T, 1964.
217. Krohn, C.: *Acta Chem. Scand.* **20,** 255 (1966).
218. Kul'varskaya, B. S., and K. S. Maslovskaya: *Radiotekh. i Elektron.* **5,** 1254 (1960).
219. Kusano, K.: *Nippon Kagaku Zasshi* **78,** 614 (1958).
220. Lander: J. J.: *J. Am. Chem. Soc.* **73,** 5794 (1951).
221. Langer, S., and F. F. Blankenship: *J. Inorg. Nuclear Chem.* **14,** 26 (1960).
222. Levin, E. M., and R. S. Roth: *J. Research NBS* **A68,** 189 (1964).
223. Lieser, K. H.: *Z. physik. Chem.* [**NF**] **2,** 238 (1954).
224. Loehman, R. E., R. A. Kent, and J. L. Margrave: *J. Chem. Eng. Data* **10,** 296 (1965).
225. Long, R. D., J. J. Martin, and R. C. Vogel: *J. Chem. Eng. Data* **3,** 28 (1958).

226. Luchinskii, G. P.: *Zhur. Fiz. Khim.* **40,** 593 (1966).
227. Ludbetter, A. J., and J. E. Spice: *Can. J. Chem.* **37,** 1923 (1959).
228. Lynch, C. T., F. W. Pahldiek, and L. B. Robinson: *J. Am. Ceram. Soc.* **44,** 147 (1961).
229. McCreary, J. R., and R. J. Thorn: *J. Chem. Phys.* **48,** 3290 (1968).
230. McCurdy, K. G., and K. J. Laidler: *Can. J. Chem.* **41,** 1867 (1963).
231. McDonald, R. A., and F. L. Oetting: *CPIA Proc.* **1,** 101 (1965).
232. McGill, R., W. S. Wendolkowski, and E. J. Barber: *J. Phys. Chem.* **61,** 1101 (1957).
233. MacLaren, R. O., and N. W. Gregory: *J. Phys. Chem.* **59,** 184 (1955).
234. Magee, D. W.: Thesis, Ohio State University, 1955.
235. Mah, A. D.: *U.S. Bur. Mines Rept. Invest.* 5600, 1960.
236. Mah, A. D., and L. H. Adami: *U.S. Bur. Mines Rept. Invest.* 6034, 1962.
237. Mah, A. D., L. B. Pankratz, W. W. Weller, and E. G. King: *U.S. Bur. Mines Rept. Invest.* 7026, 1967.
238. Majumdar, A. J., and R. Roy: *J. Inorg. & Nuclear Chem.* **27,** 1961 (1965).
239. Majumdar, A. J., and R. Roy: *J. Phys. Chem.* **63,** 1858 (1959).
240. Malbrunot, P. F., P. A. Mennier, G. M. Scatema, W. H. Mears, K. P. Murphy, and J. V. Sinka: *J. Chem. Eng. Data* **13,** 16 (1968).
241. Malm, J. G., and H. Selig: *J. Inorg. & Nuclear Chem.* **20,** 189 (1961).
242. Malm, J. G., I. Sheft, and C. L. Chernick: *J. Am. Chem. Soc.* **85,** 110 (1963).
243. Mapes, W. H., and N. W. Gregory: *J. Chem. Eng. Data* **13,** 249 (1968).
244. Mar, R. W., and A. W. Searcy: *J. Phys. Chem.* **71,** 888 (1967).
245. Margulis, E. V., L. S. Getskin, and N. S. Milskaya: *Zhur. Neorg. Khim.* **7,** 729 (1962).
246. Mayer, S. W., S. J. Yosim, and L. E. Topol: *J. Phys. Chem.* **64,** 238 (1960).
247. Mezaki, R., and J. L. Margrave: *J. Phys. Chem.* **66,** 1713 (1962).
248. Michels, A., and C. Prins: *Physica* **28,** 101 (1962).
249. Mitra, G.: *J. Am. Chem. Soc.* **80,** 5639 (1958).
250. Miyake, S., S. Hashino, and T. Takenaka: *J. Phys. Soc. Japan* **7,** 19 (1952).
251. Modestova, T. P.: *Zhur. Neorg. Khim.* **5,** 1655 (1960).
252. Modestova, T. P., and T. Sumarokova: *Zhur. Neorg. Khim.* **3,** 1655 (1958).
253. Moelwyn-Hughes, E. A., and R. W. Missen: *Trans. Faraday Soc.* **53,** 607 (1957).
254. Mordovin, O. A., N. I. Timofeeva, and L. N. Drozdova: *Izvest. Akad. Nauk S.S.S.R., Neorg. Mater.* **3,** 187 (1967).
255. Moriarty, J. L.: *J. Chem. Eng. Data* **8,** 422 (1963).
256. Morozov, I. S., and D. Ya. Toptygin: *Zhur. Neorg. Khim.* **1,** 2601 (1956).
257. Mustajoki, A.: *Ann. Acad. Sci. Fennicae,* ser. A, **6**(7), (1957).
258. Mustajoki, A.: *Ann. Acad. Sci. Fennicae,* ser. A, **6**(9), (1958).
259. Neudorffer, J.: *Compt. rend.* **232,** 2102 (1951).
260. Newbury, R. S., G. W. Bartow, and A. W. Searcy: *J. Chem. Phys.* **48,** 793 (1968).
261. Newns, G. R., and R. Hanks: *J. Chem. Soc.* **A1966,** 954.
262. Nikitin, D. T., and P. A. Akishin: *Doklady Akad. Nauk S.S.S.R.* **145,** 1294 (1962).
263. Nikolaev, K. K., Z. N. Orshanskaya, O. R. Gavrilov, and L. A. Nisel'son: *Zhur. Neorg. Khim.* **12,** 556 (1967).
264. Nikolskii, A. B.: *Zhur. Neorg. Khim.* **8,** 1045 (1963).
265. Nisel'son, L. A., I. I. Lapidus, Yu. V. Golubkov, and V. V. Mogucheva: *Zhur. Neorg. Khim.* **12,** 1952 (1967).
266. Nisel'son, L. A., and V. V. Mogucheva: *Zhur. Neorg. Khim.* **11,** 144 (1966).
267. Nisel'son, L. A., A. I. Pustilnik, O. R. Gavrilov, and V. A. Rodin: *Zhur. Neorg. Khim.* **10,** 2339 (1965).
268. Nisel'son, L. A., T. D. Sokolova, and V. I. Stolyarov: *Zhur. Fiz. Khim.* **41,** 1654 (1967).
269. Nisel'son, L. A., V. I. Stolyarov, and T. D. Sokolova: *Zhur. Fiz. Khim.* **39,** 3025 (1965).
270. Noguchi, T., M. Mizuno, and T. Kozuka: *Kogyo Kagaku Zasshi* **69,** 1705 (1966).
271. Nölting, J.: *Ber. Bunsenges. Phys. Chem.* **67,** 172 (1963).
272. Novikov, G. I., and A. K. Baev: *Zhur. Neorg. Khim.* **7,** 1349 (1962).
273. Novikov, G. I., and F. G. Gavryuchenkov: *Zhur. Neorg. Khim.* **9,** 475 (1964).
274. Novikov, G. I., and F. G. Gavryuchenkov: *Zhur. Neorg. Khim.* **10,** 1668 (1965).
275. Novoselova, A. V., Zh. G. Shleifman, V. P. Zhomanov, and R. K. Sloma: *Izvest. Akad. Nauk S.S.S.R., Neorg. Mater.* **3,** 1143 (1967).
276. Oliver, G. D., and J. W. Grisard: *J. Am. Chem. Soc.* **74,** 2705 (1952).
277. Oppermann, H.: *Z. physik. Chem.* **236,** 161 (1967).
278. Oppermann, H.: *Z. anorg. allgem. Chem.* **351,** 113 (1967).
279. Oppermann, H.: *Z. anorg. allgem. Chem.* **356,** 1 (1967).
280. Oranskaya, M. A., and N. A. Makhovlova: *Zhur. Neorg. Khim.* **5,** 12 (1960).
281. Orr, R. L.: *J. Am. Chem. Soc.* **75,** 2808 (1953).
282. Osborne, D. W., F. Schreiner, J. G. Malm, H. Selig, and L. Rochester: *J. Chem. Phys.* **44,** 2802 (1966).

283. Osborne, D. W., B. Weinstock, and J. H. Burns: Preliminary communication 1963.
284. Pace, E. L., and M. A. Reno: *J. Chem. Phys.* **48,** 1231 (1968).
285. Palko, A. A., A. D. Ryon, and D. W. Kuhn: *J. Phys. Chem.* **62,** 319 (1958).
286. Pankratz, L. B., E. G. King, and K. K. Kelley: *U.S. Bur. Mines Rept. Invest.* 6033 1962.
287. Paridon, L. J., G. E. MacWood, and J. H. Hu: *J. Phys. Chem.* **63,** 1998 (1959).
288. Parker, V.: Private communication, 1966.
289. Perrott, C. M., and N. H. Fletcher: *J. Chem. Phys.* **48,** 2143 (1968).
290. Petit, G., and C. Bourlange: *Compt. rend.* **245,** 1788 (1957).
291. Petit, G., and N. N. Chikova: *Zhur. Neorg. Khim.* **8,** 1442 (1963).
292. Petit, G., and A. Cremieu: *Compt. rend.* **243,** 360 (1956).
293. Petit, G., and F. Delbové: *Compt. rend.* **254,** 1388 (1962).
294. Pistorius, C. W. F. T.: *J. Inorg. & Nuclear Chem.* **19,** 367 (1961).
295. Platteeuw, J. C., and S. Meyer: *Trans. Faraday Soc.* **52,** 1066 (1956).
296. Plutonium Handbook, vol. I, chap. 12, C. E. Wick, ed., Gordon and Breach, Science Publishers, Inc., New York, 1967.
297. Polyachenok, O. G., and G. I. Novikov: *Zhur. Neorg. Khim.* **8,** 2631 (1963).
298. Polyachenok, O. G., and G. I. Novikov: *Zhur. Neorg. Khim.* **9,** 773 (1964).
299. Polyachenok, O. G., and G. I. Novikov: *Vestnik Leningrad Univ.* **18,** *Ser. Fiz. Khim.* **3,** 133 (1963).
300. Popov, M. M., and M. Ginzburg: *J. Gen. Chem. U.S.S.R.* **26,** 1107 (1956).
301. Porter, R., and E. A. Brown: *J. Am. Ceram. Soc.* **45,** 49 (1962).
302. Prescher, K. E., and W. Schrödter: *Z. Erzbergbau u. Metallhüttenw.* **15,** 299 (1962).
303. Prescher, K. E., and W. Schrödter: *Z. Erzbergbau u. Metallhüttenw.* **16,** 352 (1963).
304. Pugh, A. C. P., and R. F. Barrow: *Trans. Faraday Soc.* **54,** 671 (1958).
305. Pustilnik, A. I., N. D. Denisova, L. G. Nekhamkin, and L. A. Nisel'son: *Zhur. Neorg. Khim.* **12,** 103 (1967).
306. Rao, G. V. S., M. Natorjan, and C. N. R. Rao: *J. Am. Ceram. Soc.* **51,** 179 (1968).
307. Rapoport, E., and C. W. F. T. Pistorius: *J. Geophys. Res.* **72,** 6353 (1967).
308. Reinsborough, V. C., and F. E. W. Wetmore: *Australian J. Chem.* **20,** 1 (1967).
309. Rezukhina, T. N., and V. V. Shvyrev: *Vestnik Moskov. Univ.* **7,** *Fiz. Mat. i Estestven. Nauk* **4,** 41 (1952).
310. Richardson, F. D., and J. E. Anthill: *Trans. Faraday Soc.* **51,** 22 (1955).
311. Riebling, E. F., and C. E. Erickson: *J. Phys. Chem.* **67,** 509 (1963).
312 Röck, H., and W. Schröder: *Z. physik. Chem.* [*NF*] **11,** 41 (1957).
313. Rockett, T. S., and W. R. Foster: *J. Am. Ceram. Soc.* **48,** 75 (1965).
314. Rodigino, E. N., K. Z. Gomelskii, and V. F. Luginina: *Zhur. Neorg. Khim.* **4,** 975 (1959).
315. Rogers, M. T., and J. L. Spiers: *J. Phys. Chem.* **60,** 1462 (1956).
316. Rogers, M. T., J. L. Spiers, H. B. Thomson, and M. P. Pannish: *J. Am. Chem. Soc.* **76,** 4843 (1954).
317. Rolin, M., and M. Clausier: *Rev. Int. Hautes Temp.* **4,** 39 (1967).
318. Rolla, M., and P. Franzosini: *Ann. chim. (Rome)* **48,** 723 (1958).
319. Rollet, A. P., R. Cohn-Adad, and C. Ferlin: *Compt. rend.* **256,** 5580 (1963).
320. Rossini, F. D., D. D. Wagman, W. H. Evans, S. Levine, and I. Jaffe: Selected Values of Chemical Thermodynamic Properties, *NBS Circ.* 500, 1952.
321. Roy, R., A. J. Majumdar, and C. W. Hulber: *Econ. Geol.* **54,** 1278 (1959).
322. Sackman, H., D. Demus, and D. Pankow: *Z. anorg. allgem. Chem.* **318,** 257 (1962).
323. St. Pierre, P. D. S.: *J. Am. Ceram. Soc.* **35,** 188 (1952).
324. Sata, T.: *Rev. Int. Hautes Temp.* **3,** 337 (1966).
325. Schäfer, H., L. Bayer, G. Breil, K. Etzel, and K. Krehl: *Z. anorg. allgem. Chem.* **278,** 300 (1955).
326. Schäfer, H., and W. J. Hönes: *Z. anorg. allgem. Chem.* **288,** 62 (1956).
327. Schäfer, H., and H. Jacob: *Z. anorg. allgem. Chem.* **286,** 56 (1956).
328. Schäfer, H., and K. Krehl: *Z. anorg. allgem. Chem.* **268,** 35 (1952).
329. Schäfer, E. C., and R. Roy: *Z. physik. Chem.* [*NF*] **11,** 30 (1957).
330. Schäfer, H. L., and H. Skoludek: *Z. Elektrochem.* **66,** 367 (1962).
331. Schäfer, H. L., and H. W. Wills: *Z. anorg. allgem. Chem.* **351,** 279 (1967).
332. Scheer, M. D., and J. Fine: *J. Chem. Phys.* **36,** 1647 (1962).
333. Schmidt, N. E.: *Zhur. Neorg. Khim.* **11,** 441 (1966).
334. Schneider, S. J.: *J. Research NBS* **65A,** 429 (1961).
335. Schneider, S. J.: *J. Am. Ceram. Soc.* **46,** 354 (1963).
336. Schneider, S. J., and C. L. McDaniel: *J. Research NBS* **71A,** 317 (1967).
337. Schnizlein, J. G., J. L. Sheard, R. C. Toole, and T. D. O'Brien: *J. Phys. Chem.* **56,** 233 (1952).
338. Schreiner, F., G. N. McDonald, and C. L. Chernick: *J. Phys. Chem.* **72,** 1162 (1968).

339. Schrier, E. E., and H. M. Clark: *J. Phys. Chem.* **67,** 1259 (1963).
340. Schultz, D. A., and A. W. Searcy: *J. Phys. Chem.* **67,** 103 (1963).
341. Selig, H., and J. G. Malm: *J. Inorg. & Nuclear Chem.* **24,** 641 (1962).
342. Sense, K. A., M. J. Snyder, and R. B. Filbert, Jr.: *J. Phys. Chem.* **58,** 995 (1954).
343. Sense, K. A., and R. W. Stone: *J. Phys. Chem.* **62,** 453 (1958).
344. Sense, K. A., and R. W. Stone: *J. Phys. Chem.* **62,** 1411 (1958).
345. Shchukarev, S. A., and A. R. Kurbanov: *Vestnik Leningrad Univ.* **17,** *Fiz. Khim.* 144 (1962).
346. Shchukarev, S. A., G. I. Novikov, and G. A. Kokovin: *Zhur. Neorg. Khim.* **4,** 2185 (1959).
347. Shchukarev, S. A., G. A. Semenov, and K. E. Frantseva: *Zhur. Neorg. Khim.* **11,** 233 (1966).
348. Shchukarev, S. A., G. A. Semenov, and I. A. Ratkovskii: *Zhur. Neorg. Khim.* **6,** 2817 (1961).
349. Shchukarev, S. A., and A. V. Suvorov: *Vestnik Leningrad Univ.* **16,** 87 (1961).
350. Shchukarev, S. A., I. V. Vasil'kova, A. I. Efimov, and V. P. Kerdyashev: *Zhur. Neorg. Khim.* **1,** 2272 (1956).
351. Shelton, P. A. J.: *Trans. Faraday Soc.* **57,** 2113 (1961).
352. Sherman, R. H., and W. F. Giauque: *J. Am. Chem. Soc.* **77,** 2154 (1955).
353. Shimazaki, E., and K. Niwa: *Z. anorg. allgem. Chem.* **314,** 21 (1962).
354. Shirane, G., and A. Takeda: *J. Phys. Soc. Japan* **7,** 1 (1952).
355. Shomate, C. H., and A. J. Cohen: *J. Am. Chem. Soc.* **77,** 285 (1955).
356. Sime, R. J.: *J. Phys. Chem.* **67,** 501 (1963).
357. Sime, R. J., and N. W. Gregory: *J. Am. Chem. Soc.* **82,** 93 (1960).
358. Simpson, D. R.: *Econ. Geol.* **59,** 150 (1964).
359. Singh, J., and G. C. Benson: *Can. J. Chem.* **46,** 1249 (1968).
360. Singleton, E. J., L. Carpenter, and R. V. Lundquist: *U.S. Bur. Mines Rept. Invest.* 5938, 1962.
361. Smirnova, I. N., and I. P. Kislyakov: *Izvest. Akad. Nauk S.S.S.R. Neorg. Mater,* **1,** 1162 (1965).
362. Smith, F. J., and R. F. Barrow: *Trans. Faraday Soc.* **54,** 826 (1958).
363. Smith, D. K., C. F. Cline, and V. D. Frechetti: *J. Nuclear Mater.* **6,** 265 (1962).
364. Smith, W. T., Jr., J. W. Cobble, and G. E. Boyd: *J. Am. Chem. Soc.* **75,** 5773 (1953).
365. Smith, D. F., C. E. Kaylor, G. E. Walden, A. R. Taylor, and J. B. Gayle: *U.S. Bur. Mines Rept. Invest.* 5832, 1961.
366. Smith, W. T., L. E. Line, and W. A. Bell: *J. Am. Chem. Soc.* **74,** 4964 (1952).
367. Sokolov, V. A., and N. E. Schmidt: *Izvest. Sektora. Fiz.-Khim. Anal. Inst. Obshch. i. Neorg. Khim. Akad. Nauk S.S.S.R.* **27,** 217 (1956).
368. Sommer, A.: Thesis, Ohio State University, 1962.
369. Spedding, F. H., and A. H. Daane: *Iowa State Coll. Rept.* IS-902, 1957.
370. Speranskaya, E. I., and A. A. Arshakuni: *Zhur. Neorg. Khim.* **9,** 414 (1964).
371. Spice, J. E., L. A. K. Staveley, and G. A. Harrow: *J. Chem. Soc.* **1955,** 100.
372. Statton, W. O.: *J. Chem. Phys.* **19,** 33 (1951).
373. Staveley, L. A. K., J. B. Warren, H. P. Paget, and D. J. Dowrick: *J. Chem. Soc.* **1954,** 1992.
374. Stevenson, F. D., and C. E. Wicks: *U.S. Bur. Mines Rept. Invest.* 6212, 1963.
375. Stevenson, F. D., C. E. Wicks, and F. E. Block: *U.S. Bur. Mines Rept. Invest.* 6367, 1964.
376. Stevenson, F. D., C. E. Wicks, and F. E. Block: *J. Chem. Eng. Data* **10,** 33 (1965).
377. Stull, D. R., ed: JANAF Thermochemical Tables, *PB Rept.* 168370, 1965.
378. Sujishi, S., and S. Witz: *J. Am. Chem. Soc.* **79,** 2447 (1957).
379. Suvorov, A. V., E. V. Krzhizhanovskaya, and G. I. Novikov: *Zhur. Neorg. Khim.* **11,** 2685 (1966).
380. Swarc, R., E. R. Plante, and J. J. Diamond: *J. Research NBS* **69A,** 417 (1965).
381. Swaroop, B., and S. N. Flengas: *Can. J. Chem.* **44,** 199 (1966).
382. Tannenbaum, S., S. Kaye, and G. F. Lewenz: *J. Am. Chem. Soc.* **75,** 3753 (1953).
383. Tavernier, B. H., J. Vervechev, P. Messieu, and M. Baiwir: *Z. anorg. allgem. Chem.* **356,** 77 (1967).
384. Taylor, A. R., and T. E. Gardner: *U.S. Bur. Mines Rept. Invest.* 6664, 1965.
385. Thiloaud, E., and P. Flögel: *Z. anorg. allgem. Chem.* **329,** 244 (1964).
386. Thomas, R. E., C. F. Weaver, H. A. Friedman, H. Imsley, L. A. Harris, and H. A. Yokel, Jr.: *J. Phys. Chem.* **65,** 1096 (1961).
387. Thonstad, J.: *Can. J. Chem.* **42,** 2739 (1964).
388. Todd, S. S., and K. R. Bonnickson: *J. Am. Chem. Soc.* **73,** 3894 (1951).
389. Todd, S. S., and R. E. Lorenson: *J. Am. Chem. Soc.* **74,** 2043 (1952).
390. Topol, L. E., S. W. Mayer, and L. D. Ransom: *J. Phys. Chem.* **64,** 862 (1960).
391. Topol, L. E., and L. D. Ransom: *J. Phys. Chem.* **64,** 1339 (1960).

392. Treadwell, W. D., and W. Werner: *Helv. Chim. Acta* **36**, 1436 (1953).
393. Trevorrow, L. E., M. J. Steindler, D. V. Steidl, and J. T. Savage: *Inorg. Chem.* **6**, 1060 (1967).
394. Trzebiatowski, W., J. Damm, and T. Romotowski: *Roczniki Chem.* **30**, 431 (1956).
395. Tylkina, M. A., V. P. Polyakova, and O. Kh. Khamidov: *Zhur. Neorg. Khim.* **8**, 776 (1963).
396. Vollmer, O., M. Braun, and R. Kohlhaus: *Z. Naturforsch.* **22A**, 833 (1967).
397. Voskresenskaya, N. K., and E. I. Banashek: *Izvest. Sektora Fiz.-Khim. Anal. Inst. Obshch. Neorg. Khim. Akad. Nauk S.S.S.R.* **25**, 150 (1954).
398. Wadsö, I.: *Acta Chem. Scand.* **20**, 544 (1966).
399. Walden, G. E., and D. F. Smith: *U.S. Bur. Mines Rept. Invest.* 5859, 1961.
400. Waring, J. L., and R. S. Roth: *J. Research NBS* **72A**, 175 (1968).
401. Warshaw, I., and R. Roy: *J. Phys. Chem.* **65**, 2048 (1961).
402. Weed, H. C.: Thesis, Ohio State University, 1957.
403. Weinstock, B., J. G. Malm, and E. E. Weaver: *J. Am. Chem. Soc.* **83**, 4310 (1961).
404. Weinstock, B., E. E. Weaver, and C. P. Knop: *Inorg. Chem.* **5**, 2189 (1966).
405. Weinstock, B., E. E. Weaver, and J. G. Malm: *J. Inorg. & Nuclear Chem.* **11**, 104 (1959).
406. Welty, J. R.: Thesis, Oregon State University, 1962.
407. Wirth, H. E., and E. D. Palmer: *J. Phys. Chem.* **60**, 911 (1956).
408. Wirth, H. E., and E. D. Palmer: *J. Phys. Chem.* **60**, 914 (1956).
409. Wolf, A. S., J. C. Posey, and K. E. Rapp: *Inorg. Chem.* **4**, 751 (1965).
410. Wolten, G. M., and S. W. Mayer: *Acta Cryst.* **11**, 739 (1958).
411. Zakharchenko, G. A.: *Zhur. Obshchei Khim.* **21**, 453 (1951).
412. Zhitaneva, G. M., Y. V. Rumyantsev, and F. M. Bolondz: *Trudy Vostochno-Siber. Filiala Akad. Nauk S.S.S.R.* **41**, 121 (1962).
413. Zlomanov, V. P., A. V. Novoselova, A. S. Pashinkin, Yu. P. Simanov, and K. H. Semenenko: *Zhur. Neorg. Khim.* **3**, 1473 (1958).
414. Zmbov, K. F., J. W. Hastie, and J. L. Margrave: *Trans. Faraday Soc.* **64**, 861 (1968).
415. Zmbov, K. F., and J. L. Margrave: *J. Less-Common Metals* **12**, 494 (1967).
416. Zmbov, K. F., and J. L. Margrave: *J. Inorg. & Nuclear Chem.* **29**, 673 (1967).
417. Zmbov, K. F., and J. L. Margrave: *J. Phys. Chem.* **71**, 446 (1967).
418. Zmbov, K. F., and J. L. Margrave: *J. Chem. Phys.* **45**, 3167 (1966).
419. Cubicciotti, D., and H. Eding: *J. Chem. Eng. Data* **10**, 343 (1965).
420. Eding, H. and D. Cubicciotti: *J. Chem. Eng. Data* **9**, 524 (1964).