

GCE

Chemistry

Data booklet

Edexcel Advanced Subsidiary GCE in Chemistry (8CH01)

Edexcel Advanced GCE in Chemistry (9CH01)

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Introduction

This data booklet is for use with the Edexcel GCE in Chemistry (8CH01/9CH01) assessments for units 4, 5 and 6.

Students will be provided with a clean copy of this data booklet for these assessments, which should be kept under the same conditions as the assessment papers (examination papers and internal assessment tasks).

Students may have a copy of this data booklet for their personal use in lessons and for homework, to allow them to become familiar with how to use it.

Selected Elements: Physical and Thermochemical Data

Z	Atomic number	N	Number of atoms per molecule (atomicity) at T_b
St	State under standard conditions	ρ	Density (at 298 K) or density of liquid at T_b for gases
A	Molar mass of element (to one decimal place)	T_b	Boiling temperature (at 1 atm)
T_m	Melting temperature (at 1 atm)	ΔH_m^\ominus	Standard molar enthalpy change of fusion at T_m
ΔH_b^\ominus	Standard molar enthalpy change of vaporization at T_b	ΔH_{at}^\ominus	Standard molar enthalpy change of atomization at 298 K
S^\ominus	Standard molar entropy at 298 K		For this table, the mole applies to single atoms.

Z	Element	N	St	A	ρ /g cm ⁻³	T_m /K	T_b /K	ΔH_m^\ominus /kJ mol ⁻¹	ΔH_b^\ominus /kJ mol ⁻¹	S^\ominus /J mol ⁻¹ K ⁻¹	ΔH_{at}^\ominus /kJ mol ⁻¹
1	Hydrogen	H	2	g	0.07 ^{20 K}	14	20	0.06	0.45	65.3	218.0
2	Helium	He	1	g	0.15 ^{3 K}	1 ^{26 atm}	4	0.02	0.08	126.0	—
3	Lithium	Li	1	s	0.53	454	1615	3.02	134.68	29.1	159.4
4	Beryllium	Be	1	s	1.85	1551	3243	12.50	294.60	9.5	324.3
5	Boron	B	1	s	2.34	2573	2823 ^{sub}	22.18	538.90	5.9	562.7
6	Carbon	C	1	s	2.25	3925	5100	—	716.70	5.7	716.7
6	(graphite)										
6	Carbon	C	1	s	3.51	>3823	5100	—	—	2.4	714.8
6	(diamond)										
7	Nitrogen	N	2	g	0.81 ^{77 K}	63	77	0.36	2.79	95.8	472.7
8	Oxygen	O	2	g	1.15 ^{90 K}	55	90	0.22	3.41	102.5	249.2
9	Fluorine	F	2	g	1.51 ^{85 K}	53	85	2.55	3.27	158.6	79.0
10	Neon	Ne	1	g	1.20 ^{27 K}	25	27	0.34	1.77	146.2	—
11	Sodium	Na	1	s	0.97	371	1156	2.60	89.04	51.2	107.3
12	Magnesium	Mg	1	s	1.74	922	1380	8.95	128.66	32.7	147.7
13	Aluminium	Al	1	s	2.70	933	2740	10.67	293.72	28.3	326.4
14	Silicon	Si	1	s	2.33	1683	2628	46.44	376.80	18.8	455.6
15	Phosphorus	P	4	s	2.34	863 ^{43 atm}	473	4.71 ^{143 atm}	30.10 ^{sub}	22.8	332.2
15	(red)										
15	Phosphorus	P	4	s	1.82	317	553	0.63	12.40	41.1	314.6
15	(white)										

Z	Element	N	St	A	ρ	T_m	T_b	ΔH_m^e	ΔH_b^e	S^e	ΔH_{at}^e
				/g mol ⁻¹	/g cm ⁻³	/K	/K	/kJ mol ⁻¹	/kJ mol ⁻¹	/J mol ⁻¹ K ⁻¹	/kJ mol ⁻¹
16	Sulfur (rhombic)	S	8	s	32.1	2.07	386	—	—	31.8	278.8
16	Sulfur (monoclinic)	S	8	s	32.1	1.96	718	1.41	9.62	32.6	278.5
17	Chlorine	Cl	2	g	35.5	1.56 ^{238 K}	172	3.20	10.20	82.5	121.7
18	Argon	Ar	1	g	39.9	1.40 ^{87 K}	87	1.18	6.52	154.7	—
19	Potassium	K	1	s	39.1	0.86	336	2.32	77.53	64.2	89.2
20	Calcium	Ca	1	s	40.1	1.54	1112	8.66	149.95	41.4	178.2
21	Scandium	Sc	1	s	45.0	2.99	1814	16.11	304.80	34.6	377.8
22	Titanium	Ti	1	s	47.9	4.50	1933	15.48	428.86	30.6	469.9
23	Vanadium	V	1	s	50.9	5.96	2163	17.57	458.57	28.9	514.2
24	Chromium	Cr	1	s	52.0	7.20	2130	13.81	348.78	23.8	396.6
25	Manganese	Mn	1	s	54.9	7.20	1517	14.64	219.74	32.0	280.7
26	Iron	Fe	1	s	55.8	7.86	1808	15.36	351.04	27.3	416.3
27	Cobalt	Co	1	s	58.9	8.90	1768	15.23	382.42	30.0	424.7
28	Nickel	Ni	1	s	58.7	8.90	1728	17.61	371.83	29.9	429.7
29	Copper	Cu	1	s	63.5	8.92	1356	13.05	304.60	33.2	338.3
30	Zinc	Zn	1	s	65.4	7.14	693	7.38	115.31	41.6	130.7
31	Gallium	Ga	1	s	69.7	5.90	303	5.59	256.06	40.9	277.0
32	Germanium	Ge	1	s	72.6	5.35	1210	31.80	334.30	31.1	376.6
33	Arsenic	As	4	s	74.9	5.73	1090 ^{28 atm}	27.61	129.70	35.1	302.5
34	Selenium	Se	2	s	79.0	4.81	490	5.44	26.32	42.4	227.1
35	Bromine	Br	2	l	79.9	3.12 ^{293 K}	266	5.27	15.00	174.9	111.9
36	Krypton	Kr	1	g	83.8	2.15 ^{121 K}	116	1.64	9.03	164.0	—
37	Rubidium	Rb	1	s	85.5	1.53	312	2.34	69.20	76.8	80.9
38	Strontium	Sr	1	s	87.6	2.60	1042	9.20	138.91	52.3	164.4
42	Molybdenum	Mo	1	s	95.9	10.20	2883	27.61	594.13	28.7	658.1
45	Rhodium	Rh	1	s	102.9	12.40	2239	21.76	495.39	31.5	556.9
46	Palladium	Pd	1	s	106.4	12.02	1827	16.74	393.30	37.6	378.2
47	Silver	Ag	1	s	107.9	10.50	1235	11.30	255.06	42.6	284.6
48	Cadmium	Cd	1	s	112.4	8.64	594	6.07	99.87	51.8	112.0
49	Indium	In	1	s	114.8	7.30	429	3.26	226.35	57.8	243.3

Z	Element	N	St	A	ρ	T_m	T_b	ΔH_m^\ominus	ΔH_b^\ominus	S^\ominus	ΔH_{at}^\ominus	
				/g mol ⁻¹	/g cm ⁻³	/K	/K	/kJ mol ⁻¹	/kJ mol ⁻¹	/J mol ⁻¹ K ⁻¹	/kJ mol ⁻¹	
50	Tin (white)	Sn	1	s	118.7	7.28	505	2533	7.20	290.37	51.5	302.1
50	Tin (grey)	Sn	1	s	118.7	5.75	505	2543	—	—	44.1	304.2
51	Antimony	Sb	4	s	121.8	6.68	904	2023	19.83	67.91	45.7	262.3
52	Tellurium	Te	2	s	127.6	6.00	723	1263	17.49	50.63	49.7	196.7
53	Iodine	I	2	s	126.9	4.93	387	457	7.89	20.85	180.7	106.8
54	Xenon	Xe	1	g	131.3	3.52 ^{164K}	161	166	2.30	12.64	169.6	—
55	Caesium	Cs	1	s	132.9	1.88	302	942	2.13	65.90	85.2	76.1
56	Barium	Ba	1	s	137.3	3.51	998	1913	7.66	150.92	62.8	180.0
57	Lanthanum	La	1	s	138.9	6.14	1194	3730	11.30	399.57	56.9	431.0
74	Tungsten	W	1	s	183.8	19.35	3683	5933	35.22	799.14	32.6	849.4
75	Rhenium	Re	1	s	186.2	20.53	3453	5900	33.05	707.10	36.9	769.9
76	Osmium	Os	1	s	190.2	22.48	2973	>5570	29.29	627.60	32.6	790.8
77	Iridium	Ir	1	s	192.2	22.42	2683	4403	26.36	563.58	35.5	655.2
78	Platinum	Pt	1	s	195.1	21.45	2045	4100	19.66	510.45	41.6	565.3
79	Gold	Au	1	s	197.0	18.88	1337	3353	12.36	324.43	47.4	366.1
80	Mercury	Hg	1	l	200.6	13.59	234	630	2.30	59.15	76.0	61.3
81	Thallium	Tl	1	s	204.4	11.85	577	1730	4.27	162.09	64.2	182.2
82	Lead	Pb	1	s	207.2	11.34	601	2013	4.77	179.41	64.8	195.0
83	Bismuth	Bi	1	s	(209)	9.80	544	1833	10.88	151.50	56.7	207.1
84	Polonium	Po	2	s	(210)	9.40	527	1235	12.55	60.20	62.8	144.1
85	Astatine	At	2	s	(210)	—	575	610	11.92	45.20	60.7	90.4
86	Radon	Rn	1	g	(222)	4.40 ^{211K}	202	211	2.90	16.40	176.1	—
87	Francium	Fr	1	s	(223)	—	300	950	2.09	63.60	95.4	72.8
88	Radium	Ra	1	s	(226)	5.00	973	<1410	8.37	136.82	71.1	161.9
89	Actinium	Ac	1	s	(227)	10.07	1323	3473	14.23	397.5	56.5	405.9
90	Thorium	Th	1	s	232	11.70	2023	5060	15.65	543.92	53.4	598.3
91	Protactinium	Pa	1	s	(231)	15.37	<1870	4300	14.64	460.2	51.9	606.7
92	Uranium	U	1	s	238	19.05	1405	4091	15.48	422.60	50.2	535.6
94	Plutonium (α)	Pu	1	s	(242)	19.84	914	3505	2.09	317.10	—	—

Infrared Spectroscopy

Correlation of infrared absorption wavenumbers with molecular structure

Intensity: w – weak absorption; m – medium absorption; s – strong absorption; v – variable intensity of absorption; sh – sharp absorption; b – broad absorption.

Group	Intensity	Wavenumber range/cm ⁻¹
C–H stretching vibrations		
Alkane	m-s	2962-2853
Alkene	m	3095-3010
Alkyne	s	3300
Arene	v	3030
Aldehyde	w and w	2900-2820 and 2775-2700
C–H bending variations		
Alkane	v	1485-1365
Arene	5 adjacent hydrogen atoms	v, s and v, s
	4 adjacent hydrogen atoms	v, s
	3 adjacent hydrogen atoms	v, m
	2 adjacent hydrogen atoms	v, m
	1 adjacent hydrogen atoms	v, m
N–H stretching vibrations		
Amine	m	3500-3300
Amide	m	3500-3140
O–H stretching vibrations		
Alcohols and phenols	v, b	3750-3200
Carboxylic acids	w	3300-2500
C–O stretching vibrations		
Esters	methanoates	s
	ethanoates	s
	propanoates	s
	benzoates	s and s
		1200-1180
		1250-1230
		1200-1150
		1310-1250 and 1150-1100
Carbon-halogen stretching vibrations		
C–F	s	1400-1000
C–Cl	s	800-600
C–Br	s	600-500
C–I	s	about 500
C=C stretching vibrations		
Isolated alkene	v	1669-1645
Arene	v, m, v, m	1600, 1580, 1500, 1450
C=O stretching vibrations		
Aldehydes, saturated alkyl	s	1740-1720
Ketones, aryl, alkyl	s	1700-1680

Group		Intensity	Wavenumber range/cm ⁻¹
Carboxylic acids	alkyl	s	1725-1700
	aryl	s	1700-1680
Carboxylic acid anhydrides		s and s	1850-1800 and 1790-1740
Acyl halides	chlorides	s	1795
	bromides	s	1810
Esters, saturated		s	1750-1735
Amides		s	1700-1630

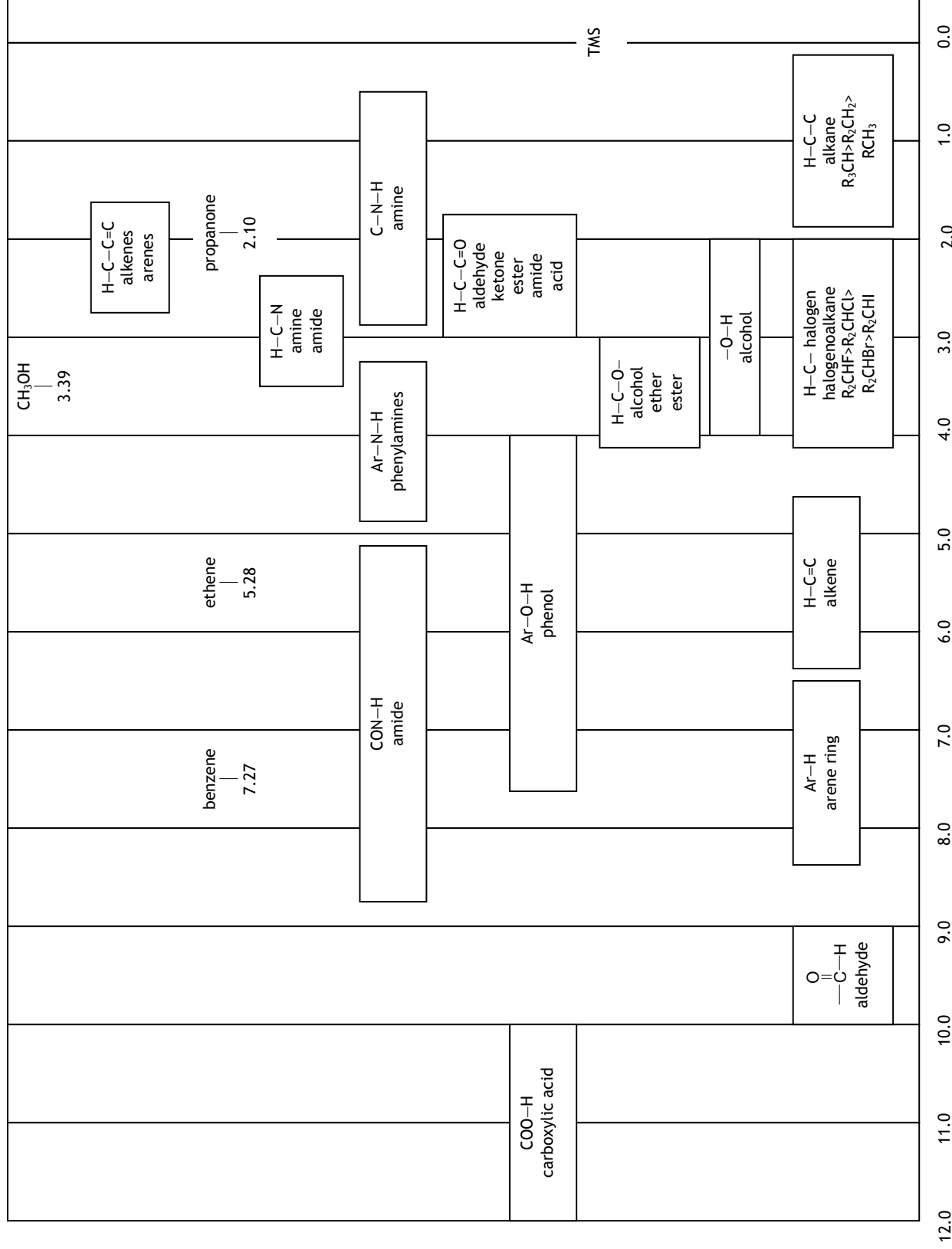
Triple bond stretching vibrations

C≡N	m	2260-2215
C≡C	v	2260-2100

Infrared correlation table

Wavenumber range/cm ⁻¹	Group
3750-3200	Alcohols and phenols
3500-3300	Amine
3500-3140	Amide
3300	Alkyne
3095-3010	Alkene
3030	Arene
2962-2853	Alkane
2900-2820	Aldehyde
2775-2700	Aldehyde
3300-2500	Carboxylic acid
2260-2215	C≡N
2260-2100	C≡C
1850-1800	Carboxylic acid anhydride
1810	Acyl bromide
1790-1740	Carboxylic acid anhydride
1795	Acyl chloride
1750-1735	Ester
1740-1720	Aldehyde
1730-1717	Aryl ester
1725-1700	Carboxylic acid
1700-1680	Aryl and alkyl ketones, aryl carboxylic acid
1700-1630	Amides
1669-1645	Alkene
1600, 1580, 1500 and 1450	Arene
1485-1365	Alkane
1400-1000	Fluoroalkane
1310-1250	Benzoate
1250-1230	Ethanoate
1200-1180	Methanoate
1200-1150	Propanoate
1150-1100	Benzoate
880-700	Arene
800-600	Chloroalkane
600-500	Bromoalkane
About 500	Iodoalkane

Nuclear Magnetic Resonance



Chemical shifts for hydrogen relative to TMS (tetramethylsilane)

Ionization Energies

Z	j = 1	2	3	4	5	6	7	8	9	10	11	12	13	14
$E_{\text{m}j}/\text{kJ mol}^{-1}$														
1	H	1312												
2	He	2372	5251											
3	Li	520	7298	11815										
4	Be	900	1757	14849	21007									
5	B	801	2427	3660	25026	32828								
6	C	1086	2353	4621	6223	37832	47278							
7	N	1402	2856	4578	7475	9445	53268	64362						
8	O	1314	3388	5301	7469	10989	13327	71337	84080					
9	F	1681	3374	6051	8408	11022	15164	17868	92040	106437				
10	Ne	2081	3952	6122	9370	12177	15239	19999	23069	115382	131435			
11	Na	496	4563	6913	9544	13352	16611	20115	25491	28934	141367	159079		
12	Mg	738	1451	7733	10541	13629	17995	21704	25657	31644	35463	169996	189371	
13	Al	578	1817	2745	11578	14831	18378	23296	27460	31862	38458	42655	201276	222313
14	Si	789	1577	3232	4356	16091	19785	23787	29253	33878	38734	45935	50512	235211
15	P	1012	1903	2912	4957	6274	21269	25398	29855	35868	40960	46274	54074	59037
16	S	1000	2251	3361	4564	7012	8496	27107	31671	36579	43140	48706	54483	62876
17	Cl	1251	2297	3822	5158	6542	9362	11018	33606	38601	43963	51068	57119	63364
18	Ar	1521	2666	3931	5771	7238	8781	11996	13842	40761	46188	52003	59654	66201
19	K	419	3051	4412	5877	7975	9649	11343	14942	16964	48577	54433	60701	68896
20	Ca	590	1145	4912	6474	8144	10496	12320	14207	18192	20385	57050		
21	Sc	631	1235	2389	7089	8844	10720	13320	15313	17370	21741	24106		
22	Ti	658	1310	2653	4175	9573	11517	13586	16259	18640	20833	25592		
23	V	650	1414	2828	4507	6294	12362	14490	16760	19860	22240	24609		
24	Cr	653	1592	2987	4740	6686	8738	15540	17822	20200	23580	26130		
25	Mn	717	1509	3249	4940	6985	9200	11508	18956	21400	23960	27600		
26	Fe	759	1561	2958	5290	7236	9600	12100	14576	22679	25290	28020		
27	Co	758	1646	3232	4950	7671	9840	12400	15100	17960	26600	29400		
28	Ni	737	1753	3394	5300	7285	10400	12800	15600	18600	21660	30990		
29	Cu	746	1958	3554	5330	7709	9940	13400	16000	19200	22400	25700		

Z	j = 1	2	3	4	5	6	7	8	9	10	11	12	13	14
	$E_{mj}/\text{kJ mol}^{-1}$													
30	Zn	906	1733	3833	5730	7970	10400	12900	16800	19600	23000			
31	Ga	579	1979	2963	6200									
32	Ge	762	1537	3302	4411	9021								
33	As	947	1798	2736	4837	6043	12312							
34	Se	941	2045	2974	4144	6590	7883	14990						
35	Br	1140	2100	3500	4560	5760	8549	9938	18600					
36	Kr	1315	2368	3565	5070	6243	7574	10710	12158	22230				
37	Rb	403	2632	3900	5080	6850	8144	9572	13100	14500	26740			
38	Sr	550	1064	4210	5500	6908	8761	10200	11800	15600	17100	31270		
39	Y	616	1181	1980	5960	7429	8973	11200	12400	14137	18400	19900		
40	Zr	660	1267	2218	3313	7863	9500							
41	Nb	664	1382	2416	3700	4877	9900	12100						
42	Mo	685	1558	2621	4480	5905	6600	12230	14800					
43	Tc	702	1472	2850										
44	Ru	711	1617	2747										
45	Rh	720	1745	2997										
46	Pd	805	1875	3177										
47	Ag	731	2074	3361										
48	Cd	868	1631	3616										
49	In	558	1821	2705	5200									
50	Sn	709	1412	2943	3930	6974								
51	Sb	834	1595	2440	4260	5403	10400							
52	Te	869	1790	2698	3610	5668	6820	13200						
53	I	1008	1846	3200										
54	Xe	1170	2047	3100										
55	Cs	376	2420	3300										
56	Ba	503	965											
78	Pt	870	1791											
79	Au	890	1980											
80	Hg	1007	1810	3300										
86	Rn	1037												

Atomic Radii and Pauling Electronegativities

This table is arranged according to the periodic table.

- r_v Van der Waals radius r_m Metallic radius for coordination number 12
 r_{cov} Covalent radius
 r_i Ionic radius for coordination number 6, except where superscript number ^{4 3 etc} indicates different coordination number (figures in parentheses give charge state)
 N_p Pauling electronegativity index

Group		r_v /nm	r_m /nm	r_{cov} /nm	r_i /nm	N_p			
1	Li	0.180	0.157	0.134	0.074(+1)	1.0			
	Na	0.230	0.191	0.154	0.102(+1)	0.9			
	K	0.280	0.235	0.196	0.138(+1)	0.8			
	Rb		0.250		0.149(+1)	0.8			
	Cs		0.272		0.170(+1)	0.7			
	NH ₄ ⁺				0.150(+1)				
2	Be		0.112	0.125	0.027(+2) ⁴	1.5			
	Mg	0.170	0.160	0.145	0.072(+2)	1.2			
	Ca		0.197		0.100(+2)	1.0			
	Sr		0.215		0.113(+2)	1.0			
	Ba		0.224		0.136(+2)	0.9			
3	B		0.098	0.090	0.012(+3) ⁴	2.0			
	Al		0.143	0.130	0.053(+3)	1.5			
	Ga	0.190	0.153	0.120	0.062(+3)	1.6			
d block	Sc		0.164		0.075(+3)	1.3			
	Ti		0.147		0.061(+4)	0.067(+3)	0.086(+2)	1.5	
	V		0.135		0.054(+5)	0.059(+4)	0.064(+3)	0.079(+2)	1.6
	Cr		0.129		0.030(+6) ⁴	0.062(+3)	0.073(+2)	1.6	
	Mn		0.137	0.139	0.026(+7) ⁴	0.058(+3)	0.067(+2)	1.5	
	Fe		0.126	0.125	0.055(+3)	0.061(+2)		1.8	
	Co		0.125	0.126	0.053(+3)	0.065(+2)		1.8	
	Ni	0.160	0.125	0.121	0.056(+3)	0.070(+2)		1.8	
	Cu	0.140	0.128	0.135	0.073(+2)	0.046(+1) ²		1.9	
	Zn	0.140	0.137	0.120	0.075(+2)			1.6	
	Mo		0.140		0.060(+6)	0.065(+4)	0.067(+3)	1.8	
	Ag	0.160	0.144	0.152	0.065(+3) ⁴	0.115(+1)	0.089(+2)	1.9	
	Cd	0.170	0.152	0.148	0.095(+2)			1.7	
	Au	0.175	0.144		0.070(+3) ⁴	0.137(+1)		2.4	
Hg	0.170	0.155	0.148	0.102(+2)	0.097(+1) ³		1.9		
4	C	0.170	0.092	0.077			2.5		
	Si	0.210	0.132	0.118	0.040(+4)		1.8		
	Ge		0.139	0.122	0.054(+4)		1.8		
	Sn	0.190	0.158	0.140	0.069(+4)	0.122(+2) ⁸		1.8	

Group		r_v /nm	r_m /nm	r_{cov} /nm	r_i /nm		N_p	
	Pb	0.200	0.175		0.078(+4)	0.118(+2)	1.8	
5	N	0.155	0.088	0.075	0.171(-3)		3.0	
	P	0.185	0.128	0.110	0.017(+5) ⁴	0.190(-3)	2.1	
	As		0.139	0.122	0.050(+5)	0.220(-3)	2.0	
	Sb		0.161	0.143	0.061(+5)	0.080(+3) ⁵	1.9	
	Bi	0.200	0.182		0.102(+3)		1.9	
6	O	0.150	0.089	0.073	0.140(-2)		3.5	
	S	0.180	0.127	0.102	0.102(+6) ⁴	0.185(-2)	2.5	
	Se	0.190	0.140	0.117	0.029(+6) ⁴	0.195(-2)	2.4	
	Te	0.210	0.143	0.135	0.052(+4) ³	0.220(-2)	2.1	
7	H	0.120	0.078	0.037	0.208(-1)		2.1	
	F	0.155		0.071	0.133(-1)		4.0	
	Cl	0.180		0.099	0.180(-1)	0.020(+7) ⁴	0.012(+5) ³	3.0
	Br	0.190		0.144	0.195(-1)	0.026(+7) ⁴		2.8
	I	0.195		0.133	0.215(-1)	0.095(+5)		2.5
0 (8)	He	0.180						
	Ne	0.160						
	Ar	0.190						
	Kr	0.200						
	Xe	0.220						

Electron Affinities

ΔU Electron affinity*, that is, molar internal energy change (at 0 K) for process: $X^{n-}(g) + e^- \rightarrow X^{(n+1)-}(g)$ ($n =$ zero or positive).

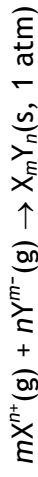
Element	$\Delta U/\text{kJ mol}^{-1}$	Element	$\Delta U/\text{kJ mol}^{-1}$
H	-72.8	C	-122.3
N	0 (± 19)	O	-141.1
O^-	+798	F	-328.0
P	-72	S	-200.4
S^-	+640	Cl	-348.8
Br	-324.6	I	-295.4

* Some chemists define electron affinity for the reverse process.

Reference: Hotop.

Lattice Energies

The lattice energy U of a crystal X_mY_n is the molar internal energy change for the process:



The main entry in the table is the experimental value of $-U$ (based on the Born-Haber cycle and using data in this booklet); the second entry in parentheses is the theoretical value based on calculations.

Lattice	F ⁻	Cl ⁻	Br ⁻	I ⁻	O ²⁻	S ²⁻
	$-U/\text{kJ mol}^{-1}$					
Li ⁺	1031 (1031)	848 (845)	803 (799)	759 (738)	2814 (2799)	2499 (2376)
Na ⁺	918 (912)	780 (770)	742 (735)	705 (687)	2478 (2481)	2198 (2134)
K ⁺	817 (807)	711 (702)	679 (674)	651 (636)	2232 (2238)	2052 (1933)
Rb ⁺	783 (772)	685 (677)	656 (653)	628 (617)	2161 (2163)	1944 (1904)
Cs ⁺	747 (739)	661 (643)	635 (623)	613 (592)	2063 (—)	1850 (—)
Ag ⁺	958 (920)	905 (833)	891 (816)	889 (778)	2910 (3002)	2677 (—)
Be ²⁺	3505 (3150)	3020 (3004)	2914 (2950)	2800 (2653)	4443 (4293)	3832 (3841)
Mg ²⁺	2957 (2913)	2526 (2326)	2440 (2097)	2327 (1944)	3791 (3795)	3299 (3318)
Ca ²⁺	2630 (2609)	2258 (2223)	2176 (2132)	2074 (1905)	3401 (3414)	3013 (3038)
Sr ²⁺	2492 (2476)	2156 (2127)	2075 (2008)	1963 (1937)	3223 (3217)	2848 (2874)
Ba ²⁺	2352 (2341)	2056 (2033)	1985 (1950)	1877 (1831)	3054 (3029)	2725 (2711)
Zn ²⁺	3032 (2930)	2734 (2690)	2678 (2632)	2605 (2549)	3971 (4142)	3322 (—)
Cd ²⁺	2809 (2740)	2552 (2526)	2507 (2468)	2441 (2406)	— (3806)	3121 (—)
Hg ²⁺	— (2757)	2651 (2569)	2628 (2598)	2610 (2569)	— (3907)	3037 (—)
Pb ²⁺	2522 (2460)	2269 (2229)	2219 (2169)	2163 (2086)	— (3502)	— (—)
Mn ²⁺	— (2644)	2537 (2368)	2471 (2304)	— (2212)	3745 (3724)	3238 (3376)
Cu ²⁺	— (—)	993 (904)	976 (870)	963 (833)	3189 (3273)	2865 (—)
NH ₄ ⁺	829 (834)	705 (688)	673 (658)	641 (629)	— (—)	2026 (2008)

Bond Lengths and Bond Energies

<i>L</i>	Bond length		<i>E</i> (X-Y)		Bond length		<i>E</i> (X-Y)		
<i>E</i> (X-Y)	Bond	in	<i>L</i>	<i>E</i> (X-Y)	Bond	in	<i>L</i>	<i>E</i> (X-Y)	
			/nm	/kJ mol ⁻¹			/nm	/kJ mol ⁻¹	
1	Br—Br	Br ₂	0.228	192.9	33	O—Si	SiO ₂ (s)	0.161	466
2	Br—H	HBr	0.141	366.3	34	O=Si	SiO ₂ (g)		638
3	Cl—Cl	Cl ₂	0.199	243.4	35	O≡Si	SiO		805
4	Cl—H	HCl	0.127	432.0	36	P—P	P ₄	0.221	198
5	F—F	F ₂	0.142	158	37	P≡P	P ₂	0.189	485
6	F—H	HF	0.092	568.0	38	C—C	average	0.154	347
7	I—I	I ₂	0.267	151.2	39	C=C	average	0.134	612
8	H—I	HI	0.161	298.3	40	C≡C	average	0.120	838
9	H—H	H ₂	0.074	435.9	41	C—H	average	0.108	413
10	H—Si	SiH ₄	0.148	318	42	C—H	CH ₄	0.109	435
11	H—Ge	GeH ₄	0.153	285	43	C—F	average	0.138	467
12	H—N	NH ₃	0.101	391	44	C—F	CH ₃ F	0.139	452
13	H—P	PH ₃	0.144	321	45	C—F	CF ₄	0.132	485
14	H—As	AsH ₃	0.152	297	46	C—Cl	average	0.177	346
15	H—O	H ₂ O	0.096	464	47	C—Cl	CCl ₄	0.177	327
16	H—S	H ₂ S	0.134	364	48	C...Cl	C ₆ H ₅ Cl	0.170	—
17	H—Se	H ₂ Se	0.146	313	49	C—Br	average	0.194	290
18	Na—Na	Na ₂	0.308	72	50	C—Br	CBr ₄	0.194	285
19	K—K	K ₂	0.392	49	51	C—I	average	0.214	228
20	N—N	N ₂ H ₄	0.145	158	52	C—I	CH ₃ I	0.214	234
21	N=N	C ₆ H ₁₄ N ₂	0.120	410	53	C—N	average	0.147	286
22	N≡N	N ₂	0.110	945.4	54	C=N	average	0.130	615
23	N—O	HNO ₂	0.120	214	55	C≡N	average	0.116	887
24	N=O	NOF, NOCl	0.114	587	56	C...N	phenylamine	0.135	—
25	N≡P	PN	0.149	582	57	C—O	average	0.143	358
26	O—O	H ₂ O ₂	0.148	144	58	C—O	CH ₃ OH	0.143	336
27	O—O	O ₃	0.128	302	59	C=O	CO ₂	0.116	805
28	O=O	O ₂	0.121	498.3	60	C=O	HCHO	0.121	695
29	S—S	S ₈	0.205	266	61	C=O	aldehydes	0.122	736
30	S=S	S ₂	0.189	429.2	62	C=O	ketones	0.122	749
31	O—Si	SO ₃	0.143	469	63	C≡O	CO	0.113	1077
32	Si—Si	Si(s), SiH ₄	0.235	226	64	C—Si	(CH ₃) ₄ Si, SiC(s)	0.187	307

References: Sutton, Johnson, Cottrell.

Standard Electrode Potentials

E^\ominus Standard electrode potential of aqueous system at 298 K, that is, standard emf of electrochemical cell in which Pt [H₂(g)]2H⁺(aq) forms the left-hand side electrode system

	Right-hand electrode system	E^\ominus / V
1	Li ⁺ (aq) Li(s)	-3.03
2	Rb ⁺ (aq) Rb(s)	-2.93
3	K ⁺ (aq) K(s)	-2.92
4	Ca ²⁺ (aq) Ca(s)	-2.87
5	Na ⁺ (aq) Na(s)	-2.71
6	Mg ²⁺ (aq) Mg(s)	-2.37
7	Ce ³⁺ (aq) Ce(s)	-2.33
8	U ³⁺ (aq) U(s)	-1.80
9	Al ³⁺ (aq) Al(s)	-1.66
10	Mn ²⁺ (aq) Mn(s)	-1.19
11	V ²⁺ (aq) V(s)	-1.18
12	[SO ₄ ²⁻ (aq) + H ₂ O(l)], [SO ₃ ²⁻ (aq) + 2OH ⁻ (aq)] Pt	-0.93
13	Zn ²⁺ (aq) Zn(s)	-0.76
14	Cr ³⁺ (aq) Cr(s)	-0.74
15	[As(s) + 3H ⁺ (aq)], AsH ₃ (g) Pt	-0.60
16	[2SO ₃ ²⁻ (aq) + 3H ₂ O(l)], [S ₂ O ₃ ²⁻ (aq) + 6OH ⁻ (aq)] Pt	-0.58
17	Fe(OH) ₃ (s), [Fe(OH) ₂ (s) + OH ⁻ (aq)] Pt	-0.56
18	S(s), S ²⁻ (aq) Pt	-0.48
19	Fe ²⁺ (aq) Fe(s)	-0.44
20	Cr ³⁺ (aq), Cr ²⁺ (aq) Pt	-0.41
21	Cd ²⁺ (aq) Cd(s)	-0.40
22	[Se(s) + 2H ⁺ (aq)], H ₂ Se(g) Pt	-0.40
23	PbSO ₄ (s), [Pb(s) + SO ₄ ²⁻ (aq)] Pt	-0.36
24	Co ²⁺ (aq) Co(s)	-0.28
25	[H ₃ PO ₄ (aq) + 2H ⁺ (aq)], [H ₃ PO ₃ (aq) + H ₂ O(l)] Pt	-0.28
26	V ³⁺ (aq), V ²⁺ (aq) Pt	-0.26
27	Ni ²⁺ (aq) Ni(s)	-0.25
28	Sn ²⁺ (aq) Sn(white, s)	-0.14
29	Pb ²⁺ (aq) Pb(s)	-0.13
30	[CrO ₄ ²⁻ (aq) + 4H ₂ O(l)], [Cr(OH) ₃ (s) + 5OH ⁻ (aq)] Pt	-0.13

	Right-hand electrode system	E^\ominus / V
31	$2H^+(aq) [H_2(g)]Pt$	0
32	$\frac{1}{2}S_4O_6^{2-}(aq), S_2O_3^{2-}(aq) Pt$	+0.09
33	$[2H^+(aq) + S(s)], H_2S(aq) Pt$	+0.14
34	$[Sn^{4+}(aq)1.0M HCl], [Sn^{2+}(aq)(1.0M HCl)] Pt$	+0.15
35	$Cu^{2+}(aq), Cu^+(aq) Pt$	+0.15
36	$[4H^+(aq) + SO_4^{2-}(aq)], [H_2SO_3(aq) + H_2O(l)] Pt$	+0.17
37	$AgCl(s), [Ag(s) + Cl^-(aq)] Pt$	+0.22
38	$[PbO_2(s) + 2H_2O(l)], [Pb(OH)_2(s) + 2OH^-(aq)] Pt$	+0.25
39	$Hg_2Cl_2(s), [2Hg(s) + 2Cl^-(aq)] Pt$	+0.27
40	$[PbO_2(s) + H_2O(l)], [PbO(s) + 2OH^-(aq)] Pt$	+0.28
41	$Cu^{2+}(aq) Cu(s)$	+0.34
42	$[VO^{2+}(aq) + 2H^+(aq)], [V^{3+}(aq) + H_2O(l)] Pt$	+0.34
43	$Fe(CN)_6^{3-}(aq), Fe(CN)_6^{4-}(aq) Pt$	+0.36
44	$[O_2(g) + 2H_2O(l)], 4OH^-(aq) Pt$	+0.40
45	$[2H_2SO_3(aq) + 2H^+(aq)], [S_2O_3^{2-}(aq) + 3H_2O(l)] Pt$	+0.40
46	$[S_2O_3^{2-}(aq) + 6H^+(aq)], [2S(s) + 3H_2O(l)] Pt$	+0.47
47	$[IO^-(aq) + H_2O(l)], [I^-(aq) + 2OH^-(aq)] Pt$	+0.49
48	$[4H_2SO_3(aq) + 4H^+(aq)], [S_4O_6^{2-}(aq) + 6H_2O(l)] Pt$	+0.51
49	$Cu^+(aq) Cu(s)$	+0.52
50	$I_2(aq), 2I^-(aq) Pt$	+0.54
51	$[MnO_4^{2-}(aq) + 2H_2O(l)], [MnO_2(s) + 4OH^-(aq)] Pt$	+0.59
52	$[2H^+(aq) + O_2(g)], H_2O_2(aq) Pt$	+0.68
53	$[C_6H_4O_2(aq) + 2H^+(aq)], C_6H_4(OH)_2(aq) Pt$	+0.70
54	$Fe^{3+}(aq), Fe^{2+}(aq) Pt$	+0.77
55	$\frac{1}{2}Hg_2^{2+}(aq) Hg(s)$	+0.79
56	$Ag^+(aq) Ag(s)$	+0.80
57	$[2NO_3^-(aq) + 4H^+(aq)], [N_2O_4(g) + 2H_2O(l)] Pt$	+0.80
58	$[ClO^-(aq) + H_2O(l)], [Cl^-(aq) + 2OH^-(aq)] Pt$	+0.89
59	$2Hg^{2+}(aq), Hg_2^{2+}(aq) Pt$	+0.92
60	$[NO_3^-(aq) + 3H^+(aq)], [HNO_2(aq) + H_2O(l)] Pt$	+0.94

	Right-hand electrode system	E^\ominus / V
61	$[\text{HNO}_2(\text{aq}) + \text{H}^+(\text{aq})], [\text{NO}(\text{g}) + \text{H}_2\text{O}(\text{l})] \text{Pt}$	+0.99
62	$[\text{HIO}(\text{aq}) + \text{H}^+(\text{aq})], [\text{I}^-(\text{aq}) + \text{H}_2\text{O}(\text{l})] \text{Pt}$	+0.99
63	$[\text{VO}_2^+(\text{aq}) + 2\text{H}^+(\text{aq})], [\text{VO}^{2+}(\text{aq}) + \text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.00
64	$[\text{N}_2\text{O}_4(\text{g}) + 4\text{H}^+(\text{aq})], [2\text{NO}(\text{g}) + 2\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.03
65	$\text{Br}_2(\text{l}), 2\text{Br}^-(\text{aq}) \text{Pt}$	+1.07
66	$\text{Br}_2(\text{aq}), 2\text{Br}^-(\text{aq}) \text{Pt}$	+1.09
67	$[2\text{IO}_3^-(\text{aq}) + 12\text{H}^+(\text{aq})], [\text{I}_2(\text{aq}) + 6\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.19
68	$[\text{MnO}_2(\text{s}) + 4\text{H}^+(\text{aq})], [\text{Mn}^{2+}(\text{aq}) + 2\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.23
69	$[\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + 14\text{H}^+(\text{aq})], [2\text{Cr}^{3+}(\text{aq}) + 7\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.33
70	$\text{Cl}_2(\text{aq}), 2\text{Cl}^-(\text{aq}) \text{Pt}$	+1.36
71	$[\text{PbO}_2(\text{s}) + 4\text{H}^+(\text{aq})], [\text{Pb}^{2+}(\text{aq}) + 4\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.46
72	$\text{Mn}^{3+}(\text{aq}), \text{Mn}^{2+}(\text{aq}) \text{Pt}$	+1.49
73	$[\text{MnO}_4^-(\text{aq}) + 8\text{H}^+(\text{aq})], [\text{Mn}^{2+}(\text{aq}) + 4\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.51
74	$2\text{BrO}_3^-(\text{aq}), [\text{Br}_2(\text{aq}) + 6\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.52
75	$[2\text{HBrO}(\text{aq}) + 2\text{H}^+(\text{aq})], [\text{Br}_2(\text{aq}) + 2\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.57
76	$[2\text{HClO}(\text{aq}) + 2\text{H}^+(\text{aq})], [\text{Cl}_2(\text{aq}) + 2\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.59
77	$[2\text{HBrO}(\text{aq}) + 2\text{H}^+(\text{aq})], [\text{Br}_2(\text{l}) + 2\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.60
78	$[\text{H}_5\text{IO}_6(\text{aq}) + \text{H}^+(\text{aq})], [\text{IO}_3^-(\text{aq}) + 3\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.60
79	$[2\text{HClO}(\text{aq}) + 2\text{H}^+(\text{aq})], [\text{Cl}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.63
80	$[2\text{HCl}(\text{aq}) + 6\text{H}^+(\text{aq})], [\text{Cl}_2(\text{g}) + 4\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.64
81	$\text{Pb}^{4+}(\text{aq}), \text{Pb}^{2+}(\text{aq}) \text{Pt}$	+1.66 (in 1.1M HClO_4)
82	$[2\text{ClO}_2^-(\text{aq}) + 8\text{H}^+(\text{aq})], [\text{Cl}_2(\text{g}) + 4\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.68
83	$[\text{Cl}_2\text{O}(\text{g}) + 2\text{H}^+(\text{aq})], [\text{Cl}_2(\text{g}) + \text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.68
84	$[\text{PbO}_2(\text{s}) + \text{SO}_4^{2-}(\text{aq}) + 4\text{H}^+(\text{aq})], [\text{PbSO}_4(\text{s}) + 2\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.69
85	$[\text{MnO}_4^-(\text{aq}) + 4\text{H}^+(\text{aq})], [\text{MnO}_2(\text{s}) + 2\text{H}_2\text{O}(\text{l})] \text{Pt}$	+1.70
86	$\text{Ce}^{4+}(\text{aq}), \text{Ce}^{3+}(\text{aq}) \text{Pt}$	+1.70 (in M HClO_4)
87	$[\text{H}_2\text{O}_2(\text{aq}) + 2\text{H}^+(\text{aq})], 2\text{H}_2\text{O}(\text{l}) \text{Pt}$	+1.77
88	$\text{Co}^{3+}(\text{aq}), \text{Co}^{2+}(\text{aq}) \text{Pt}$	+1.81 (in M HNO_3)
89	$\text{Ag}^{2+}(\text{aq}), \text{Ag}^+(\text{aq}) \text{Pt}$	+1.98
90	$\text{S}_2\text{O}_8^{2-}(\text{aq}), 2\text{SO}_4^{2-}(\text{aq}) \text{Pt}$	+2.01
91	$[\text{O}_3(\text{g}) + 2\text{H}^+(\text{aq})], [\text{O}_2(\text{g}) + \text{H}_2\text{O}(\text{l})] \text{Pt}$	+2.08
92	$[\text{F}_2\text{O}(\text{g}) + 2\text{H}^+(\text{aq})], [2\text{F}^-(\text{aq}) + \text{H}_2\text{O}(\text{l})] \text{Pt}$	+2.15
93	$\text{F}_2(\text{g}), 2\text{F}^-(\text{aq}) \text{Pt}$	+2.87

References: Latimer, de Bethune, Parsons, US National Bureau of Standards.

Standard Reduction Potentials

Values at 298K (in alphabetical order).

Electrode reaction	E°/V
$\text{Ag}^+(\text{aq}) + \text{e}^- \rightleftharpoons \text{Ag}(\text{s})$	+0.80
$\text{Al}^{3+}(\text{aq}) + 3\text{e}^- \rightleftharpoons \text{Al}(\text{s})$	-1.66
$\text{Ba}^{2+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Ba}(\text{s})$	-2.90
$\frac{1}{2}\text{Br}_2(\text{l}) + \text{e}^- \rightleftharpoons \text{Br}^-(\text{aq})$	+1.07
$\text{Ca}^{2+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Ca}(\text{s})$	-2.87
$\frac{1}{2}\text{Cl}_2(\text{g}) + \text{e}^- \rightleftharpoons \text{Cl}^-(\text{aq})$	+1.36
$\text{HClO}(\text{g}) + \text{H}^+(\text{aq}) + \text{e}^- \rightleftharpoons \frac{1}{2}\text{Cl}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$	+1.59
$\text{Cr}^{3+}(\text{aq}) + \text{e}^- \rightleftharpoons \text{Cr}^{2+}(\text{aq})$	-0.41
$\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + 14\text{H}^+(\text{aq}) + 6\text{e}^- \rightleftharpoons 2\text{Cr}^{3+}(\text{aq}) + 7\text{H}_2\text{O}(\text{l})$	+1.33
$\text{Cu}^+(\text{aq}) + \text{e}^- \rightleftharpoons \text{Cu}(\text{s})$	+0.52
$\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Cu}(\text{s})$	+0.34
$\text{Cu}^{2+}(\text{aq}) + \text{e}^- \rightleftharpoons \text{Cu}^+(\text{aq})$	+0.15
$\frac{1}{2}\text{F}_2(\text{g}) + \text{e}^- \rightleftharpoons \text{F}^-(\text{aq})$	+2.87
$\text{Fe}^{2+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Fe}(\text{s})$	-0.44
$\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightleftharpoons \text{Fe}^{2+}(\text{aq})$	+0.77
$\text{H}^+(\text{aq}) + \text{e}^- \rightleftharpoons \frac{1}{2}\text{H}_2(\text{g})$	+0.00
$\frac{1}{2}\text{I}_2(\text{s}) + \text{e}^- \rightleftharpoons \text{I}^-(\text{aq})$	+0.54
$\text{Li}^+(\text{aq}) + \text{e}^- \rightleftharpoons \text{Li}(\text{s})$	-3.03
$\text{MnO}_4^-(\text{aq}) + 8\text{H}^+(\text{aq}) + 5\text{e}^- \rightleftharpoons \text{Mn}^{2+}(\text{aq}) + 4\text{H}_2\text{O}(\text{l})$	+1.51
$\text{MnO}_4^-(\text{aq}) + \text{e}^- \rightleftharpoons \text{MnO}_4^{2-}(\text{aq})$	+0.56
$\text{MnO}_4^{2-}(\text{aq}) + 2\text{H}_2\text{O}(\text{l}) + 2\text{e}^- \rightleftharpoons \text{MnO}_2(\text{s}) + 4\text{OH}^-(\text{aq})$	+0.59
$\frac{1}{2}\text{H}_2\text{O}_2(\text{aq}) + \text{H}^+(\text{aq}) + \text{e}^- \rightleftharpoons \text{H}_2\text{O}(\text{l})$	+1.77
$\frac{1}{2}\text{O}_2(\text{g}) + 2\text{H}^+(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{H}_2\text{O}(\text{l})$	+1.23
$\text{O}_2(\text{g}) + 2\text{H}^+(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{H}_2\text{O}_2(\text{aq})$	+0.68
$\text{Pb}^{4+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Pb}^{2+}(\text{aq})$	+1.66
$\text{Sn}^{4+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Sn}^{2+}(\text{aq})$	+0.15
$\text{S} + 2\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{H}_2\text{S}$	+0.14
$\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Zn}(\text{s})$	-0.76

Equilibrium Constants for Acids and Bases in Aqueous Solution

Acid or ion	Equilibrium (all in aqueous solution)	K_a (298 K) /mol dm ⁻³	pK_a (at 298 K)
Sulfuric	$H_2SO_4 \rightleftharpoons H^+ + HSO_4^-$	Very large	
Nitric	$HNO_3 \rightleftharpoons H^+ + NO_3^-$	40	-1.4
Chromic(VI)	$H_2CrO_4 \rightleftharpoons H^+ + HCrO_4^-$	10	-1.0
Trichloroethanoic	$CCl_3CO_2H \rightleftharpoons H^+ + CCl_3CO_2^-$	2.3×10^{-1}	0.7
Iodic(V)	$HIO_3 \rightleftharpoons H^+ + IO_3^-$	1.7×10^{-1}	0.8
Dichloroethanoic	$CHCl_2CO_2H \rightleftharpoons H^+ + CHCl_2CO_2^-$	5.0×10^{-2}	1.3
Sulfurous	$H_2SO_3 \rightleftharpoons H^+ + HSO_3^-$	1.5×10^{-2}	1.8
Phosphonic	$H_3PO_3 \rightleftharpoons H^+ + H_2PO_3^-$	1.6×10^{-2}	1.8
Chloric(III)	$HClO_2 \rightleftharpoons H^+ + ClO_2^-$	1.0×10^{-2}	2.0
Hydrogensulfate ion	$HSO_4^- \rightleftharpoons H^+ + SO_4^{2-}$	1.0×10^{-2}	2.0
Phosphoric(V)	$H_3PO_4 \rightleftharpoons H^+ + H_2PO_4^-$	7.9×10^{-3}	2.1
Chloroethanoic	$CH_2ClCO_2H \rightleftharpoons H^+ + CH_2ClCO_2^-$	1.3×10^{-3}	2.9
Nitrous	$HNO_2 \rightleftharpoons H^+ + NO_2^-$	4.7×10^{-4}	3.3
Methanoic	$HCO_2H \rightleftharpoons H^+ + HCO_2^-$	1.6×10^{-4}	3.8
Benzoic	$C_6H_5CO_2H \rightleftharpoons H^+ + C_6H_5CO_2^-$	6.3×10^{-5}	4.2
Phenylammonium ion	$C_6H_5NH_3^+ \rightleftharpoons H^+ + C_6H_5NH_2$	2.0×10^{-5}	4.6
Ethanoic	$CH_3CO_2H \rightleftharpoons H^+ + CH_3CO_2^-$	1.7×10^{-5}	4.8
Butanoic	$CH_3(CH_2)_2CO_2H \rightleftharpoons H^+ + CH_3(CH_2)_2CO_2^-$	1.5×10^{-5}	4.8
Propanoic	$CH_3CH_2CO_2H \rightleftharpoons H^+ + CH_3CH_2CO_2^-$	1.3×10^{-5}	4.9
Dihydrogen phosphonate ion	$H_2PO_3^- \rightleftharpoons H^+ + HPO_3^{2-}$	6.3×10^{-7}	6.2
Carbonic	$H_2O + CO_2 \rightleftharpoons H^+ + HCO_3^-$	4.5×10^{-7}	6.4
Hydrogen sulfide	$H_2S \rightleftharpoons H^+ + HS^-$	8.9×10^{-8}	7.1
Hydrogensulfite ion	$HSO_3^- \rightleftharpoons H^+ + SO_3^{2-}$	6.2×10^{-8}	7.2
Dihydrogenphosphate(V) ion	$H_2PO_4^- \rightleftharpoons H^+ + HPO_4^{2-}$	6.2×10^{-8}	7.2
Chloric(I)	$HClO \rightleftharpoons H^+ + ClO^-$	3.7×10^{-8}	7.4
Bromic(I)	$HBrO \rightleftharpoons H^+ + BrO^-$	2.1×10^{-9}	8.7
Boric	$H_3BO_3 \rightleftharpoons H^+ + H_2BO_3^-$	5.8×10^{-10}	9.2
Ammonium ion	$NH_4^+ \rightleftharpoons H^+ + NH_3$	5.6×10^{-10}	9.3
Hydrocyanic	$HCN \rightleftharpoons H^+ + CN^-$	4.9×10^{-10}	9.3
Ethane-1,2-diammonium ion	$CH_2NH_2CH_2NH_3^+ \rightleftharpoons H^+ + CH_2NH_2CH_2NH_2$	1.3×10^{-10}	9.9
Phenol	$C_6H_5OH \rightleftharpoons H^+ + C_6H_5O^-$	1.3×10^{-10}	9.9
Hydrogencarbonate ion	$HCO_3^- \rightleftharpoons H^+ + CO_3^{2-}$	4.8×10^{-11}	10.3
Butylammonium ion	$C_4H_9NH_3^+ \rightleftharpoons H^+ + C_4H_9NH_2$		10.8
Hydrogen peroxide	$H_2O_2 \rightleftharpoons H^+ + HO_2^-$	2.4×10^{-12}	11.6
Hydrogenphosphate(V) ion	$HPO_4^{2-} \rightleftharpoons H^+ + PO_4^{3-}$	4.4×10^{-13}	12.4
Hydrogensulfide ion	$HS^- \rightleftharpoons H^+ + S^{2-}$	1.2×10^{-13}	12.9
Water	$H_2O \rightleftharpoons H^+ + OH^-$	1.0×10^{-14}	14.0

Indicators

		pK_{in} (at 298 K)	<i>acid</i>	pH range	<i>alkaline</i>
1	Methyl violet	0.8	yellow	0.0–1.6	blue
2	Malachite green	1.0	yellow	0.2–1.8	blue/green
3	Thymol blue (acid)	1.7	red	1.2–2.8	yellow
4	Methyl yellow (in ethanol)	3.5	red	2.9–4.0	yellow
5	Methyl orange–xylene cyanole solution	3.7	purple	3.2–4.2	green
6	Methyl orange	3.7	red	3.2–4.4	yellow
7	Bromophenol blue	4.0	yellow	2.8–4.6	blue
8	Congo red	4.0	violet	3.0–5.0	red
9	Bromocresol green	4.7	yellow	3.8–5.4	blue
10	Methyl red	5.1	red	4.2–6.3	yellow
11	Azolitmin (litmus)		red	5.0–8.0	blue
12	Bromocresol purple	6.3	yellow	5.2–6.8	purple
13	Bromothymol blue	7.0	yellow	6.0–7.6	blue
14	Phenol red	7.9	yellow	6.8–8.4	red
15	Thymol blue (base)	8.9	yellow	8.0–9.6	blue
16	Phenolphthalein (in ethanol)	9.3	colourless	8.2–10.0	red
17	Thymolphthalein	9.7	colourless	8.3–10.6	blue
18	Alizarin yellow R	12.5	yellow	10.1–13.0	orange/red

Note: Most indicators are 0.1% solutions in H₂O unless stated otherwise.

Warning: Certain indicators are poisonous and should be handled carefully, particularly when concentrated.

Organic Compounds: Physical and Thermochemical Data

St	State: s solid, l liquid, g gas	M	Molar mass
ρ	Density at 298 K or density of liquid at just below T_b for gases, unless otherwise indicated	T_b	Boiling temperature (at 1 atm unless stated)
T_m	Melting temperature (at 1 atm unless stated)	ΔH_f^\ominus	Standard molar enthalpy change of formation at 298 K
ΔH_c^\ominus	Standard molar enthalpy change of combustion at 298 K	p	Dipole moment in the gas phase (debye D)
S^\ominus	Standard molar entropy at 298 K (the values of standard entropy of diatomic gaseous elements is for $\frac{1}{2}$ mol of the element)		

Compound	Formula	St	M /g mol ⁻¹	ρ /g cm ⁻³	T_m /K	T_b /K	ΔH_c^\ominus /kJ mol ⁻¹	ΔH_f^\ominus /kJ mol ⁻¹	S^\ominus /J mol ⁻¹ K ⁻¹	P /D
Carbon monoxide	CO	g	28.0	1.25×10^{-3} gas	74.1	81.6	-283.0	-110.5	197.6	—
Carbon dioxide	CO ₂	g	44.0	1.98×10^{-3} gas	216.5	194.0	—	-393.5	213.6	—
Straight chain alkanes										
Methane	CH ₄	g	16.0	0.466 ^{liq}	91.1	109.1	-890.3	-74.8	186.2	0
Ethane	CH ₃ CH ₃	g	30.1	0.572 ^{liq}	89.8	184.5	-1559.7	-84.7	229.5	0
Propane	CH ₃ CH ₂ CH ₃	g	44.1	0.585 ^{liq}	83.4	231.0	-2219.2	-104.5	269.9	0
Butane	CH ₃ (CH ₂) ₂ CH ₃	g	58.1	0.601 ^{liq}	134.7	272.6	-2876.5	-126.5	310.1	0
Pentane	CH ₃ (CH ₂) ₃ CH ₃	l	72.2	0.626	143.1	309.2	-3509.1	-173.2	261.2	0
Hexane	CH ₃ (CH ₂) ₄ CH ₃	l	86.2	0.660	178.1	342.1	-4163.0	-198.6	295.9	0
Heptane	CH ₃ (CH ₂) ₅ CH ₃	l	100.2	0.684	182.5	371.5	-4816.9	-224.0	328.5	0
Octane	CH ₃ (CH ₂) ₆ CH ₃	l	114.2	0.703	216.3	398.8	-5470.2	-250.0	361.1	0
Decane	CH ₃ (CH ₂) ₈ CH ₃	l	142.3	0.730	243.4	447.2	-6777.9	-300.9	425.9	0
Eicosane	CH ₃ (CH ₂) ₁₈ CH ₃	s	282.6	0.789	309.9	616.9	—	—	—	0
Branched alkanes										
2-methylpropane	(CH ₃) ₂ CHCH ₃	g	58.1	0.557 ^{liq}	113.7	261.4	-2868.5	-134.5	294.6	0
2-methylbutane	(CH ₃) ₂ CHCH ₂ CH ₃	l	72.2	0.620	113.2	301.0	-3503.4	-178.9	260.4	—
2-methylpentane	(CH ₃) ₂ CH(CH ₂) ₂ CH ₃	l	86.2	0.653	119.4	333.4	-4157.0	-204.6	—	—
2-methylhexane	(CH ₃) ₂ CH(CH ₂) ₃ CH ₃	l	100.2	0.679	154.8	363.1	-4811.4	-229.5	—	—
2-methylheptane	(CH ₃) ₂ CH(CH ₂) ₄ CH ₃	l	114.2	0.698	164.1	390.7	-5465.2	-255.0	—	—
2,2-dimethylpropane	C(CH ₃) ₄	g	72.2	0.591 ^{liq}	256.6	282.6	-3492.5	-189.8	306.4	—

Compound	Formula	St	M /g mol ⁻¹	ρ /g cm ⁻³	T _m /K	T _b /K	ΔH_c^\ominus /kJ mol ⁻¹	ΔH_f^\ominus /kJ mol ⁻¹	S ^o /J mol ⁻¹ K ⁻¹	ρ /D
Cyclo-alkanes										
Cyclopropane	(CH ₂) ₃	g	42.1	—	145.5	240.4	-2091.4	+53.3	—	0
Cyclobutane	(CH ₂) ₄	g	56.1	0.694 ^{liq}	182.4	285.1	-2720.9	+3.7	—	—
Cyclopentane	CH ₂ (CH ₂) ₃ CH ₃	l	70.1	0.745	179.2	322.3	-3289.4	-107.1	204.3	0
Cyclohexane	CH ₂ (CH ₂) ₄ CH ₃	l	84.2	0.779	279.6	353.8	-3919.5	-156.3	204.4	—
Alkenes										
Ethene	CH ₂ =CH ₂	g	28.1	0.610 ^{liq}	104.1	169.4	-1410.8	+52.2	219.5	0
Propene	CH ₂ =CHCH ₃	g	42.1	0.514 ^{liq}	87.9	225.7	-2058.1	+20.2	266.9	0.35
But-1-ene	CH ₂ =CHCH ₂ CH ₃	g	56.1	0.595 ^{liq}	87.8	266.8	-2716.8	-0.4	305.6	0.38
E-But-2-ene (trans-But-2-ene)	CH ₃ CH=CHCH ₃	g	56.1	0.604 ^{liq}	167.6	274.0	-2705.0	-12.2	296.4	0
Z-But-2-ene (cis-But-2-ene)	CH ₃ CH=CHCH ₃	g	56.1	0.621 ^{liq}	134.2	276.8	-2709.4	-7.8	300.8	—
Cyclohexene	CH ₂ (CH ₂) ₃ CH=CH	l	81.2	0.811	169.6	356.5	-3751.9	-38.1	—	0.55
Phenylethene (styrene)	C ₆ H ₅ CH=CH ₂	l	104.2	0.906	242.5	418.3	-4395.0	+103.8	345.1	0
Alkynes										
Ethyne (acetylene)	CH≡CH	g	26.0	0.618 ^{liq}	192.3	189.1	-1300.8	+228.0	200.8	0
Arenes										
Benzene	C ₆ H ₆	l	78.1	0.879	278.6	353.2	-3267.4	+49.0	172.8	0
Naphthalene	C ₁₀ H ₈	s	128.2	1.101	353.6	491.1	-5155.9	+77.7	—	—
Methylbenzene (toluene)	C ₆ H ₅ CH ₃	l	92.1	0.867	178.1	383.7	-3909.8	+12.1	319.7	0.36
Amines										
Methylamine	CH ₃ NH ₂	g	31.1	0.660 ^{liq}	179.6	266.8	-1085.0	-23.0	243.3	1.30
Dimethylamine	(CH ₃) ₂ NH	g	45.1	0.656 ^{liq}	180.1	280.5	-1768.8	-18.5	280.5	0.93
Trimethylamine	(CH ₃) ₃ N	g	59.1	0.633 ^{liq}	155.9	276.0	-2442.9	-23.7	287.0	0.71
Ethylamine	CH ₃ CH ₂ NH ₂	g	45.1	0.683 ^{liq}	192.1	289.7	-1739.8	-47.5	—	0.99
1-Aminobutane	CH ₃ (CH ₂) ₃ NH ₂	l	73.1	0.739	224.0	350.9	-3018.3	-127.6	—	1.32
2-Aminobutane	CH ₃ CH ₂ CHNH ₂ CH ₃	l	73.1	0.734	201.1	336.6	-3008.4	-137.5	—	—
Phenylamine (aniline)	C ₆ H ₅ NH ₂	l	93.1	1.022	266.8	457.1	-3392.6	+31.3	—	1.53
Halogenocompounds										
Fluoromethane	CH ₃ F	g	34.0	0.557 ^{liq}	131.3	194.7	—	-247.0	—	—
Chloromethane	CH ₃ Cl	g	50.5	0.916 ^{liq}	176.0	248.9	-764.0	-82.0	234.5	1.86
Bromomethane	CH ₃ Br	g	94.9	1.676 ^{liq}	179.5	276.7	-769.9	-37.2	246.3	1.79

Compound	Formula	St	M /g mol ⁻¹	ρ /g cm ⁻³	T _m /K	T _b /K	ΔH_c^\ominus /kJ mol ⁻¹	ΔH_f^\ominus /kJ mol ⁻¹	S ^o /J mol ⁻¹ K ⁻¹	ρ /D	
Iodomethane	CH ₃ I	l	141.9	2.279	206.7	315.5	-814.6	-15.5	163.2	1.64	
Dichloromethane	CH ₂ Cl ₂	l	84.9	1.316	178.0	313.1	-605.8	-124.1	177.8	1.54	
Trichloromethane	CHCl ₃	l	119.4	1.479	209.6	334.8	-474.0	-135.1	201.8	1.02	
Tetrachloromethane	CCl ₄	l	153.8	1.594	250.1	349.6	-359.9	-129.6	216.4	0	
Tetraiodomethane	CI ₄	s	519.6	4.320	—	403-13 ^{sub}	—	—	—	0	
1-Chlorobutane	CH ₃ (CH ₂) ₃ Cl	l	92.6	0.886	150.0	351.5	-2704.1	-187.9	—	2.16	
1-Bromobutane	CH ₃ (CH ₂) ₃ Br	l	137.0	1.276	160.7	374.7	-2716.5	-143.8	—	1.93	
1-Iodobutane	CH ₃ (CH ₂) ₃ I	l	184.0	1.615	170.1	403.6	—	—	—	1.88	
2-Chloro-2-methylpropane	(CH ₃) ₂ CClCH ₃	l	92.6	0.842	247.7	323.8	-2692.8	-191.1	—	2.13	
2-Bromo-2-methylpropane	(CH ₃) ₂ CBrCH ₃	l	137.0	1.221	256.9	346.4	—	-163.4	—	—	
2-Iodo-2-methylpropane	(CH ₃) ₂ CICh ₃	l	184.0	1.571	234.9	373.1	—	-107.4	—	—	
Chlorobenzene	C ₆ H ₅ Cl	l	112.6	1.106	227.5	405.1	-3111.6	+11.0	—	1.67	
Alcohols											
Methanol	CH ₃ OH	l	32.0	0.793	179.2	338.1	-726.0	-239.1	239.7	1.70	
Ethanol	C ₂ H ₅ OH	l	46.1	0.789	155.8	351.6	-1367.3	-277.1	160.7	1.69	
Propan-1-ol	CH ₃ CH ₂ CH ₂ OH	l	60.1	0.804	146.6	370.5	-2021.0	-302.7	196.6	1.66	
Propan-2-ol	CH ₃ CHOHCH ₃	l	60.1	0.787	183.6	355.5	-2005.8	-317.9	180.5	1.68	
Butan-1-ol	CH ₃ (CH ₂) ₂ CH ₂ OH	l	74.1	0.810	183.6	390.3	-2675.6	-327.4	228.0	1.66	
Pentan-1-ol	CH ₃ (CH ₂) ₃ CH ₂ OH	l	88.2	0.815	194.1	411.1	-3328.7	-353.6	259.0	—	
Hexan-1-ol	CH ₃ (CH ₂) ₄ CH ₂ OH	l	102.2	0.820	226.4	431.1	-3983.8	-377.8	289.5	1.60	
Ethane-1,2-diol	CH ₂ OHCH ₂ OH	l	62.1	1.114	261.6	471.1	-1179.5	-454.8	166.9	2.00	
Propan-1,2,3-triol	CH ₂ OHCHOHCH ₂ OH	l	92.1	1.260	293.1	563.1	-1655.2	-668.5	—	—	
2-Methylpropan-2-ol	(CH ₃) ₃ COH	l	74.1	0.789	298.6	355.4	-2643.8	-359.2	—	—	
Cyclohexanol	CH ₂ (CH ₂) ₄ CHOH	s	100.2	0.962	298.2	434.2	-3727.0	-348.8	—	—	
Aldehydes											
Methanal (formaldehyde)	HCHO	g	30.0	0.815	181.1	252.1	-570.6	-108.7	218.7	2.27	
Ethanal (acetaldehyde)	CH ₃ CHO	g	44.1	0.778	152.1	293.9	-1167.1	-191.5	160.2	2.49	
Propanal	CH ₃ CH ₂ CHO	l	58.1	0.797	192.1	321.9	-1820.8	-217.1	—	2.54	
Butanal	CH ₃ CH ₂ CH ₂ CHO	l	72.1	0.801	174.1	348.8	-2476.0	-241.2	—	2.57	
Benzaldehyde	C ₆ H ₅ CHO	l	106.1	1.050	247.1	451.1	-3525.1	-86.8	—	2.96	
Ketones											
Propanone (acetone)	CH ₃ COCH ₃	l	58.1	0.789	177.8	329.3	-1816.5	-248.0	—	2.95	

Compound	Formula	St	M /g mol ⁻¹	ρ /g cm ⁻³	T _m /K	T _b /K	ΔH_c° /kJ mol ⁻¹	ΔH_f° /kJ mol ⁻¹	S ^o /J mol ⁻¹ K ⁻¹	ρ /D
Butanone	CH ₃ CH ₂ COCH ₃	l	72.1	0.805	186.8	352.7	-2441.5	-275.7	—	—
Cyclohexanone	CH ₂ (CH ₂) ₄ CO	l	98.1	0.948	256.7	428.7	-3519.3	-270.7	—	—
Carboxylic acids										
Methanoic (formic)	HCO ₂ H	l	46.0	1.220	281.5	373.7	-254.3	-425.0	129.0	1.52
Ethanoic (acetic)	CH ₃ CO ₂ H	l	60.1	1.049	289.7	391.0	-874.1	-484.5	159.8	1.74
Propanoic	CH ₃ CH ₂ CO ₂ H	l	74.1	0.993	252.3	414.1	-1527.2	-510.7	—	1.74
Butanoic	CH ₃ CH ₂ CH ₂ CO ₂ H	l	88.1	0.958	268.6	438.6	-2183.3	-533.9	—	—
Chloroethanoic	ClCH ₂ CO ₂ H	s	94.5	1.404	336.1	460.9	-715.5	—	—	—
Dichloroethanoic	Cl ₂ CHCO ₂ H	l	128.9	1.563	286.6	467.1	—	—	—	—
Trichloroethanoic	Cl ₃ CCO ₂ H	s	163.4	1.617	331.1	470.6	-388.3	-513.8	—	—
1-Aminoethanoic (Glycine)	NH ₂ CH ₂ CO ₂ H	s	75.1	1.607	535 ^{dec}	—	-981.1	-528.6	—	—
2-Hydroxypropanoic (lactic)	CH ₃ CHOHCO ₂ H	l	90.1	1.206	326.1	376.1	-1343.9	-694.0	—	—
Ethanedioic (oxalic)	CO ₂ HCO ₂ H	s	90.0	1.653	—	430 ^{sub}	-243.3	-829.5	—	—
Hexanedioic (adipic)	CO ₂ H(CH ₂) ₄ CO ₂ H	s	146.1	1.360	426.0	dec	-2795.7	-994.3	—	—
Benzenesulfonic	C ₆ H ₅ SO ₃ H	s	158.2	—	338.1	—	—	—	—	—
Benzene-1,4-dicarboxylic	C ₆ H ₄ (CO ₂ H) ₂	s	166.1	—	Sub	7573 ^{sub}	-3189.3	-816.1	—	—
Benzoic (benzenecarboxylic)	C ₆ H ₅ CO ₂ H	s	122.1	1.266	395.3	522.0	-3227.0	-384.9	—	1.71
Carboxylic acid derivatives										
Ethanoyl chloride	CH ₃ COCl	l	78.5	1.104	161.1	324.0	—	-272.9	200.8	2.45
Ethanamide (acetamide)	CH ₃ CONH ₂	s	59.1	1.159	355.4	494.3	-1184.6	-317.0	—	3.44
Ethanoic anhydride	(CH ₃ CO) ₂ O	l	102.1	1.082	200.0	412.7	-1794.2	-637.2	—	2.80
Esters										
Ethyl ethanoate	CH ₃ CO ₂ CH ₂ CH ₃	l	88.1	0.900	189.6	350.2	-2237.9	-479.3	—	1.78
Miscellaneous										
Carbamide (urea)	NH ₂ CONH ₂	s	60.1	1.320	408.1	dec	-632.2	-332.9	104.6	4.56
Nitrobenzene	C ₆ H ₅ NO ₂	l	123.1	1.203	278.8	483.9	-3087.9	+12.4	—	4.22
Phenol	C ₆ H ₅ OH	s	94.1	1.076	316.1	454.8	-3053.4	-165.0	—	1.45
Glucose	C ₆ H ₁₂ O ₆	s	180.2	1.562	423.1	—	-2802.5	-1273.3	—	—
Sucrose	C ₁₂ H ₂₂ O ₁₁	s	342.3	1.580	458.0	—	-5639.7	-2226.1	—	—
^{sub} Sublimes		^{liq} Liquid								
		^{dec} Decomposes								

Selected Inorganic Compounds: Physical and Thermochemical Data

St	State: s solid, l liquid, g gas	M	Molar mass
ρ	Density at 298 K or density of liquid at just below T_b for gases, unless otherwise indicated		
T_m	Melting temperature		
T_b	Boiling temperature (both at 1 atm unless otherwise stated)		
ΔH_f^\ominus	Standard molar enthalpy change of formation at 298 K		
S^\ominus	Standard molar entropy at 298 K (the values of standard entropy of diatomic gaseous elements is for $\frac{1}{2}$ mol of the element)		
sub	Sublime	dec	Decomposes
dhd	Dehydrated		

Compound	St	M /g mol ⁻¹	ρ /g cm ⁻³	T_m /K	T_b /K	ΔH_f^\ominus /kJ mol ⁻¹	S^\ominus /J mol ⁻¹ K ⁻¹
Aluminium							
AlCl ₃	s	133.3	2.44	463 ^{2.5 atm}	451 ^{sub}	-704.2	110.7
AlBr ₃	s	266.7	—	371	536	-527.2	163.2
Al ₂ O ₃	s	102.0	3.97	2345	3253	-1675.7	50.9
Al(OH) ₃	s	78.0	2.42	573 ^{dhd}	—	-1287.4	85.4
Al(NO ₃) ₃ ·6H ₂ O	s	321.1	—	—	—	-2850.5	467.8
Al ₂ (SO ₄) ₃	s	342.1	2.71	1043 ^{dec}	—	-3440.8	239.3
Barium							
BaCl ₂	s	208.2	3.91	1236	1833	-858.6	123.7
BaO	s	153.3	5.72	2191	2273	-553.5	70.4
BaO ₂	s	169.3	4.96	723	1073 ^{dec}	-634.3	65.7
Ba(OH) ₂	s	171.3	4.50	681	dec	-944.7	99.7
BaCO ₃	s	197.3	4.43	1123 ^{dec}	—	-1216.3	112.1
Ba(NO ₃) ₂	s	261.3	3.24	865	dec	-992.1	213.8
BaSO ₄	s	233.4	4.50	1853	—	-1473.2	132.2
Bismuth							
BiCl ₃	s	315.3	4.75	505	720	-379.1	177.0
BiOCl	s	260.4	7.72	—	—	-366.9	120.5
Boron							
B ₂ H ₆	g	27.7	0.45	108	181	35.6	232.0
BF ₃	g	67.8	2.99	129	173	-1137.0	254.0
BCl ₃	g	117.2	—	166	286	-403.7	290.0
B ₂ O ₃	s	69.6	2.46	723	2133	-1272.8	54.0
BN	s	24.8	2.25	3300 ^{sub}	—	-254.4	14.8
Caesium							
CsF	s	151.9	4.11	955	1524	-553.5	92.8
CsCl	s	168.4	3.99	918	1563	-443.0	101.2
CsBr	s	212.8	4.44	909	1573	-405.8	113.1
CsI	s	259.8	4.51	899	1553	-346.6	123.1
Calcium							
CaH ₂	s	42.1	1.90	1089 ^{in H₂}	873 ^{dec}	-186.2	42.0
CaF ₂	s	78.1	3.18	1696	2773	-1219.6	68.9
CaCl ₂	s	111.0	2.15	1055	1873	-795.8	104.6
CaCl ₂ ·6H ₂ O	s	219.1	1.71	303	—	-2607.9	284.9
CaBr ₂	s	199.9	3.35	1003	1083	-682.8	130.0
CaO	s	56.1	3.35	2887	3123	-635.1	39.7
Ca(OH) ₂	s	74.1	2.24	853 ^{dhd}	dec	-986.1	83.4
CaC ₂	s	64.1	2.22	720	2573	-59.8	69.9

Compound	St	<i>M</i> /g mol ⁻¹	<i>ρ</i> /g cm ⁻³	<i>T_m</i> /K	<i>T_b</i> /K	ΔH_f^\ominus /kJ mol ⁻¹	<i>S</i> ^o /J mol ⁻¹ K ⁻¹
CaCO ₃ (calcite)	s	100.1	2.71	1612 ^{1025atm}	1172 ^{dec}	-1206.9	92.9
Ca(NO ₃) ₂	s	164.1	2.50	834	—	-938.4	193.3
CaSO ₄	s	136.1	2.96	1723	—	-1434.1	106.7
CaSO ₄ ·½H ₂ O	s	145.1	—	436 ^{dhd}	—	-1576.7	130.5
CaSO ₄ ·2H ₂ O	s	172.2	2.32	401 ^{dhd 1.5}	436 ^{dhd}	-2022.6	194.1
Ca ₃ (PO ₄) ₂	s	310.2	3.14	1943	—	-4120.8	236.0
Carbon							
HCN	l	27.0	0.70	259	299	108.9	112.8
C ₂ N ₂	g	52.0	—	245	252	307.9	242.1
CS ₂	l	76.1	1.26	162	319	89.7	151.3
Chlorine							
Cl ₂ O	g	86.9	3.89 ^{273K}	253	277 ^{exp}	80.3	266.1
ClO ₂	g	67.4	3.01 ^{214K}	214	283 ^{exp}	102.5	256.7
Chromium							
CrCl ₃	s	158.3	2.76	1423	1573 ^{sub}	-556.5	115.3
CrO ₂ Cl ₂	l	154.9	1.91	177	390	-579.5	221.8
Cr ₂ O ₃	s	152.0	5.21	2538	4273	-1139.7	81.2
Cr ₂ (SO ₄) ₃ ·18H ₂ O	s	716.4	1.70	373 ^{dhd 12}	—	-8339.5	—
Cobalt							
CoCl ₂	s	129.8	3.36	997 ^{in HCl}	1322	-312.5	109.2
CoCl ₂ ·6H ₂ O	s	237.9	1.92	359	383 ^{dhd}	-2115.4	343.0
CoO	s	74.9	6.45	2078	—	-237.9	53.0
Co(OH) ₂	s	92.9	3.60	dec	—	-539.7	79.0
CoSO ₄	s	155.0	3.71	1008 ^{dec}	—	-888.3	118.0
CoSO ₄ ·7H ₂ O	s	281.1	1.95	370	693 ^{dhd}	-2979.9	406.1
Copper							
CuCl	s	99.0	4.14	703	1763	-137.2	86.2
CuCl ₂	s	134.4	3.39	893	1266 ^{dec}	-220.1	108.1
CuI	s	190.4	5.62	878	1563	-67.7	96.7
Cu ₂ O	s	143.1	6.0	1508	2073 ^{dec}	-168.6	93.1
CuO	s	79.5	6.40	1599	—	-157.3	42.6
Cu(OH) ₂	s	97.6	3.37	dec	—	-449.8	75.0
Cu(NO ₃) ₂ ·6H ₂ O	s	295.6	2.07	299.4 ^{dhd 3}	—	-2110.8	—
Cu ₂ S	s	159.1	5.6	1373	—	-79.0	120.9
CuS	s	95.6	4.6	376	493 ^{dec}	-53.1	66.5
CuSO ₄	s	159.6	3.60	473	923 ^{dec}	-771.4	109.0
CuSO ₄ ·5H ₂ O	s	249.7	2.28	383 ^{dhd 4}	423 ^{dhd}	-2279.6	300.4
Fluorine							
F ₂ O	g	54.0	1.90 ^{40 k}	49	128	-21.7	247.3
Hydrogen							
HF	g	20.0	0.99	190	293	-271.1	173.7
HCl	g	36.5	1.64 ^{159K}	158	188	-92.3	186.8
HBr	g	80.9	2.77 ^{206K}	185	206	-36.4	198.6
HI	g	127.9	2.85 ^{268K}	222	238	26.5	206.5
HIO ₃	s	175.9	4.63	383 ^{dec}	—	-230.1	118.0
H ₂ O	l	18.0	1.00	273	373	-285.8	69.9
H ₂ O	g	18.0	—	273	373	-241.8	188.7
H ₂ O ₂	l	34.0	1.44	273	323	-187.8	109.6
HNO ₃	l	63.0	1.50	231	356	-174.1	266.3
H ₂ S	g	34.1	1.54 ^{188K}	188	212	-20.6	205.7
H ₂ SO ₄	l	98.1	1.84	283	611	-814.0	156.9

Compound	St	<i>M</i> /g mol ⁻¹	ρ /g cm ⁻³	<i>T</i> _m /K	<i>T</i> _b /K	ΔH_f^\ominus /kJ mol ⁻¹	<i>S</i> ^o /J mol ⁻¹ K ⁻¹
H ₃ PO ₄	s	98.0	1.83	316	486 ^{dhd_{1/2}}	-1279.0	110.5
H ₃ BO ₃	s	61.8	1.44	442	573 ^{dhd_{1/2}}	-1094.3	88.8
Iodine							
ICl	s	162.3	3.18	300	371	-35.1	—
ICl ₃	s	233.3	3.12	374 ^{16 atm}	350 ^{dec}	-89.5	167.4
I ₂ O ₅	s	333.8	4.80	573 ^{dec}	—	-158.1	—
Iron							
FeCl ₂	s	126.7	3.16	945	sub	-341.8	117.9
FeCl ₃	s	162.2	2.90	579	588 ^{dec}	-399.5	142.3
FeCl ₃ ·6H ₂ O	s	270.3	—	310	553-558	-2223.8	—
FeO	s	71.8	5.7	1642	—	-271.9	58.5
Fe ₂ O ₃	s	159.7	5.24	1838	—	-824.2	87.4
Fe ₃ O ₄	s	231.5	5.18	1867	—	-1118.4	146.4
Fe(OH) ₂	s	89.9	3.4	dec	—	-569.0	88.0
Fe(OH) ₃	s	106.8	—	—	—	-823.0	106.7
FeCO ₃	s	115.8	3.8	dec	—	-740.6	92.9
FeS	s	87.9	4.74	1468	dec	-100.0	60.3
FeSO ₄ ·7H ₂ O	s	278.0	1.90	337	363 ^{dhd 6}	-3014.6	409.2
Fe ₂ (SO ₄) ₃	s	399.9	3.10	753 ^{dec}	—	-2581.5	261.7
Lead							
PbCl ₂	s	278.1	5.85	774	1223	-359.4	136.0
PbCl ₄	l	349.0	3.18	258	378	-329.2	—
PbI ₂	s	461.0	6.16	675	1127	-175.5	174.8
PbO	s	223.2	9.53	1159	1745	-217.3	68.7
Pb ₃ O ₄	s	685.6	9.1	773 ^{dec}	—	-718.4	211.3
PbO ₂	s	239.2	9.37	563 ^{dec}	—	-277.4	68.6
PbCO ₃	s	267.2	6.6	588 ^{dec}	—	-700.0	131.0
Pb(NO ₃) ₂	s	331.2	4.53	743 ^{dec}	—	-451.9	213.0
PbS	s	239.2	7.5	1387	1553	-100.4	91.2
PbSO ₄	s	303.2	6.2	1443	—	-919.9	148.6
PbCrO ₄	s	323.2	6.12	1117	dec	-899.6	152.7
Pb(CH ₃ CO ₂) ₂ ·3H ₂ O	s	379.3	2.55	348 ^{dhd 1}	473 ^{dec}	-1851.5	—
Pb(C ₂ H ₅) ₄	l	323.4	1.66	137	473 ^{dec}	52.7	472.5
Lithium							
LiH	s	7.9	0.82	953	—	-90.5	20.0
LiF	s	25.9	2.64	1118	1949	-616.0	35.6
LiCl	s	42.4	2.07	878	1613	-408.6	59.3
LiBr	s	86.8	3.46	823	1538	-351.2	74.3
LiI	s	133.8	4.08	722	1444	-270.4	86.8
Li ₂ O	s	29.9	2.01	>1973	—	-597.9	37.6
LiOH	s	23.9	1.46	723	1197 ^{dec}	-484.9	42.8
Li ₂ CO ₃	s	73.9	2.11	996	1583 ^{dec}	-1215.9	90.4
LiNO ₃	s	68.9	2.38	537	873 ^{dec}	-483.1	90.0
Li ₂ SO ₄	s	109.9	2.22	—	1118	-1436.5	115.1
LiAlH ₄	s	37.9	0.92	398 ^{dec}	—	-116.3	78.7
Magnesium							
MgCl ₂	s	95.2	2.32	987	1685	-641.3	89.6
MgCl ₂ ·6H ₂ O	s	203.3	1.57	390 ^{dec}	—	-2499.0	366.1
MgO	s	40.3	3.58	3125	3873	-601.7	26.9
MgCO ₃	s	84.3	2.96	623 ^{dec}	1173 ^{-CO₂}	-1095.8	65.7
Mg ₃ N ₂	s	100.9	2.71	1073 ^{dec}	973 ^{dec}	-460.7	90.0

Compound	St	<i>M</i> /g mol ⁻¹	ρ /g cm ⁻³	<i>T_m</i> /K	<i>T_b</i> /K	ΔH_f^\ominus /kJ mol ⁻¹	<i>S</i> ^o /J mol ⁻¹ K ⁻¹
Mg(NO ₃) ₂ ·6H ₂ O	s	256.4	1.64	362	603 ^{dec}	-2613.3	452.0
MgSO ₄	s	120.4	2.66	1397 ^{dec}	—	-1284.9	91.6
MgSO ₄ ·7H ₂ O	s	246.5	1.68	423 ^{dhd 6}	473 ^{dhd}	-3388.7	372.0
Mg ₂ Si	s	76.7	1.94	1375	—	-77.8	75.0
Manganese							
MnO ₂	s	86.9	5.03	808 ^{dec}	—	-520.0	53.1
MnSO ₄	s	151.0	3.25	973	1123 ^{dec}	-1065.2	112.1
Mercury							
Hg ₂ Cl ₂	s	472.1	7.15	673 ^{sub}	—	-265.2	192.5
HgCl ₂	s	271.5	5.44	549	575	-224.3	146.0
HgS red	s	232.6	8.10	857 ^{sub}	—	-58.2	82.4
Nickel							
NiCl ₂	s	129.6	3.55	1274	1246 ^{sub}	-305.3	97.7
NiSO ₄	s	154.8	3.68	1121 ^{dec}	—	-872.9	92.0
NiSO ₄ ·7H ₂ O	s	280.9	1.95	372	376 ^{dhd 6}	-2976.3	378.9
Ni(CO) ₄	l	170.7	1.32	248	316	-633.0	313.4
Nitrogen							
N ₂ H ₄	l	32.0	1.01	275	387	50.6	121.2
N ₂ O	g	44.0	1.98 ^{182 K}	182	185	82.0	219.7
NO	g	30.0	1.27 ^{123 K}	110	121	90.2	210.7
N ₂ O ₃	g	76.0	1.45 ^{171 K}	171	277 ^{dec}	83.7	312.2
NO ₂	g	46.0	1.49 ^{262 K}	262	294	33.2	240.0
N ₂ O ₄	g	92.0	1.45 ^{262 K}	262	294	9.2	304.2
N ₂ O ₅	s	108.0	1.64	303	320 ^{dec}	-41.3	178.2
Ammonia							
NH ₃	g	17.0	0.77 ^{195K}	195	240	-46.1	192.3
NH ₄ Cl	s	53.5	1.53	613 ^{sub}	793 ^{>1 atm}	-314.4	94.6
NH ₄ Br	s	97.9	2.43	725 ^{sub}	508 ^{vac}	-270.8	113.0
NH ₄ I	s	144.9	2.51	824 ^{sub}	493 ^{vac}	-201.4	117.0
NH ₄ NO ₃	s	80.0	1.72	443	483	-365.6	151.1
(NH ₄) ₂ SO ₄	s	132.1	1.77	508 ^{dec}	786 ^{>1 atm}	-1180.9	220.1
Oxygen							
O ₃	g	48.0	2.14 ^{81K}	81	161	142.7	238.8
Phosphorus							
PH ₃	g	34.0	—	140	185	5.4	210.1
PCl ₃	l	137.3	1.57	161	349	-319.7	217.1
PCl ₅	s	208.2	2.12	435 ^{sub}	440 ^{dec}	-443.5	166.5
POCl ₃	l	153.3	1.67	275	378	-597.1	222.5
P ₄ O ₆	s	219.9	2.13	297	448	-1640.1	—
P ₄ O ₁₀	s	283.9	2.39	853 ^{>1 atm}	573 ^{sub}	-2984.0	228.9
Potassium							
KF	s	58.1	2.48	1131	1778	-567.3	66.6
KCl	s	74.6	1.98	1043	1773 ^{sub}	-436.7	82.6
KClO ₃	s	122.5	2.32	629	673 ^{dec}	-397.7	143.1
KClO ₄	s	138.5	2.52	883	673 ^{dec}	-432.8	151.0
KBr	s	119.0	2.75	1007	1708	-393.8	95.9
KI	s	166.0	3.13	954	1603	-327.9	106.3
KIO ₃	s	214.0	3.93	833	373 ^{dec}	-501.4	151.5
KIO ₄	s	230.0	3.62	855	573 ^{dec}	-467.2	176.0
K ₂ O	s	94.2	2.32	623 ^{sub}	—	-361.4	—
KO ₂	s	71.1	2.14	653	dec	-284.9	116.7

Compound	St	<i>M</i> /g mol ⁻¹	ρ /g cm ⁻³	<i>T</i> _m /K	<i>T</i> _b /K	ΔH_f^\ominus /kJ mol ⁻¹	<i>S</i> ^o /J mol ⁻¹ K ⁻¹
KOH	s	56.1	2.04	633	1593	-424.8	78.9
K ₂ CO ₃	s	138.2	2.43	1164	dec	-1151.0	155.5
KHCO ₃	s	100.1	2.17	373 ^{dec}	—	-963.2	115.5
KNO ₂	s	85.1	1.92	713	dec	-369.8	152.1
KNO ₃	s	101.1	2.11	607	673 ^{dec}	-494.6	133.1
KCN	s	65.1	1.52	908	—	-113.0	128.5
KCNS	s	97.2	1.89	446	773 ^{dec}	-200.2	124.3
K ₂ SO ₄	s	174.3	2.66	1342	1962	-1437.8	175.6
KMnO ₄	s	158.0	2.70	<513 ^{dec}	—	-837.2	171.7
K ₂ CrO ₄	s	194.2	2.73	1241	—	-1403.7	200.1
K ₂ Cr ₂ O ₇	s	294.2	2.68	671	773 ^{dec}	-2061.4	291.2
KAl(SO ₄) ₂ ·12H ₂ O	s	474.4	1.76	366	473 ^{dhd}	-6061.8	687.4
K ₃ Fe(CN) ₆	s	329.3	1.85	dec	—	-249.8	426.1
K ₄ Fe(CN) ₆	s	368.3	—	dec	—	-594.1	418.8
Rubidium							
RbCl	s	120.9	2.80	991	1663	-435.3	95.9
Silicon							
SiH ₄	g	32.1	0.68 ^{188 K}	88	161	34.3	204.5
SiCl ₄	l	169.9	1.48	203	331	-687.0	239.7
SiO ₂ (quartz)	s	60.1	2.65	1883	2503	-910.9	41.8
Sodium							
NaH	s	24.0	0.92	1073 ^{dec}	—	-56.3	40.0
NaF	s	42.0	2.56	1266	1968	-573.6	51.5
NaCl	s	58.4	2.17	1074	1686	-411.2	72.1
NaClO ₃	s	106.4	2.49	521-534	dec	-365.8	123.4
NaClO ₄	s	122.4	—	755 ^{dec}	dec	-383.3	142.3
NaBr	s	102.9	3.20	1020	1663	-361.1	86.8
NaI	s	149.9	3.67	934	1577	-287.8	98.5
Na ₂ O	s	62.0	2.27	1548 ^{sub}	—	-414.2	75.1
Na ₂ O ₂	s	78.0	2.81	733 ^{dec}	930 ^{dec}	-510.9	95.0
NaOH	s	40.0	2.13	592	1663	-425.6	64.5
Na ₂ CO ₃	s	106.0	2.53	1124	dec	-1130.7	135.0
Na ₂ CO ₃ ·10H ₂ O	s	286.1	1.44	306-8	306 ^{dhd}	-4081.3	564.0
NaHCO ₃	s	84.0	2.16	543 ^{dec}	—	-950.8	101.7
NaNO ₂	s	69.0	2.17	544	593 ^{dec}	-358.7	103.8
NaNO ₃	s	85.0	2.26	580	653 ^{dec}	-467.9	116.5
Na ₂ S	s	78.0	1.86	1453	—	-364.8	83.7
Na ₂ SO ₄	s	142.0	—	1157	—	-1387.1	149.6
Na ₂ SO ₄ ·10H ₂ O	s	322.2	1.46	306	373 ^{dhd}	-4327.3	592.0
NaHSO ₄	s	120.1	2.43	588	dec	-1125.5	113.0
Na ₂ S ₂ O ₃	s	158.1	1.67	—	—	-1123.0	155.0
Na ₂ S ₂ O ₃ ·5H ₂ O	s	248.2	1.73	313-318	373 ^{dhd}	-2607.9	372.4
Na ₃ PO ₄	s	164.1	—	—	—	-1917.4	173.8
Na ₂ SiO ₃ (water glass)	s	122.1	2.4	1361	—	-1554.9	113.8

Compound	St	M /g mol ⁻¹	ρ /g cm ⁻³	T_m /K	T_b /K	ΔH_f^\ominus /kJ mol ⁻¹	S^\ominus /J mol ⁻¹ K ⁻¹
Sulphur							
SF ₄	g	108.1	—	149	233	-774.9	291.9
SF ₆	g	146.1	1.88 ^{223 K}	223 ^m	209 ^{sub}	-12.9.0	291.7
SCl ₂	g	103.0	1.62	195	332 ^{dec}	-19.7	282.2
SOCl ₂	l	119.0	1.66	168	352	-245.6	307.9
SO ₂ Cl ₂	l	135.0	1.67	219	342	-394.1	216.7
SO ₂	g	64.1	1.43 ^{200 K}	200	263	-296.8	248.1
SO ₃	l	80.1	1.97	290	318	-441.0	95.6
Tin							
SnCl ₂	s	189.6	3.95	519	925	-325.1	—
SnCl ₄	l	260.5	2.23	240	387	-511.3	258.6
SnO ₂ (cassiterite)	s	150.7	6.95	1903	2123 ^{sub}	-580.7	52.3
Titanium							
TiO ₂	s	79.9	3.84	2103	—	-939.7	49.9
Xenon							
XeF ₂	s	169.3	4.3	413	—	-133.9	133.9
XeF ₄	s	207.2	4.1	387	—	-261.5	146.4
XeF ₆	s	245.3	—	319	—	-380.7	—
XeO ₃	s	179.3	4.6	dec	—	401.7	—
Uranium							
UF ₆	g	352.0	4.68	338	329	-2112.9	379.7
UO ₂ (NO ₃) ₂	s	394.0	—	—	—	-1377.4	276.1
Vanadium							
VCl ₂	s	121.8	3.23	—	—	-452.0	97.1
VCl ₃	s	157.3	3.00	dec	—	-580.7	131.0
VCl ₄	l	192.8	1.82	245	422	-569.4	255.2
VO ₂	s	82.9	4.34	2240	—	—	—
V ₂ O ₅	s	181.9	3.36	963	2023 ^{dec}	-1550.6	131.0
Zinc							
ZnCl ₂	s	136.3	2.91	556	1005	-415.1	111.5
ZnO	s	319.2	4.74	719	897	-348.3	43.6
ZnCO ₃	s	125.4	4.40	573 ^{dec}	—	-812.8	82.4
Zn(NO ₃) ₂	s	189.4	—	—	—	-483.7	—
ZnS (blende)	s	97.4	4.10	1293	—	-206.0	65.3
ZnSO ₄	s	161.4	3.54	873 ^{dec}	—	-982.8	119.7

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