$$Q = \Delta H_{vap} m$$

$$\Delta H_{fus} m = \frac{Q}{m}$$

Prefixes For Molecular Compounds

1 = mono-	6 = hexa-
2 = di-	7 = hepta-
3 = tri-	8 = octa-
4 = tetra-	9 = ennea (nona)
5 = penta-	10 = deca-

Selected SI Prefixes

Prefix	Exponential Symbol	Value
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
kilo	k	10^{3}
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}

1	2	3	4	5	6	7	8	9

Table of Common Polyatomic Ions

acetate (ethanoate)	CH_3COO^-	chromate	CrO_4^{2-}	phosphate	PO_4^{3-}
ammonium	NH_4^+	dichromate	$Cr_2O_7^{2-}$	hydrogen phosphate	HPO_4^{2-}
benzoate	$C_6H_5COO^-$	cyanide	CN^-	dihydrogen phosphate	$H_2PO_4^-$
borate	BO_3^{3-}	hydroxide	OH^-	silicate	SiO_3^{2-}
carbide	C_2^{2-}	iodate	IO_3^-	sulfate	SO_4^{2-}
carbonate	CO_3^{2-}	nitrate	NO_3^-	hydrogen sulfate	HSO_4^-
hydrogen carbonate (bicarbonate)	HCO_3^-	nitrite	NO_2^-	sulfite	SO_3^{2-}
		oxalate	$OOCCOO^{2-}$	hydrogen sulfite	HSO_3^-
perchlorate	ClO_4^-	hydrogen oxalate	$HOOCCOO^-$	hydrogen sulfide	HS^-
chlorate	ClO_3^-	permanganate	MnO_4^-	thiocyanate	SCN^-
chlorite	ClO_2^-	peroxide	O_2^{2-}	thiosulfate	$S_2O_3^{2-}$
hypochlorite	ClO^- or OCl^-	persulfide	S_2^{2-}		

1	2	3	4	5	6	7	8	9
1 1.01 1+,1− 2.2 −253 −259 H hydrogen								
3 6.94 1+ 1.0 1342 181 Li lithium	4 9.01 2+ 1.6 2467 1287 Be beryllium							
11 22.99 1+ 0.9 883 98 Na sodium	12 24.31 2+ 1.3 1090 650 Mg magnesium							
19 39.10 1+ 0.8 759 64 K potassium	20 40.08 2+ 1.0 1484 842 Ca calcium	21 44.96 3+ 1.4 2836 1541 Sc scandium	22 47.87 4+, 3+ 1.5 3287 1668 Ti titanium	23 50.94 5+, 4+ 1.6 3407 1910 V vanadium	24 52.00 3+, 2+ 1.7 2671 1907 Cr chromium	25 54.94 2+, 4+ 1.6 2061 1246 Mn manganese	26 55.85 3+, 2+ 1.8 2861 1538 Fe iron	27 58.93 2+, 3+ 1.9 2927 1495 Co cobalt
37 85.47 1+ 0.8 688 39 Rb rubidium	38 87.62 2+ 1.0 1382 777 Sr strontium	39 88.91 3+ 1.2 3345 1522 Y yttrium	40 91.22 4+ 1.3 4409 1855 Zr zirconium	41 92.91 5+, 3+ 1.6 4744 2477 Nb niobium	42 95.94 6+ 2.2 4639 2623 Mo molybdenum	43 (98) 7+ 2.1 4265 2157 Tc technetium	44 101.07 3+, 4+ 2.2 4150 2334 Ru ruthenium	45 102.91 3+ 2.3 3695 1964 Rh rhodium
55 132.91 1+ 0.8 671 29 Cs cesium	56 137.33 2+ 0.9 1897 727 Ba barium	57-71	72 178.49 4+ 1.3 4603 2233 Hf hafnium	73 180.95 5+ 1.5 5458 3017 Ta tantalum	74 183.84 6+ 1.7 5555 3422 W tungsten	75 186.21 7+ 1.9 5596 3186 Re rhenium	76 190.23 4+ 2.2 5012 3033 Os osmium	77 192.22 4+ 2.2 4428 2446 Ir iridium
87 (223) 1+ 0.7 — 27 Fr francium	88 (226) 2+ 0.9 1737 700 Ra radium	89-103	104 (261) Rf rutherfordium	105 (262) Db dubnium	106 (266) Sg seaborgium	107 (264) Bh bohrium	108 (277) Hs hassium	109 (268) Mt meitnerium

57 138.91 3+ 1.1 3464 918 La lanthanum	58 140.12 3+ 1.1 3443 798 Ce cerium	59 140.91 3+ 1.1 3520 931 Pr praseodymium	60 144.24 3+ 1.1 3074 1021 Nd neodymium	61 (145) 3+ — 3000 1042 Pm promethium	62 150.36 3+, 2+ 1.2 1794 1074 Sm samarium
89 (227) 3+ 1.1 3198 1051 Ac actinium	90 232.04 4+ 1.3 4788 1750 Th thorium	91 231.04 5+, 4+ 1.5 — 1572 Pa protactinium	92 238.03 6+, 4+ 1.7 4131 1135 U uranium	93 (237) 5+ 1.3 — 644 Np neptunium	94 (244) 4+, 6+ 1.3 3228 640 Pu plutonium

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10	11	12	13	14	15	16	17	18

Elements

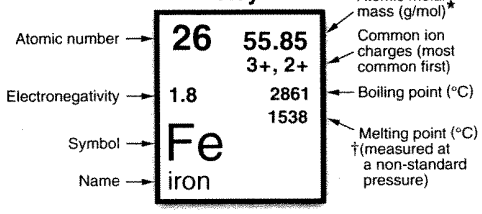
Astatine	At_2	iodine	I_2
Bromine	Br_2	nitrogen	N_2
Chlorine	Cl_2	oxygen	O_2
Fluorine	F_2	phosphorus	P_4
Hydrogen	H_2	sulphur	S_8

Legend for Elements

Solid	*Liquid*	Gas
Natural	Synthetic	

Note: The legend denotes the physical state of the elements at exactly 101.325 kPa and 298.15 K.

Key



* Based on $^{12}_{6}C$

( ) Indicates mass of the most stable isotope

								2 4.00 — — –269 –272† He helium
			5 10.81 — 2.0 4000 2075 B boron	6 12.01 — 2.6 — 4489 C carbon	7 14.01 3– 3.0 –196 –210 N nitrogen	8 16.00 2– 3.4 –183 –219 O oxygen	9 19.00 1– 4.0 –188 –220 F fluorine	10 20.18 — — –246 –249 Ne neon
			13 26.98 3+ 1.6 2519 660 Al aluminum	14 28.09 — 1.9 3265 1414 Si silicon	15 30.97 3– 2.2 281 44 P phosphorus	16 32.07 2– 2.6 445 115 S sulfur	17 35.45 1– 3.2 –34 –101 Cl chlorine	18 39.95 — — –186 –189 Ar argon
28 58.69 2+, 3+ 1.9 2913 1455 Ni nickel	29 63.55 2+, 1+ 1.9 2562 1085 Cu copper	30 65.39 2+ 1.7 907 420 Zn zinc	31 69.72 3+ 1.8 2204 30 Ga gallium	32 72.64 4+ 2.0 2833 938 Ge germanium	33 74.92 3– 2.2 — 817 As arsenic	34 78.96 2– 2.6 685 221 Se selenium	35 79.90 1– 3.0 59 –7 Br bromine	36 83.80 — — –153 –157† Kr krypton
46 106.42 2+, 4+ 2.2 2963 1555 Pd palladium	47 107.87 1+ 1.9 2162 962 Ag silver	48 112.41 2+ 1.7 767 321 Cd cadmium	49 114.82 3+ 1.8 2072 157 In indium	50 118.71 4+, 2+ 2.0 2602 232 Sn tin	51 121.76 3+, 5+ 2.1 1587 631 Sb antimony	52 127.60 2– 2.1 988 450 Te tellurium	53 126.90 1– 2.7 184 114 I iodine	54 131.29 — 2.6 –108 –112† Xe xenon
78 195.08 4+, 2+ 2.2 3825 1768 Pt platinum	79 196.97 3+, 1+ 2.4 2856 1064 Au gold	80 200.59 2+, 1+ 1.9 357 –39 Hg mercury	81 204.38 1+, 3+ 1.8 1473 304 Tl thallium	82 207.21 2+, 4+ 1.8 1749 327 Pb lead	83 208.98 3+, 5+ 1.9 1564 271 Bi bismuth	84 (209) 2+, 4+ 2.0 962 254 Po polonium	85 (210) 1– 2.2 — 302 At astatine	86 (222) — — –62 –71 Rn radon
110 (281) Uun ununnilium	111 (272) Uuu unununium	112 (285) Uub ununbium		114 (289) Uuq ununquadium				

63 151.96 3+, 2+ — 1529 822 Eu europium	64 157.25 3+ 1.2 3273 1313 Gd gadolinium	65 158.93 3+ — 3230 1356 Tb terbium	66 162.50 3+ 1.2 2567 1412 Dy dysprosium	67 164.93 3+ 1.2 2700 1474 Ho holmium	68 167.26 3+ 1.2 2868 1529 Er erbium	69 168.93 3+ 1.3 1950 1545 Tm thulium	70 173.04 3+, 2+ — 1196 819 Yb ytterbium	71 174.97 2+ 1.0 3402 1663 Lu lutetium
95 (243) 3+, 4+ — 2011 1176 Am americium	96 (247) 3+ — 3100 1345 Cm curium	97 (247) 3+, 4+ — — 1050 Bk berkelium	98 (251) 3+ — — 900 Cf californium	99 (252) 3+ — — 860 Es einsteinium	100 (257) 3+ — — 1527 Fm fermium	101 (258) 2+, 3+ — — 827 Md mendelevium	102 (259) 2+, 3+ — — 827 No nobelium	103 (262) 3+ — — 1627 Lr lawrencium

CAPACITIES OF SOME COMMON COMPOUNDS

Compound	Specific Heat Capacity (J/g°C)
Water (liquid)	4.19
Methanol	2.53
Ethanol	2.44
Hexane	2.26
Water (solid)	2.00
Water (gas)	2.02
Toluene	1.80
Sulphuric acid	1.13

HEATS OF FUSION OF VARIOUS SUBSTANCES

Substances	Heat of Fusion (J/g)
Water	333
Sulphuric acid	163
Hexane	152
Ethanol	109
Methanol	100
Toluene	72

HEATS OF VAPORIZATION OF VARIOUS SUBSTANCES

Substances	Heat of Vaporization (J/g)
Water	2260
Methanol	1076
Ethanol	855
Sulphuric acid	510
Toluene	363
Hexane	335

SOLUBILITY OF SOME COMMON IONIC COMPOUNDS IN WATER AT 298.15 K (25°C)

Ion	Group NH_4^+ $H^+(H_30^+)$	ClO_3^- NO_3^- ClO_4^-	CH_3COO^-	Cl^- Br^- I^-	SO_4^{2-}	S^{2-}	OH^-	PO_4^{3-} SO_3^{2-} CO_3^{2-}
good solubility (aqueous)	All	All	Most	Most	Most	Group 1 Group 2 NH_4^+	Group 1 NH_4^+ Sr^{2+} Ba^{2+} Tl^+	Group 1 NH_4^+
Poor solubility (solid)	None	None	Ag^+ Hg^+	Ag^+ Pb^{2+} Hg^+ Cu^+ Tl^+	Ca^{2+} Sr^{2+} Ba^{2+} Ra^{2+} Pb^{2+} Ag^+	Most	Most	most

IUPAC RULES FOR NAMING ACIDS

Ionic Name	Acid Name	Example		
		Formula	Ionic Name	Acid Name
hydrogen –ide	hydro—ic acid	HCl(aq)	hydrogen chloride	hydrochloric acid
hydrogen –ate	--ic acid	$H_3PO_{4(aq)}$	hydrogen phosphate	phosphoric acid
hydrogen –ite	--ous acid	$H_3PO_{3(aq)}$	hydrogen phosphite	phosphorous acid

1	2	3	4	5	6	7	8	9

Table of Common Polyatomic Ions

acetate (ethanoate)	CH_3COO^-	chromate	CrO_4^{2-}	phosphate	PO_4^{3-}
ammonium	NH_4^+	dichromate	$Cr_2O_7^{2-}$	hydrogen phosphate	HPO_4^{2-}
benzoate	$C_6H_5COO^-$	cyanide	CN^-	dihydrogen phosphate	$H_2PO_4^-$
borate	BO_3^{3-}	hydroxide	OH^-	silicate	SiO_3^{2-}
carbide	C_2^{2-}	iodate	IO_3^-	sulfate	SO_4^{2-}
carbonate	CO_3^{2-}	nitrate	NO_3^-	hydrogen sulfate	HSO_4^-
hydrogen carbonate (bicarbonate)	HCO_3^-	nitrite	NO_2^-	sulfite	SO_3^{2-}
		oxalate	$OOCCOO^{2-}$	hydrogen sulfite	HSO_3^-
perchlorate	ClO_4^-	hydrogen oxalate	$HOOCCOO^-$	hydrogen sulfide	HS^-
chlorate	ClO_3^-	permanganate	MnO_4^-	thiocyanate	SCN^-
chlorite	ClO_2^-	peroxide	O_2^{2-}	thiosulfate	$S_2O_3^{2-}$
hypochlorite	ClO^- or OCl^-	persulfide	S_2^{2-}		

1 1.01 1+,1− 2.2 −253 −259 **H** hydrogen								
3 6.94 1+ 1.0 1342 181 **Li** lithium	**4** 9.01 2+ 1.6 2467 1287 **Be** beryllium							
11 22.99 1+ 0.9 883 98 **Na** sodium	**12** 24.31 2+ 1.3 1090 650 **Mg** magnesium							
19 39.10 1+ 0.8 759 64 **K** potassium	**20** 40.08 2+ 1.0 1484 842 **Ca** calcium	**21** 44.96 3+ 1.4 2836 1541 **Sc** scandium	**22** 47.87 4+, 3+ 1.5 3287 1668 **Ti** titanium	**23** 50.94 5+, 4+ 1.6 3407 1910 **V** vanadium	**24** 52.00 3+, 2+ 1.7 2671 1907 **Cr** chromium	**25** 54.94 2+, 4+ 1.6 2061 1246 **Mn** manganese	**26** 55.85 3+, 2+ 1.8 2861 1538 **Fe** iron	**27** 58.93 2+, 3+ 1.9 2927 1495 **Co** cobalt
37 85.47 1+ 0.8 688 39 **Rb** rubidium	**38** 87.62 2+ 1.0 1382 777 **Sr** strontium	**39** 88.91 3+ 1.2 3345 1522 **Y** yttrium	**40** 91.22 4+ 1.3 4409 1855 **Zr** zirconium	**41** 92.91 5+, 3+ 1.6 4744 2477 **Nb** niobium	**42** 95.94 6+ 2.2 4639 2623 **Mo** molybdenum	**43** (98) 7+ 2.1 4265 2157 **Tc** technetium	**44** 101.07 3+, 4+ 2.2 4150 2334 **Ru** ruthenium	**45** 102.91 3+ 2.3 3695 1964 **Rh** rhodium
55 132.91 1+ 0.8 671 29 **Cs** cesium	**56** 137.33 2+ 0.9 1897 727 **Ba** barium	**57-71**	**72** 178.49 4+ 1.3 4603 2233 **Hf** hafnium	**73** 180.95 5+ 1.5 5458 3017 **Ta** tantalum	**74** 183.84 6+ 1.7 5555 3422 **W** tungsten	**75** 186.21 7+ 1.9 5596 3186 **Re** rhenium	**76** 190.23 4+ 2.2 5012 3033 **Os** osmium	**77** 192.22 4+ 2.2 4428 2446 **Ir** iridium
87 (223) 1+ 0.7 — 27 **Fr** francium	**88** (226) 2+ 0.9 1737 700 **Ra** radium	**89-103**	**104** (261) **Rf** rutherfordium	**105** (262) **Db** dubnium	**106** (266) **Sg** seaborgium	**107** (264) **Bh** bohrium	**108** (277) **Hs** hassium	**109** (268) **Mt** meitnerium

57 138.91 3+ 1.1 3464 918 **La** lanthanum	**58** 140.12 3+ 1.1 3443 798 **Ce** cerium	**59** 140.91 3+ 1.1 3520 931 **Pr** praseodymium	**60** 144.24 3+ 1.1 3074 1021 **Nd** neodymium	**61** (145) 3+ — 3000 1042 **Pm** promethium	**62** 150.36 3+, 2+ 1.2 1794 1074 **Sm** samarium			
89 (227) 3+ 1.1 3198 1051 **Ac** actinium	**90** 232.04 4+ 1.3 4788 1750 **Th** thorium	**91** 231.04 5+, 4+ 1.5 — 1572 **Pa** protactinium	**92** 238.03 6+, 4+ 1.7 4131 1135 **U** uranium	**93** (237) 5+ 1.3 — 644 **Np** neptunium	**94** (244) 4+, 6+ 1.3 3228 640 **Pu** plutonium			

References

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10	11	12	13	14	15	16	17	18

Elements

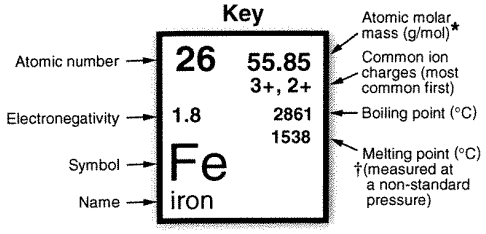
astatine	At_2	iodine	I_2
bromine	Br_2	nitrogen	N_2
chlorine	Cl_2	oxygen	O_2
fluorine	F_2	phosphorus	P_4
hydrogen	H_2	sulphur	S_8

Legend for Elements

Solid	*Liquid*	Gas
Natural	Synthetic	

Note: The legend denotes the physical state of the elements at exactly 101.325 kPa and 298.15 K.

Key



* Based on $^{12}_{6}C$

( ) Indicates mass of the most stable isotope

								2 4.00 — — –269 –272† He helium
			5 10.81 — 2.0 4000 2075 B boron	6 12.01 — 2.6 — 4489 C carbon	7 14.01 3– 3.0 –196 –210 N nitrogen	8 16.00 2– 3.4 –183 –219 O oxygen	9 19.00 1– 4.0 –188 –220 F fluorine	10 20.18 — — –246 –249 Ne neon
			13 26.98 3+ 1.6 2519 660 Al aluminum	14 28.09 — 1.9 3265 1414 Si silicon	15 30.97 3– 2.2 281 44 P phosphorus	16 32.07 2– 2.6 445 115 S sulfur	17 35.45 1– 3.2 –34 –101 Cl chlorine	18 39.95 — — –186 –189 Ar argon
28 58.69 2+, 3+ 1.9 2913 1455 Ni nickel	29 63.55 2+, 1+ 1.9 2562 1085 Cu copper	30 65.39 2+ 1.7 907 420 Zn zinc	31 69.72 3+ 1.8 2204 30 Ga gallium	32 72.64 4+ 2.0 2833 938 Ge germanium	33 74.92 3– 2.2 — 817 As arsenic	34 78.96 2– 2.6 685 221 Se selenium	35 79.90 1– 3.0 59 –7 ***Br*** bromine	36 83.80 — — –153 –157† Kr krypton
46 106.42 2+, 4+ 2.2 2963 1555 Pd palladium	47 107.87 1+ 1.9 2162 962 Ag silver	48 112.41 2+ 1.7 767 321 Cd cadmium	49 114.82 3+ 1.8 2072 157 In indium	50 118.71 4+, 2+ 2.0 2602 232 Sn tin	51 121.76 3+, 5+ 2.1 1587 631 Sb antimony	52 127.60 2– 2.1 988 450 Te tellurium	53 126.90 1– 2.7 184 114 I iodine	54 131.29 — 2.6 –108 –112† Xe xenon
78 195.08 4+, 2+ 2.2 3825 1768 Pt platinum	79 196.97 3+, 1+ 2.4 2856 1064 Au gold	80 200.59 2+, 1+ 1.9 357 –39 ***Hg*** mercury	81 204.38 1+, 3+ 1.8 1473 304 Tl thallium	82 207.21 2+, 4+ 1.8 1749 327 Pb lead	83 208.98 3+, 5+ 1.9 1564 271 Bi bismuth	84 (209) 2+, 4+ 2.0 962 254 Po polonium	85 (210) 1– 2.2 — 302 At astatine	86 (222) — — –62 –71 Rn radon
110 (281) Uun ununnilium	111 (272) Uuu unununium	112 (285) Uub ununbium		114 (289) Uuq ununquadium				

63 151.96 3+, 2+ — 1529 822 Eu europium	64 157.25 3+ 1.2 3273 1313 Gd gadolinium	65 158.93 3+ — 3230 1356 Tb terbium	66 162.50 3+ 1.2 2567 1412 Dy dysprosium	67 164.93 3+ 1.2 2700 1474 Ho holmium	68 167.26 3+ 1.2 2868 1529 Er erbium	69 168.93 3+ 1.3 1950 1545 Tm thulium	70 173.04 3+, 2+ — 1196 819 Yb ytterbium	71 174.97 2+ 1.0 3402 1663 Lu lutetium
95 (243) 3+, 4+ — 2011 1176 Am americium	96 (247) 3+ — 3100 1345 Cm curium	97 (247) 3+, 4+ — — 1050 Bk berkelium	98 (251) 3+ — — 900 Cf californium	99 (252) 3+ — — 860 Es einsteinium	100 (257) 3+ — — 1527 Fm fermium	101 (258) 2+, 3+ — — 827 Md mendelevium	102 (259) 2+, 3+ — — 827 No nobelium	103 (262) 3+ — — 1627 Lr lawrencium