

Conversion/Formula Sheet (Data Sheet)

$$1 \text{ kg} = 1000 \text{ g}$$

$$1 \text{ g} = 1000 \text{ mg}$$

$$1 \text{ L} = 1000 \text{ mL}$$

$$1 \text{ kg} = 2.204 \text{ lbs}$$

$$\text{Density (g/mL)} = \text{Mass(g)} / \text{Volume(mL)}$$

$$1 \text{ mL} = 1 \text{ cm}^3$$

$$\text{Celsius to Kelvin} \quad T_K = T_C + 273$$

$$\text{Kelvin to Celsius} \quad T_C = T_K - 273$$

$$\text{Celsius to Fahrenheit} \quad T_F = 1.80 (T_C) + 32$$

$$\text{Fahrenheit to Celsius} \quad T_C = (T_F - 32) / 1.80$$

Where

T_F = Temperature in Fahrenheit

T_C = Temperature in Celsius

T_K = Temperature in Kelvin

$$M_1 \times V_1 = M_2 \times V_2$$

$$N_1 \times V_1 = N_2 \times V_2$$

Molecular formula = $n \times$ empirical formula

$$Q = m \times c \times \Delta T$$

Q = heat energy (Joules, J)

m = mass of a substance (g)

c = specific heat (units J/g⁰C)

ΔT = change in temperature (Celsius, C)

$$\Delta E = q + w$$

E represents internal energy, q represents heat and w represents work

$$\text{Molarity (M)} = \frac{\text{moles of solute}}{\text{Volume of solution(litres)}}$$

$$\text{Mass percent} = \frac{\text{mass of the element}}{\text{mass of compound}} \times 100\%$$

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$$\text{Percent Yield} = \frac{\text{Actual yield}}{\text{Theoretical yield}} \times 100\%$$

$$\text{Normality (N)} = \frac{\text{Equivalents}}{\text{litre}}$$

Table 7.1 ► General Rules for Solubility of Ionic Compounds (Salts) in Water at 25 °C

1. Most nitrate (NO_3^-) salts are soluble.
2. Most salts of Na^+ , K^+ , and NH_4^+ are soluble.
3. Most chloride salts are soluble. Notable exceptions are AgCl , PbCl_2 , and Hg_2Cl_2 .
4. Most sulfate salts are soluble. Notable exceptions are BaSO_4 , PbSO_4 , and CaSO_4 .
5. Most hydroxide compounds are only slightly soluble.* The important exceptions are NaOH and KOH . Ba(OH)_2 and Ca(OH)_2 are only moderately soluble.
6. Most sulfide (S^{2-}), carbonate (CO_3^{2-}), and phosphate (PO_4^{3-}) salts are only slightly soluble.*

*The terms *insoluble* and *slightly soluble* really mean the same thing: such a tiny amount dissolves that it is not possible to detect it with the naked eye.

Ionic Charges Chart

Cations

1+		2+		3+	
ammonium	NH ₄ ⁺	barium	Ba ²⁺	aluminum	Al ³⁺
cesium	Cs ⁺	beryllium	Be ²⁺	chromium(III)	Cr ³⁺
gold(I)	Au ⁺	cadmium	Cd ²⁺	cobalt(III)	Co ³⁺
hydrogen	H ⁺	calcium	Ca ²⁺	gold(III)	Au ³⁺
lead(I)	Pb ⁺	cobalt(II)	Co ²⁺	iron(III)	Fe ³⁺
lithium	Li ⁺	copper(II)	Cu ²⁺	manganese(III)	Mn ³⁺
potassium	K ⁺	iron(II)	Fe ²⁺		
silver	Ag ⁺	lead(II)	Pb ²⁺		
sodium	Na ⁺	magnesium	Mg ²⁺		
copper(I)	Cu ⁺	manganese(II)	Mn ²⁺		
		mercury(I)	Hg ₂ ²⁺	tin(IV)	Sn ⁴⁺
		mercury(II)	Hg ²⁺	nickel(IV)	Ni ⁴⁺
		nickel(II)	Ni ²⁺	lead(IV)	Pb ⁴⁺
		strontium	Sr ²⁺		
		zinc	Zn ²⁺		
		tin(II)	Sn ²⁺		

Roman numeral notation indicates charge of ion when element commonly forms more than one ion. For example, iron(II) has a 2+ charge; iron(III) a 3+ charge.

Anions

1-		2-		3-			
acetate	$C_2H_3O_2^-$	cyanide	CN^-	carbonate	CO_3^{2-}	arsenate	AsO_4^{3-}
amide	NH_2^-	cyanate	OCN^-	chromate	CrO_4^{2-}	arsenite	AsO_3^{3-}
hydrogen carbonate		fluoride	F^-	dichromate	$Cr_2O_7^{2-}$	citrate	$C_6H_5O_7^{3-}$
(bicarbonate)	HCO_3^-	hydride	H^-	oxide	O^{2-}	ferricyanide	$Fe(CN)_6^{3-}$
hydrogen sulfate		hydroxide	OH^-	oxalate	$C_2O_4^{2-}$	nitride	N^{3-}
(bisulfate)	HSO_4^-	hypochlorite	ClO^-	silicate	SiO_3^{2-}	phosphate	PO_4^{3-}
bisulfide	HS^-	iodate	IO_3^-	sulfate	SO_4^{2-}	phosphite	PO_3^{3-}
bisulfite	HSO_3^-	iodide	I^-	sulfide	S^{2-}	phosphide	P^{3-}
bromate	BrO_3^-	nitrate	NO_3^-	sulfite	SO_3^{2-}		
bromide	Br^-	nitrite	NO_2^-	tartrate	$C_4H_4O_6^{2-}$		
chlorate	ClO_3^-	perchlorate	ClO_4^-	tetraborate	$B_4O_7^{2-}$		
chlorite	ClO_2^-	permanganate	MnO_4^-	thiosulfate	$S_2O_3^{2-}$		
chloride	Cl^-	thiocyanate	SCN^-				

There are no common anions with a 4- charge.

Periodic Table of the Elements

1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8 VIII	9 VIII	10 VIII	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1 H	2 He	3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne	11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
1 Hydrogen 1.008	2 Helium 4.003	3 Lithium 6.941	4 Beryllium 9.012	5 Boron 10.811	6 Carbon 12.011	7 Nitrogen 14.007	8 Oxygen 15.999	9 Fluorine 18.998	10 Neon 20.180	11 Sodium 22.990	12 Magnesium 24.305	13 Aluminum 26.982	14 Silicon 28.086	15 Phosphorus 30.974	16 Sulfur 32.065	17 Chlorine 35.453	18 Argon 39.948
19 Potassium 39.098	20 Calcium 40.078	21 Scandium 44.956	22 Titanium 47.88	23 Vanadium 50.942	24 Chromium 51.996	25 Manganese 54.938	26 Iron 55.845	27 Cobalt 58.933	28 Nickel 58.693	29 Copper 63.546	30 Zinc 65.39	31 Gallium 69.723	32 Germanium 72.61	33 Arsenic 74.922	34 Selenium 78.972	35 Bromine 79.904	36 Krypton 83.80
37 Rubidium 85.468	38 Strontium 87.62	39 Yttrium 88.906	40 Zirconium 91.224	41 Niobium 92.906	42 Molybdenum 95.94	43 Technetium 98.906	44 Ruthenium 101.07	45 Rhodium 102.905	46 Palladium 106.42	47 Silver 107.868	48 Cadmium 112.411	49 Indium 114.818	50 Tin 118.710	51 Antimony 121.757	52 Tellurium 127.6	53 Iodine 126.905	54 Xenon 131.29
55 Cesium 132.905	56 Barium 137.327	57-71 Lanthanide Series	72 Hafnium 178.49	73 Tantalum 180.948	74 Tungsten 183.85	75 Rhenium 186.207	76 Osmium 190.23	77 Iridium 192.22	78 Platinum 195.08	79 Gold 196.967	80 Mercury 200.59	81 Thallium 204.383	82 Lead 207.2	83 Bismuth 208.980	84 Polonium [209]	85 Astatine 209	86 Radon 222
87 Francium 223	88 Radium 226	89-103 Actinide Series	104 Rutherfordium [261]	105 Dubnium [262]	106 Seaborgium [266]	107 Bohrium [264]	108 Hassium [265]	109 Meitnerium [268]	110 Darmstadtium [269]	111 Roentgenium [272]	112 Copernicium [277]	113 Ununtrium [284]	114 Flerovium [289]	115 Unpentium [294]	116 Livermorium [293]	117 Unseptium [294]	118 Unoctium [294]
101 Mendelevium 258	102 Nobelium 259	103 Lawrencium [260]	104 Rutherfordium [261]	105 Dubnium [262]	106 Seaborgium [266]	107 Bohrium [264]	108 Hassium [265]	109 Meitnerium [268]	110 Darmstadtium [269]	111 Roentgenium [272]	112 Copernicium [277]	113 Ununtrium [284]	114 Flerovium [289]	115 Unpentium [294]	116 Livermorium [293]	117 Unseptium [294]	118 Unoctium [294]
109 Meitnerium [268]	110 Darmstadtium [269]	111 Roentgenium [272]	112 Copernicium [277]	113 Ununtrium [284]	114 Flerovium [289]	115 Unpentium [294]	116 Livermorium [293]	117 Unseptium [294]	118 Unoctium [294]	119 Unnonium [295]	120 Unbinilium [296]	121 Untrium [297]	122 Untrium [298]	123 Untrium [299]	124 Untrium [300]	125 Untrium [301]	126 Untrium [302]
127 Bohrium [264]	128 Hassium [265]	129 Meitnerium [268]	130 Darmstadtium [269]	131 Roentgenium [272]	132 Copernicium [277]	133 Ununtrium [284]	134 Flerovium [289]	135 Unpentium [294]	136 Livermorium [293]	137 Unseptium [294]	138 Unoctium [294]	139 Unnonium [295]	140 Unbinilium [296]	141 Untrium [297]	142 Untrium [298]	143 Untrium [299]	144 Untrium [300]
145 Unseptium [294]	146 Unoctium [294]	147 Unnonium [295]	148 Unbinilium [296]	149 Untrium [297]	150 Untrium [298]	151 Untrium [299]	152 Untrium [300]	153 Untrium [301]	154 Untrium [302]	155 Untrium [303]	156 Untrium [304]	157 Untrium [305]	158 Untrium [306]	159 Untrium [307]	160 Untrium [308]	161 Untrium [309]	162 Untrium [310]