

Useful Formulas and Values

$n = \frac{m}{M}$	$N = nN_A$	$c = \frac{n_{\text{solute}}}{V_{\text{solution}}}$	$c_1V_1 = c_2V_2$
$\frac{V_1}{T_1} = \frac{V_2}{T_2}$	$P_1V_1 = P_2V_2$	$\frac{P_1}{T_1} = \frac{P_2}{T_2}$	$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
$PV = nRT$	% yield = $\frac{\text{actual yield}}{\text{theoretical yield}} \times 100\%$		
$P_{\text{Tot}} = P_1 + P_2 + P_3 \dots$		$\text{pH} = -\log[\text{H}^+]$	$[\text{H}^+] = 10^{-\text{pH}}$
$c_{(v/v)} = \frac{V_{\text{solute}}}{V_{\text{solution}}} \times 100\%$		$c_{\text{ppm}} = \frac{m_{\text{solute}}}{m_{\text{solution}}} \times 10^6 \text{ ppm}$	
$c_{(m/v)} = \frac{m_{\text{solute}}}{V_{\text{solution}}} \times 100\%$		$c_{\text{ppb}} = \frac{m_{\text{solute}}}{m_{\text{solution}}} \times 10^9 \text{ ppb}$	
$c_{(m/m)} = \frac{m_{\text{solute}}}{m_{\text{solution}}} \times 100\%$		$c_{\text{ppt}} = \frac{m_{\text{solute}}}{m_{\text{solution}}} \times 10^{12} \text{ ppt}$	
* STP = 101.325 kPa, 0.000 °C * SATP = 100.00 kPa, 25.00 °C		* Density of water = 1.000 g/mL	
* 101.325 kPa = 1.000 atm	$\frac{n_1}{V_1} = \frac{n_2}{V_2}$	$N_A = 6.02 \times 10^{23} \ddagger$	
Molar volume of an ideal gas: 22.4 L/mol @ STP \ddagger 24.8 L/mol @ SATP \ddagger			
* $R = 8.314 \frac{\text{kPa} \cdot \text{L}}{\text{mol} \cdot \text{K}}$		* $R = 0.0821 \frac{\text{atm} \cdot \text{L}}{\text{mol} \cdot \text{K}}$	
$d = \frac{m}{v}$		* 0 °C = 273.15 K	

* = defined quantity (infinite sig. figs.)

\ddagger = measured quantity

Solubility Table

Solubility	Ion	Exceptions
very soluble(aq) $\geq 0.1 \text{ mol/L}$	NO_3^-	none
	halides	except with Cu^+ , Ag^+ , Hg^{2+} , Pb^{2+}
	SO_4^{2-}	except with Ca^{2+} , Ba^{2+} , Sr^{2+} , Hg^{2+} , Pb^{2+} , Ag^+
	$\text{C}_2\text{H}_3\text{O}_2^-$	Ag^+
	Na^+ , K^+	none
slightly soluble (s) $< 0.1 \text{ mol/L}$	NH_4^+	none
	CO_3^{2-}	except with Group 1 ions and NH_4^+
	PO_4^{3-}	except with Group 1 ions and NH_4^+
	OH^-	except with Group 1 ions, Ca^{2+} , Ba^{2+} , Sr^{2+}
	S^{2-}	except with Group 1 and 2 ions and NH_4^+

Polyatomic Ions

Ion	Name
$\text{C}_2\text{H}_3\text{O}_2^-$	acetate
NH_4^+	ammonium
BO_3^{3-}	borate
BrO_3^-	bromate
CO_3^{2-}	carbonate
ClO_3^-	chlorate
ClO_2^-	chlorite
CrO_4^{2-}	chromate
CN^-	cyanide
$\text{Cr}_2\text{O}_7^{2-}$	dichromate
H_2PO_4^-	dihydrogen phosphate
H_2PO_3^-	dihydrogen phosphite
HCO_3^-	hydrogen carbonate
HPO_4^{2-}	hydrogen phosphate
HPO_3^{2-}	hydrogen phosphite
HSO_4^-	hydrogen sulfate
HS^-	hydrogen sulfide
HSO_3^-	hydrogen sulfite
ClO^-	hypochlorite
H_3O^+	hydronium
OH^-	hydroxide
IO_3^-	iodate
NO_2^-	nitrite
NO_3^-	nitrate
$\text{C}_2\text{O}_4^{2-}$	oxalate
ClO_4^-	perchlorate
MnO_4^-	permanganate
SCN^-	thiocyanate
O_2^{2-}	peroxide
PO_4^{3-}	phosphate
SO_4^{2-}	sulfate
SO_3^{2-}	sulfite
$\text{S}_2\text{O}_3^{2-}$	thiosulfate

Activity Series

most reactive				least reactive
	Li	displace hydrogen from acids	displace hydrogen from cold water	
	K			
	Ba			
	Ca			
	Na			
	Mg			
	Al			
	Zn			
	Fe			
	Ni			
	Sn			
	Pb			
	H			
	Cu			
	Hg			
	Ag			
	Au			
				most reactive
				F
				Cl
				Br
				I
				least reactive

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Periodic Table of the Elements

1 1.0 H hydrogen 1.01																	18 4.00 He helium
3 1.0 Li lithium 6.94	4 1.6 Be beryllium 9.01															10 20.18 Ne neon	
11 0.9 Na sodium 22.99	12 1.3 Mg magnesium 24.31															18 39.95 Ar argon	
19 0.8 K potassium 39.10	20 1.0 Ca calcium 40.08	21 1.4 Sc scandium 44.96	22 1.5 Ti titanium 47.87	23 1.6 V vanadium 50.94	24 1.7 Cr chromium 52.00	25 1.6 Mn manganese 54.94	26 1.8 Fe iron 55.85	27 1.9 Co cobalt 58.93	28 1.9 Ni nickel 58.69	29 1.9 Cu copper 63.55	30 1.7 Zn zinc 65.41	31 1.8 Ga gallium 69.72	32 2.0 Ge germanium 72.64	33 2.2 As arsenic 74.92	34 2.6 Se selenium 78.96	35 3.0 Br bromine 79.90	36 3.0 Kr krypton 83.80
37 0.8 Rb rubidium 85.47	38 1.0 Sr strontium 87.62	39 1.2 Y yttrium 88.91	40 1.3 Zr zirconium 91.22	41 1.6 Nb niobium 92.91	42 2.2 Mo molybdenum 95.96	43 1.9 Tc technetium (98)	44 2.2 Ru ruthenium 101.07	45 2.3 Rh rhodium 102.91	46 2.2 Pd palladium 106.42	47 1.9 Ag silver 107.87	48 1.7 Cd cadmium 112.41	49 1.8 In indium 114.82	50 2.0 Sn tin 118.71	51 2.1 Sb antimony 121.76	52 2.1 Te tellurium 127.60	53 2.7 I iodine 126.90	54 2.6 Xe xenon 131.29
55 0.8 Cs cesium 132.91	56 0.9 Ba barium 137.33	57 1.1 La lanthanum 138.91	72 1.3 Hf hafnium 178.49	73 1.5 Ta tantalum 180.95	74 2.4 W tungsten 183.84	75 1.9 Re rhenium 186.21	76 2.2 Os osmium 190.23	77 2.2 Ir iridium 192.22	78 2.3 Pt platinum 195.08	79 2.5 Au gold 196.97	80 2.0 Hg mercury 200.59	81 1.6 Tl thallium 204.38	82 2.3 Pb lead 207.2	83 2.0 Bi bismuth 208.98	84 2.0 Po polonium (209)	85 2.2 At astatine (210)	86 — Rn radon (222)
87 0.7 Fr francium (223)	88 0.9 Ra radium (226)	89 1.1 Ac actinium (227)	104 — Rf rutherfordium (261)	105 — Db dubnium (262)	106 — Sg seaborgium (266)	107 — Bh bohrium (264)	108 — Hs hassium (277)	109 — Mt meitnerium (268)	110 — Ds darmstadtium (281)	111 — Rg roentgenium (272)	112 — Cn copernicium (285)	113 — Uut ununtrium (284)	114 — Uuq ununquadium (289)	115 — Uup ununpentium (288)	116 — Uuh ununhexium (291)	117 — Uus ununseptium (294)	118 — Uuo ununoctium (294)

Key

atomic number → 26
electronegativity → 1.8
symbol of element → Fe
name of element → iron
atomic mass (u) — based on C-12
atomic molar mass (g/mol) → 55.85

3+ → most common ion charge
2+ → other ion charge

solids in black, liquids in blue, gases in red

Measured values are subject to change as experimental techniques improve. Atomic molar mass values in this table are based on IUPAC website values (2005 and 2007).

58 1.1 Ce cerium 140.12	59 1.1 Pr praseodymium 140.91	60 1.1 Nd neodymium 144.24	61 — Pm promethium (145)	62 1.1 Sm samarium 150.36
90 1.3 Th thorium 232.04	91 1.5 Pa protactinium 231.04	92 1.4 U uranium 238.03	93 1.4 Np neptunium (237)	94 1.3 Pu plutonium (244)

63 — Eu europium 151.96	64 1.2 Gd gadolinium 157.25	65 — Tb terbium 158.93	66 1.2 Dy dysprosium 162.50	67 1.2 Ho holmium 164.93	68 1.2 Er erbium 167.26	69 1.3 Tm thulium 168.93	70 — Yb ytterbium 173.05	71 1.3 Lu lutetium 174.97
95 1.3 Am americium (243)	96 1.3 Cm curium (247)	97 1.3 Bk berkelium (247)	98 1.3 Cf californium (251)	99 1.3 Es einsteinium (252)	100 1.3 Fm fermium (257)	101 1.3 Md mendelevium (258)	102 1.3 No nobelium (259)	103 — Lr lawrencium (262)

- Alkali metals
- Alkaline earth metals
- Metals
- Metalloids
- Non-metals
- Hydrogen

Halogens Noble gases