

**Formulas**

Density =  $\frac{\text{mass}}{\text{volume}}$

$D = \frac{m}{V}$

Equilibrium constant for  $aA + bB \rightleftharpoons cC + dD$

$K_{eq} = \frac{[C]^c[D]^d}{[A]^a[B]^b}$

Ionization constant of water =  $\left(\frac{\text{hydrogen ion}}{\text{concentration}}\right)\left(\frac{\text{hydroxide ion}}{\text{concentration}}\right)$

$K_w = [H^+][OH^-]$

pH = -logarithm (hydrogen ion concentration)

$pH = -\log[H^+]$

Molarity =  $\frac{\text{moles of solute}}{\text{liter of solution}}$

$M = \frac{\text{mol}}{L}$

Molality =  $\frac{\text{moles of solute}}{\text{kilogram of solvent}}$

$m = \frac{\text{mol}}{\text{kg}}$

Boiling point elevation =  $\left(\frac{\text{molal boiling point}}{\text{constant}}\right)(\text{molality})$

$\Delta T_b = K_b m$

Freezing point depression =  $\left(\frac{\text{molal freezing point}}{\text{constant}}\right)(\text{molality})$

$\Delta T_f = K_f m$

$\left(\frac{\text{Volume of}}{\text{solution a}}\right)\left(\frac{\text{molarity of}}{\text{solution a}}\right) = \left(\frac{\text{volume of}}{\text{solution b}}\right)\left(\frac{\text{molarity of}}{\text{solution b}}\right)$

$V_a M_a = V_b M_b$

$(\text{Pressure})(\text{volume}) = (\text{moles})(\text{ideal gas constant})(\text{temperature})$

$PV = nRT$

$\frac{(\text{Initial pressure})(\text{initial volume})}{(\text{Initial moles})(\text{initial temperature})} = \frac{(\text{final pressure})(\text{final volume})}{(\text{final moles})(\text{final temperature})}$

$\frac{P_1 V_1}{n_1 T_1} = \frac{P_2 V_2}{n_2 T_2}$

Total pressure of a gas =  $\left(\frac{\text{sum of the partial pressures}}{\text{of the component gases}}\right)$

$P_T = P_1 + P_2 + P_3 + \dots$

Heat gained or lost =  $(\text{mass})\left(\frac{\text{specific}}{\text{heat}}\right)\left(\frac{\text{change in}}{\text{temperature}}\right)$

$Q = mc_p \Delta T$

Final mass =  $(\text{initial mass})\left(\frac{1}{2}\right)^{\text{(number of half-lives)}}$

$m_f = m_i \left(\frac{1}{2}\right)^n$

Enthalpy of reaction =  $\left(\frac{\text{enthalpy}}{\text{of products}}\right) - \left(\frac{\text{enthalpy}}{\text{of reactants}}\right)$

$\Delta H = \Delta H_f^\circ(\text{products}) - \Delta H_f^\circ(\text{reactants})$

Percent error =  $\left(\frac{\text{accepted value} - \text{experimental value}}{\text{accepted value}}\right)(100)$

Percent yield =  $\left(\frac{\text{actual yield}}{\text{theoretical yield}}\right)(100)$

10 <sup>n</sup>	Prefix	Symbol	Decimal
10 <sup>24</sup>	votta-	Y	1 000 000 000 000 000 000 000 000
10 <sup>21</sup>	zetta-	Z	1 000 000 000 000 000 000 000
10 <sup>18</sup>	exa-	E	1 000 000 000 000 000 000
10 <sup>15</sup>	peta-	P	1 000 000 000 000 000
10 <sup>12</sup>	tera-	T	1 000 000 000 000
10 <sup>9</sup>	giga-	G	1 000 000 000
10 <sup>6</sup>	mega-	M	1 000 000
10 <sup>3</sup>	kilo-	k	1 000
10 <sup>2</sup>	hecto-	h	100
10 <sup>1</sup>	deca-	da	10
10 <sup>0</sup>	(none)	(none)	1
10 <sup>-1</sup>	deci-	d	0.1
10 <sup>-2</sup>	centi-	c	0.01
10 <sup>-3</sup>	milli-	m	0.001
10 <sup>-6</sup>	micro-	μ	0.000 001
10 <sup>-9</sup>	nano-	n	0.000 000 001
10 <sup>-12</sup>	pico-	p	0.000 000 000 001
10 <sup>-15</sup>	femto-	f	0.000 000 000 000 001
10 <sup>-18</sup>	atto-	a	0.000 000 000 000 000 001
10 <sup>-21</sup>	zepto-	z	0.000 000 000 000 000 000 001
10 <sup>-24</sup>	yocto-	y	0.000 000 000 000 000 000 000 001

# Periodic Table of Elements

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
1 H Hydrogen 1.00794	2 He Helium 4.002602																		
3 Li Lithium 6.941	4 Be Beryllium 9.012182																		
5 B Boron 10.811	6 C Carbon 12.0107	7 N Nitrogen 14.0064	8 O Oxygen 15.9994	9 F Fluorine 18.9984032	10 Ne Neon 20.1797														
11 Na Sodium 22.98976928	12 Mg Magnesium 24.3050																		
13 Al Aluminum 26.9815386	14 Si Silicon 28.0855	15 P Phosphorus 30.973762	16 S Sulfur 32.065	17 Cl Chlorine 35.453	18 Ar Argon 39.948														
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955912	22 Ti Titanium 47.887	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938045	26 Fe Iron 55.845	27 Co Cobalt 58.933194	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.630	33 As Arsenic 74.9216	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.798		
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.94	43 Tc Technetium (97.9072)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.90550	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.757	52 Te Tellurium 127.60	53 I Iodine 126.90545	54 Xe Xenon 131.29		
55 Cs Cesium 132.9054519	56 Ba Barium 137.327	57-71 Lanthanoids	72 Hf Hafnium 178.49	73 Ta Tantalum 180.94788	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.227	78 Pt Platinum 195.084	79 Au Gold 196.966569	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98040	84 Po Polonium (209)	85 At Astatine (209)	86 Rn Radon (222.0175)		
87 Fr Francium (223)	88 Ra Radium (226)	89-103 Actinoids	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 (271)	111 Rg Roentgenium (272)	112 Uub Ununbium (285)	113 Uut Ununtrium (284)	114 Uuq Ununquadium (289)	115 Uup Ununpentium (288)	116 Uuh Ununhexium (289)	117 Uuq Ununseptium (289)	118 Uuo Ununoctium (289)		

For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.

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