Chemistry Equation Sheet

Key

Variable	Meaning	Variable	Meaning	Variable	Meaning
c	Specific heat	m	Mass	S	Solubility
D	Density	m	Molality	ΔS	Change in entropy
Σ	"sum of"	n	Moles	t	Total time
ΔG	Change in Gibbs free energy	N	Final sample	T	Half-life
ΔH	Change in enthalpy	N_o	Original sample	T	Temperature
i	# ions in solution	P	Pressure	ΔT	Change in temperature
M	molarity	q	heat	V	volume

Measurement

$$\%\ error = \frac{|experimental\ value - accepted\ value|}{accepted\ value} \times 100$$

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

Solutions

$$M = \frac{mol}{L} \qquad \frac{S_1}{P_1} = \frac{S_2}{P_2} \qquad \Delta T_b = K_b m i$$

$$m = \frac{mol}{kg} \qquad M_1V_1 = M_2V_2 \qquad \Delta T_f = K_f m i$$

$$\%\ mass = \frac{mass\ solute}{mass\ solution} \times 100$$

Calculations Using Chemical Formulas

$$Avogadro's\ Number = 6.02 \times 10^{23}\ \frac{particles}{mol}$$

Stoichiometry

$$\%\ yield = \frac{actual\ yield}{theoretical\ yield} \times 100$$

Thermodynamics and Kinetics

$$\Delta H^o_{rxn} = \sum \Delta H^o_f\ (products) - \sum \Delta H^o_f\ (reactants)$$

$$q = \mathrm{m}c(\Delta T) \qquad q = \frac{(\Delta H)\mathrm{m}}{(molar\ mass)}$$

$$\Delta G_{sys} = \Delta H_{sys} - T(\Delta S_{sys})$$

Nuclear Chemistry

$$N = N_o \left(\frac{1}{2}\right)^{\frac{t}{\mathrm{T}}}$$

$$Nuclear\ Radiation\ Types = {}^{1}_{0}n, {}^{4}_{2}He, {}^{0}_{0}\gamma, {}^{0}_{-1}e, {}^{0}_{+1}e$$

Gas Laws

$$P_1V_1 = P_2V_2 \qquad \frac{V_1}{T_1} = \frac{V_2}{T_2} \qquad PV = nRT$$

$$\frac{P_1}{T_1} = \frac{P_2}{T_2} \qquad \frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \qquad D = \frac{(molar\ mass)P}{RT}$$

$$R = 0.0821 \frac{L \times atm}{mol \times K}$$

$$Standard\ Pressures = 1\ atm, 101.3\ kPa, 760\ mm\ Hg$$

$$molar\ volume = 22.4\ \frac{L}{mol}\ at\ STP$$

$$rate = \sqrt{\frac{(molar\ mass)_B}{(molar\ mass)_A}} \qquad Standard\ Temperature = 273\ K$$

Acids and Bases

$$pH = -log[H^+] \qquad pOH = -log[OH^-]$$

$$10^{-pH} = [H^+] \qquad 10^{-pOH} = [OH^-]$$

$$pH + pOH = 14 \qquad n_AM_AV_A = n_BM_BV_B$$

$$K_w = 1 \times 10^{-14} = [H^+][OH^-]$$

Table of Solubilities in Water

i-nearly insoluble ss-slightly soluble s-soluble d-decomposes n-not isolated	acetate	bromide	carbonate	chloride	chromate	hydroxide	iodide	nitrate	phosphate	sulfate	sulfide
aluminum	ss	s	n	s	n	i	s	s	i	s	d
ammonium	s	s	s	s	s	s	s	s	s	s	s
barium	s	s	i	s	i	s	s	s	i	i	d
calcium	s	s	i	s	s	ss	s	s	i	ss	d
copper (II)	s	s	i	s	i	i	n	s	i	s	i
iron (II)	s	s	i	s	n	i	s	s	i	s	i
iron (III)	s	s	n	s	i	i	n	s	i	ss	d
lead	s	ss	i	ss	i	i	ss	s	i	i	i
magnesium	s	s	i	s	s	i	s	s	i	s	d
mercury (I)	ss	i	i	i	ss	n	i	s	i	ss	i
mercury (II)	s	ss	i	s	ss	i	i	s	i	d	i
potassium	s	s	s	s	s	s	s	s	s	s	s
silver	ss	i	i	i	ss	n	i	s	i	ss	i
sodium	s	s	s	s	s	s	s	s	s	s	s
zinc	s	s	i	s	s	i	s	s	i	s	i

Solubility Rules

1. Most sodium, potassium, and ammonium compounds are soluble in water
2. Most nitrates, acetates, and chlorates are soluble.
3. Most chlorides are soluble, except those of silver, mercury (I), and lead. Lead (II) chloride is soluble in hot water.
4. Most sulfates are soluble, except those of barium, strontium, and lead.
5. Most carbonates, phosphates, and silicates are insoluble, except those of sodium, potassium, and ammonium.
6. Most sulfides are insoluble, except those of calcium, strontium, sodium, potassium, and ammonium.

More Active	**Activity Series**	
	Metals	**Nonmetals**
	Li	Fluorine, F_2
	K	Chlorine, Cl_2
	Ba	Bromine, Br_2
	Sr	Iodine, I_2
	Ca	
	Na	
	Mg	
	Al	
	Zn	
	Fe	
	Ni	
	Sn	
	Pb	
	Hydrogen, H_2	
Less Active	Cu	
	Hg	
	Ag	
	Au	

Polyatomic Ions

Ammonium	$\mathbf{NH_4^+}$
Acetate	$\mathbf{C_2H_3O_2^-}$
Carbonate	$\mathbf{CO_3^{2-}}$
Chlorite	$\mathbf{ClO_2^-}$
Chlorate	$\mathbf{ClO_3^-}$
Chromate	$\mathbf{CrO_4^{2-}}$
Cyanide	$\mathbf{CN^-}$
Dichromate	$\mathbf{Cr_2O_7^{2-}}$
Hydrogen Carbonate	$\mathbf{HCO_3^-}$
Hydrogen phosphate	$\mathbf{HPO_4^{2-}}$
Hydroxide	$\mathbf{OH^-}$
Hypochlorite	$\mathbf{ClO^-}$
Nitrate	$\mathbf{NO_3^-}$
Nitrite	$\mathbf{NO_2^-}$
Perchlorate	$\mathbf{ClO_4^-}$
Permanganate	$\mathbf{MnO_4^-}$
Peroxide	$\mathbf{O_2^{2-}}$
Phosphate	$\mathbf{PO_4^{3-}}$
Sulfate	$\mathbf{SO_4^{2-}}$
Sulfite	$\mathbf{SO_3^{2-}}$