OTHS Pre-AP Chemistry Equations and Constants

The following symbols have the definitions specified unless otherwise noted.

g	= gram(s)	J, kJ	= joule(s), kilojoule(s)
nm	= nanometer(s)	mol	= mole(s)
atm	= atmosphere(s)	mm Hg	= millimeters of mercury
L, mL	= liter(s), milliliter(s)	Pa, kPa	= pascal(s), kilopascal(s)

ATOMS, ENERGY, & ELECTRONS

$E_{photon} = hv$

$c = \lambda v$

$E_{photon} = \frac{hc}{\lambda}$

E = energy
v = frequency
λ = wavelength

Planck's constant, h = $6.626 \times 10^{-34}\ J \cdot s$
Speed of light, c = $2.998 \times 10^{8}\ m \cdot s^{-1}$
Avogadro's number = $6.022 \times 10^{23}\ mol^{-1}$

ACIDS and BASES

$K_a = \frac{[H^+][A^-]}{[HA]}$

$K_b = \frac{[OH^-][HB^+]}{[B]}$

$K_w = [H^+][OH^-] = 1.0 \times 10^{-14}$ @ 25℃

$K_w = K_a \times K_b$

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

$14 = pH + pOH$

Equilibrium Constants

K_a (weak acid)
K_b (weak base)
K_W (water)

GASES, LIQUIDS, AND SOLUTIONS

$PV = nRT$

$P_{total} = P_1 + P_2 + P_3 \ldots$

$\frac{P_1V_1}{T_1n_1} = \frac{P_2V_2}{T_2n_2}$

$K = ℃ + 273.15$

$n = \frac{m}{molar\ mass}$

$Kinetic\ Energy = \frac{1}{2}mv^2$

$Molarity,\quad M = \frac{moles\ solute}{liters\ solution}$

$Dilution\ formula,\quad M_1V_1 = M_2V_2$

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

P = pressure
V = volume
T = temperature
n = number of moles of gas
R, Ideal Gas Constant = $8.314\ L \cdot kPa \cdot mol^{-1}K^{-1}$
= $0.08206\ L \cdot atm \cdot mol^{-1}K^{-1}$
= $62.36\ L \cdot torr \cdot mol^{-1}K^{-1}$
= $8.314\ J \cdot mol^{-1}K^{-1}$
K = Kelvin temperature
℃ = Celsius temperature

$1atm = 760\ mm\ Hg = 760\ torr = 101.3kPa$

$STP = 273.15\ K\ and\ 1.000\ atm$

$Volume\ of\ an\ Ideal\ Gas\ @\ STP = 22.4\ L \cdot mol^{-1}$

v = velocity

D = density, m = mass

$1cm^3 = 1mL$

THERMOCHEMISTRY

$$q = mc\Delta T$$

$$\Delta H^\circ = \sum \Delta H_f^\circ(products) - \sum \Delta H_f^\circ(reactants)$$

q = heat
m = mass
c = specific heat capacity
T = temperature

$H^\circ = standard\ enthalpy$
$\Delta H_f^\circ = standard\ enthalpy\ of\ formation$

OTHER FORMULAE

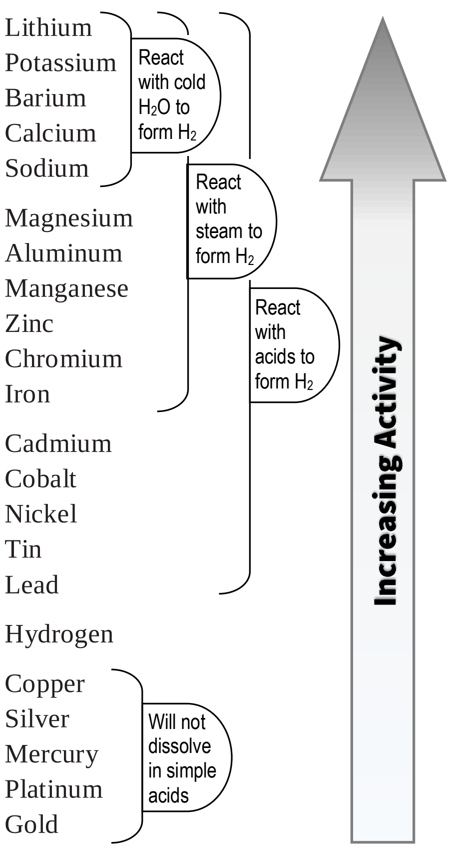
$$Percent\ error = \left|\frac{accepted\ value - experimental\ value}{accepted\ value}\right| \times 100$$

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

SIGNIFICANT FIGURE RULES

1. Non-zero digits and zeros between non-zero digits are always significant.
2. Leading zeros are not significant.
3. Trailing zeros are significant if a decimal point is shown.
4. In scientific notation, all digits of the coefficient are significant.
5. In a logarithm, there are as many digits after the decimal point as there are significant figures in the original value.

ACTIVITY SERIES FOR METALS



SOLUBILITY RULES FOR SALTS

These rules are written by priority, top to bottom. Rules higher in the list override rules lower in the list. Each statement implies that the listed ion behaves as the title states.
**Examining several sources will yield several slightly different sets of solubility rules. For our work and assessments, these are the only rules to consider.*

Always Soluble

1. alkali metal cations (Li^+, Na^+, K^+, Rb^+, Cs^+) and NH_4^+
2. NO_3^- , $C_2H_3O_2^-$, NO_2^-, ClO_3^- , ClO_4^- , CN^- , HCO_3^-

Generally Soluble

3. Cl^-, Br^-, I^- except when bound to Hg_2^{2+}, Ag^+, Pb^{2+}
4. SO_4^{2-} except Ca^{2+}, Sr^{2+}, Ba^{2+}, Hg_2^{2+}, Ag^+, Pb^{2+}

Generally Insoluble

5. F^-, CO_3^{2-}, PO_4^{3-}, S^{2-}, SO_3^{2-}, $C_2O_4^{2-}$, CrO_4^{2-}, $Cr_2O_7^{2-}$ except Rule 1.
6. O^{2-}, OH^- except Rule 1. Oxides and hydroxides of Ca^{2+}, Sr^{2+}, Ba^{2+} are slightly soluble (this is still considered insoluble!)