Equations & Constants

Metrics

M · · k h dk b d c m · · μ · · n · · p

Mass:
1 kg = 2.2 lb

Volume:
1 gal = 4 qt = 3.78 L
1 cm^3 = 1 mL

Length:
1 mile = 1.61 km
1 m = 1.09 yd
1 in = 2.54 cm

Matter

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

$V_{box} = L \cdot W \cdot H$

$V_{cyl} = \pi r^2 h$

$V_{sph} = 4/3\pi r^3$

charge = (# protons) – (#electrons)

$$\% \text{ yield} = \frac{\text{experimental value}}{\text{accepted value}} x100$$

$$\% \text{ error} = \frac{(\text{experimental} - \text{accepted})}{\text{accepted}} x\ 100$$

Temperature

$K = {}^{o}C + 273$

${}^{o}C = K - 273$

${}^{o}F = \frac{9}{5}{}^{o}C + 32$

${}^{o}C = \frac{5}{9}({}^{o}F - 32)$

Mole Conversions

1 mole = 6.02 x 10^{23} particles
1 mole = 22.4 L (at STP)
1 mole = (molar mass) g

Gas Laws

1 atm = 101,325 Pa = 101.325 kPa = 760 mmHg = 760 torr = 14.7 psi

PV=nRT

$$R = 0.0821 \frac{atm\ L}{mol\ K} = 8.314 \frac{Pa\ m^3}{mol\ K} = 62.38 \frac{mmHg\ L}{mol\ K}$$

$P_1V_1 = P_2V_2$ $\quad \frac{P_1}{T_1} = \frac{P_2}{T_2}$ $\quad \frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\quad \frac{V_1}{n_1} = \frac{V_2}{n_2}$ $\quad \frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

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

Equations & Constants

Concentrations

$$\text{Molarity} = \frac{\text{moles solute}}{\text{Liters solution}}$$

$$\text{pph} = \frac{\text{mass solute}}{\text{mass solution}} \text{x}100 \qquad \text{ppm} = \frac{\text{mass solute}}{\text{mass solution}} \text{x}1{,}000{,}000$$

Acids and Bases

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

Calorimetry

$q = mc\Delta T$

Constants for water

Solid: $c = 2.09\ J/g^{O}C$
Liquid: $c = 4.184\ J/g^{O}C$
Gas: $c = 1.88\ J/g^{O}C$
$H_f = 334\ J/g$
$H_v = 2260\ J/g$
$K_w = 1.0 \times 10^{-14}$

Solubility Rules

Compounds that contain the following ions are generally *soluble* in water:

1) alkali metals and ammonium ions: Li^+, Na^+, K^+, Rb^+, Cs^+, NH_4^+
2) acetate ion: $C_2H_3O_2^-$
3) nitrate ion: NO_3^-
4) halide ions (X): Cl^-, Br^-, I^- (Insoluble exceptions: AgX, Hg_2X_2, PbX_2)
5) sulfate ion: SO_4^{-2} (Insoluble exceptions $SrSO_4$, $BaSO_4$, $PbSO_4$)

Compounds that contain the following ions are generally *insoluble* in water:

6) carbonate ion: CO_3^{-2} (Soluble exceptions: see rule 1)
7) chromate ion: CrO_4^{-2} (Soluble exceptions: rule 1)
8) phosphate ion: PO_4^{-3} (Soluble exceptions: rule 1)
9) sulfide ion: S^{-2} (Soluble exceptions: rule 1, CaS, SrS, BaS)
10) hydroxide ion: OH^- (Soluble exceptions: rule 1, $Ca(OH)_2$, $Sr(OH)_2$, $Ba(OH)_2$)

Activity Series for Metals

Li
K
Ba
Ca
Na
Mg
Al
Mn
Zn
Fe
Cd
Co
Ni
Sn
Pb
H
Cu
Ag
Pt
Hg
Au