

Equations & Constants

Metrics

G • • M • • k h dk b d c m • • μ • • n • • p • • f

Mass:

$$1 \text{ ton} = 2000 \text{ lb} = 907.2 \text{ kg}$$

$$1 \text{ lb} = 16 \text{ oz} = 0.454 \text{ kg}$$

$$1 \text{ oz} = 28.35 \text{ g}$$

Length:

$$1 \text{ mile} = 8 \text{ furlong} = 1.61 \text{ km}$$

$$1 \text{ furlong} = 10 \text{ chain}$$

$$1 \text{ chain} = 22 \text{ yd}$$

$$1 \text{ yd} = 3 \text{ ft} = 0.914 \text{ m}$$

$$1 \text{ ft} = 12 \text{ in}$$

$$1 \text{ in} = 2.54 \text{ cm}$$

Volume:

$$1 \text{ barrel} = 5.2 \text{ bushel}$$

$$1 \text{ bushel} = 8 \text{ gal}$$

$$1 \text{ gal} = 4 \text{ qt} = 3.78 \text{ L}$$

$$1 \text{ qt} = 2 \text{ pt} = 0.946 \text{ L}$$

$$1 \text{ pt} = 2 \text{ cup}$$

$$1 \text{ cup} = 8 \text{ fl.oz.}$$

$$1 \text{ fl.oz.} = 29.57 \text{ mL}$$

$$1 \text{ cm}^3 = 1 \text{ mL}$$

Matter

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

$$\text{charge} = (\# \text{ protons}) - (\# \text{ electrons})$$

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

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

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

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

$$\% \text{ yield} = \left(\frac{\text{experimental value}}{\text{accepted value}} \right) \times 100$$

Temperature

$$K = ^\circ C + 273$$

$$^\circ C = K - 273$$

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

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

Mole Conversions

$$1 \text{ mole} = 6.02 \times 10^{23} \text{ particles}$$

$$1 \text{ mole} = 22.4 \text{ L (at STP)}$$

$$1 \text{ mole} = (\text{molar mass}) \text{ g}$$

Light & Energy

$$\text{Speed of light} = 3.0 \times 10^8 \text{ m/s}$$

$$\text{Planck's constant} = 6.63 \times 10^{-34} \text{ J}\cdot\text{s}$$

$$v = \lambda f$$

$$E = hf$$

Concentrations

$$\text{Molarity (M)} = \frac{\text{moles solute}}{\text{L solution}}$$

$$\text{Molality (m)} = \frac{\text{mol solute}}{\text{kg solvent}}$$

$$\text{Mole fraction (X)} = \frac{\text{mol component}}{\text{total mol}}$$

$$\text{pph} = \frac{\text{mass solute}}{\text{mass solution}} \times 100$$

$$\text{ppm} = \frac{\text{mass solute}}{\text{mass solution}} \times 1,000,000$$

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Gas Laws

$$1 \text{ atm} = 101,325 \text{ Pa} = 101.325 \text{ kPa} = 760 \text{ mmHg} = 760 \text{ torr} = 14.7 \text{ psi}$$

$$PV=nRT \quad R = 0.0821 \frac{\text{atm} \cdot \text{L}}{\text{mol} \cdot \text{K}} = 8.314 \frac{\text{Pa} \cdot \text{m}^3}{\text{mol} \cdot \text{K}} = 62.38 \frac{\text{mmHg} \cdot \text{L}}{\text{mol} \cdot \text{K}}$$

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

$$P_T = P_1 + P_2 + P_3 + \dots \quad D = \frac{PM}{RT} \quad M = \frac{DRT}{P}$$

Acids and Bases

$$K_w = [\text{H}^+][\text{OH}^-]$$

$$\text{pH} = -\log [\text{H}^+]$$

$$\text{pOH} = -\log [\text{OH}^-]$$

$$M_aV_a = M_bV_b$$

Colligative Properties

$$\Delta T_f = iK_f m$$

$$\Delta T_b = iK_b m$$

$$P_A = X_A P_A^\circ$$

$$\pi = iMRT$$

Calorimetry

$$q = mc\Delta T$$

Constants for water

$$\text{Solid: } c = 2.09 \text{ J/g}^\circ\text{C}$$

$$\text{Liquid: } c = 4.184 \text{ J/g}^\circ\text{C}$$

$$\text{Gas: } c = 1.88 \text{ J/g}^\circ\text{C}$$

$$H_f = 334 \text{ J/g}$$

$$H_v = 2260 \text{ J/g}$$

$$K_f = 1.86 \text{ }^\circ\text{C/m}$$

$$K_b = 0.52 \text{ }^\circ\text{C/m}$$

$$K_w = 1.0 \times 10^{-14}$$

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: $\text{C}_2\text{H}_3\text{O}_2^-$

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, $\text{Ca}(\text{OH})_2$, $\text{Sr}(\text{OH})_2$, $\text{Ba}(\text{OH})_2$)

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