

Chemistry Reference Materials

ATOMIC STRUCTURE

$$\text{Speed of light} = (\text{frequency})(\text{wavelength}) \quad c = f\lambda$$

$$\text{Energy} = (\text{Planck's constant})(\text{frequency}) \quad E_{\text{photon}} = hf$$

$$\text{Energy} = \frac{(\text{Planck's constant})(\text{speed of light})}{(\text{wavelength})} \quad E_{\text{photon}} = \frac{hc}{\lambda}$$

BEHAVIOR OF GASES

$$\text{Total pressure of a gas} = \left(\begin{array}{l} \text{sum of the partial pressures} \\ \text{of the component gases} \end{array} \right) \quad P_T = P_1 + P_2 + P_3 + \dots$$

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

$$\frac{(\text{Initial pressure})(\text{initial volume})}{(\text{Initial moles})(\text{initial temperature})} = \frac{(\text{final pressure})(\text{final volume})}{(\text{final moles})(\text{final temperature})} \quad \frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$$

$$(\text{Initial pressure})(\text{initial volume}) = (\text{final pressure})(\text{final volume}) \quad P_1V_1 = P_2V_2$$

$$\frac{(\text{Initial volume})}{(\text{Initial temperature})} = \frac{(\text{final volume})}{(\text{final temperature})} \quad \frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{(\text{Initial volume})}{(\text{Initial moles})} = \frac{(\text{final volume})}{(\text{final moles})} \quad \frac{V_1}{n_1} = \frac{V_2}{n_2}$$

SOLUTIONS

$$\text{Molarity} = \frac{\text{moles of solute}}{\text{liter of solution}} \quad M = \frac{\text{mol}}{\text{L}}$$

$$\text{Ionization constant of water} = \left(\begin{array}{l} \text{hydrogen ion} \\ \text{concentration} \end{array} \right) \left(\begin{array}{l} \text{hydroxide ion} \\ \text{concentration} \end{array} \right) \quad K_w = [\text{H}^+][\text{OH}^-]$$

$$\left(\begin{array}{l} \text{Volume of} \\ \text{solution 1} \end{array} \right) \left(\begin{array}{l} \text{molarity of} \\ \text{solution 1} \end{array} \right) = \left(\begin{array}{l} \text{volume of} \\ \text{solution 2} \end{array} \right) \left(\begin{array}{l} \text{molarity of} \\ \text{solution 2} \end{array} \right) \quad V_1M_1 = V_2M_2$$

$$\text{pH} = -\log(\text{hydrogen ion concentration}) \quad \text{pH} = -\log[\text{H}^+]$$

THERMOCHEMISTRY

$$\text{Heat gained or lost} = (\text{mass}) \left(\begin{array}{l} \text{specific} \\ \text{heat} \end{array} \right) \left(\begin{array}{l} \text{change in} \\ \text{temperature} \end{array} \right) \quad Q = mc_p\Delta T$$

$$\text{Enthalpy of reaction} = \left(\begin{array}{l} \text{enthalpy} \\ \text{of products} \end{array} \right) - \left(\begin{array}{l} \text{enthalpy} \\ \text{of reactants} \end{array} \right) \quad \Delta H = \Delta H_f^\circ(\text{products}) - \Delta H_f^\circ(\text{reactants})$$

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OTHER FORMULAS

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

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

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

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

CONSTANTS AND CONVERSIONS

$$\text{Avogadro's number} = 6.02 \times 10^{23} \text{ particles per mole}$$

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

$$c = \text{speed of light} = 3.00 \times 10^8 \frac{\text{m}}{\text{s}}$$

$$K_w = \text{ionization constant of water} = 1.00 \times 10^{-14} \left(\frac{\text{mol}}{\text{L}} \right)^2$$

$$\text{alpha particle } (\alpha) = {}_2^4\text{He} \quad \text{beta particle } (\beta) = {}_{-1}^0\text{e} \quad \text{neutron} = {}_0^1\text{n}$$

$$\text{standard temperature and pressure (STP)} = 0^\circ\text{C and 1 atm}$$

$$0^\circ\text{C} = 273 \text{ K}$$

$$\text{volume of ideal gas at STP} = 22.4 \frac{\text{L}}{\text{mol}}$$

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

$$1 \text{ atm} = 760 \text{ mm Hg} = 101.3 \text{ kPa}$$


$$R = \text{ideal gas constant} = 0.0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} = 8.31 \frac{\text{L} \cdot \text{kPa}}{\text{mol} \cdot \text{K}} = 62.4 \frac{\text{L} \cdot \text{mm Hg}}{\text{mol} \cdot \text{K}}$$

$$1 \text{ calorie (cal)} = 4.18 \text{ joules (J)}$$

$$1000 \text{ calories (cal)} = 1 \text{ Calorie (Cal)} = 1 \text{ kilocalorie (kcal)}$$

RULES FOR SIGNIFICANT FIGURES

1. Non-zero digits and zeros between non-zero digits are always significant.
2. Leading zeros are not significant.
3. Zeros to the right of all non-zero digits are only significant if a decimal point is shown.
4. For values written in scientific notation, the digits in the coefficient are significant.
5. In a common logarithm, there are as many digits after the decimal point as there are significant figures in the original number.

POLYATOMIC IONS	SOLUBILITY OF COMMON IONIC COMPOUNDS IN WATER	ACTIVITY SERIES
Acetate $C_2H_3O_2^-$, CH_3COO^- Ammonium NH_4^+ Carbonate CO_3^{2-} Chlorate ClO_3^- Chlorite ClO_2^- Chromate CrO_4^{2-} Cyanide CN^- Dichromate $Cr_2O_7^{2-}$ Hydrogen carbonate HCO_3^- Hydroxide OH^- Hypochlorite ClO^- Nitrate NO_3^- Nitrite NO_2^- Perchlorate ClO_4^- Permanganate MnO_4^- Phosphate PO_4^{3-} Sulfate SO_4^{2-} Sulfite SO_3^{2-}	SOLUBLE COMPOUNDS CONTAIN $C_2H_3O_2^-$, CH_3COO^- NH_4^+ NO_3^- CN^- ClO_2^- ClO_3^- ClO_4^- Br^- Cl^- I^- SO_4^{2-}	COMMON EXCEPTIONS None None None None None None None None Compounds of Ag^+ , Pb^{2+} , and Hg_2^{2+} Compounds of Ag^+ , Pb^{2+} , and Hg_2^{2+} Compounds of Ag^+ , Pb^{2+} , and Hg_2^{2+} Compounds of Sr^{2+} , Ba^{2+} , Pb^{2+} , and Hg_2^{2+}
Insoluble Carbonate CO_3^{2-} Phosphate PO_4^{3-} Chromate CrO_4^{2-} Dichromate $Cr_2O_7^{2-}$ Hydroxide OH^- Sulfite S^{2-}	INSOLUBLE COMPOUNDS CONTAIN CO_3^{2-} PO_4^{3-} CrO_4^{2-} $Cr_2O_7^{2-}$ OH^- S^{2-}	COMMON EXCEPTIONS Compounds of NH_4^+ and the alkali metal cations Compounds of NH_4^+ and the alkali metal cations Compounds of NH_4^+ and the alkali metal cations Compounds of NH_4^+ and the alkali metal cations Compounds of NH_4^+ , the alkali metal cations, Ca^{2+} , Sr^{2+} , and Ba^{2+} Compounds of NH_4^+ , the alkali metal cations, Ca^{2+} , Sr^{2+} , and Ba^{2+}
		
		METAL Lithium Potassium Barium Calcium Sodium Magnesium Aluminum Manganese Zinc Chromium Iron Cobalt Nickel Tin Lead (Hydrogen) Copper Mercury Silver Platinum Gold

