

DAT General Chemistry Equation Sheet

General Concepts

Density: ($d = m/v$)

Dilutions: $M_1V_1 = M_2V_2$ (or $C_1V_1 = C_2V_2$)

% Error Calculations

$$\% \text{ Error} = \frac{\text{Actual} - \text{theoretical}}{\text{theoretical}} \times 100$$

Spectrophotometer: $Abs = \epsilon cl$

Abs = Absorbance

ϵ = molar extinction coefficient (molar absorptivity)

l = path length

Atomic Structure

Absorption/Emission Line Spectra: $\Delta E = E_{\text{photon}}$

Energy of a photon: $E_{\text{photon}} = hf = \frac{hc}{\lambda}$

$$c = 3.0 \times 10^8 \text{ m/s}$$

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

Photoelectric Effect: $KE_{\text{electron}} = E_{\text{photon}} - \phi$

ϕ = work function (minimum energy to ionize electron)

Chemical Kinetics and Equilibrium

General Rate Law: $\text{rate} = k[A]^m[B]^n$

Arrhenius Equation: $k = Ae^{-E_a/RT}$

E_a = activation energy

$R = 0.0821 \text{ L}\cdot\text{atm/mol}\cdot\text{K}$

Equilibrium Constant:

$$K_c = \frac{[\text{products}]}{[\text{reactants}]} \quad K_p = \frac{P_{\text{products}}}{P_{\text{reactants}}}$$

Solutions

Concentration

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

$$\text{molality (m)} = \frac{\text{moles}_{\text{solute}}}{kg_{\text{solvent}}}$$

Henry's Law: $P_A = k_H[A]$

Colligative Properties

Freezing Point Depression: $\Delta T_F = -iK_F m$

Boiling Point Elevation: $\Delta T_B = iK_B m$

Raoult's Law (* = pure): $P_A = X_A P_A^*$

Osmotic Pressure: $\pi = iMRT$

$$K_F/K_B = 1.86/0.51$$

depression/elevation constant

X_A = mole fraction of A

i = van't Hoff Factor

$R = 0.0821 \text{ L}\cdot\text{atm/mol}\cdot\text{K}$

M = molarity, m = molality

Gases/Gas Laws

Average Kinetic Energy:

$$KE_{\text{avg}} = \frac{3}{2} RT \text{ (per mole of gas)}$$

$$\text{Root-mean-square speed: } v = \sqrt{\frac{3RT}{M_m}}$$

Gas Laws

Ideal Gas Law: $PV = nRT$

Boyle's Law: $P \propto \frac{1}{V}$

Charles' Law: $V \propto T$

Avogadro's Law: $V \propto n$

$$\text{Combined Gas Law: } \frac{P_1 V_1}{n_1 T_1} = \frac{P_2 V_2}{n_2 T_2}$$

Dalton's Law of Partial Pressures:

$$P_{\text{Tot}} = P_A + P_B + \dots$$

$$P_A = X_A \cdot P_{\text{Tot}}$$

$$X_A = \text{mole fraction A}$$

Graham's Law of Effusion:

$$\frac{r_1}{r_2} = \sqrt{\frac{M_{m,2}}{M_{m,1}}}$$

$R = 0.0821 \text{ L}\cdot\text{atm/mol}\cdot\text{K}$

n = moles

M_m = molar mass

r = rate of effusion

a and b are constants specific to a given gas

Acid-Base

pH Scale

$$pH = -\log [H^+] \quad [H^+] = 10^{-pH}$$

$$pOH = -\log [OH^-] \quad [OH^-] = 10^{-pOH}$$

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

Weak Acids:

$$K_a = \frac{[H_3O^+][A^-]}{[HA]} \quad [H^+] = \sqrt{K_a [HA]}$$

Weak Bases:

$$K_b = \frac{[OH^-][HA]}{[A^-]} \quad [OH^-] = \sqrt{K_b [B]}$$

$$K_a \cdot K_b = K_w$$

$$\text{Buffer: } pH = pK_a + \log \frac{[A^-]}{[HA]}$$

$$\text{Titration/Neutralization: } n_A M_A V_A = n_B M_B V_B$$

DAT Bootcamp

General Chemistry Formula Sheet

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