Achievable

MCAT DUMP SHEET

Gases, kinetics, and equilibrium

Gases

- Standard temperature and pressure (STP):
  - $T = 0°\text{C} = 273\ \text{K}$
  - $P = 1\ \text{atm} = 760\ \text{torr} = 760\ \text{mmHg}$
- Ideal gas law: $PV = nRT$
- Dalton's law of partial pressures: $P_{\text{total}} = P_1 + P_2 + \cdots + P_n$
- Graham's law: $\frac{v_1}{v_2} = \sqrt{\frac{MW_2}{MW_1}}$

Kinetics

- Rate law: $\text{rate} = k[A]^a[B]^b$
- Arrhenius equation: $k = Ae^{-E_a/RT}$

Atomic chemistry

- Formal charge: $\text{FC} = \text{valence electrons} - \text{bonds} - \text{lone-pair electrons}$

Electrochemistry

- Faraday constant: $F \approx 96{,}500\ \text{C/mol}$
- $\Delta G = -nFE_{\text{cell}}$

Stoichiometry

- Moles: $n = \frac{\text{mass}}{\text{molecular weight}}$
- Mole fraction: $X_A = \frac{\text{moles of A}}{\text{total moles}}$
- Dilution: $M_1V_1 = M_2V_2$
- Molarity: $M = \frac{\text{moles of solute}}{\text{liters of solution}}$
- Molality: $m = \frac{\text{moles of solute}}{\text{kilograms of solvent}}$

Equilibrium

- For the balanced reaction $aA + bB \rightleftharpoons cC + dD$:
- Equilibrium constant: $K_{eq} = \frac{[C]^c[D]^d}{[A]^a[B]^b}$, at equilibrium
- Reaction quotient: $Q = \frac{[C]^c[D]^d}{[A]^a[B]^b}$, at any moment
- $Q < K$: the reaction runs forward; $Q > K$: it runs in reverse

Thermodynamics

- $T_K = T_C + 273$
- Heat: $q = mc\Delta T$; at a phase change, $q = n\Delta H_{\text{fusion or vaporization}}$
- $\Delta H^\circ_{\text{rxn}} = \sum n\Delta H^\circ_{f,\text{products}} - \sum n\Delta H^\circ_{f,\text{reactants}}$
- Gibbs free energy: $\Delta G = \Delta H - T\Delta S$; $\Delta G^\circ = -RT\ln K$