3.1.6 Chemical Equilibria and Kc

3.1.6.1 *Reversible reactions and dynamic equilibrium. Le Chatelier's principle. Compromise conditions in industry.*

Dynamic equilibrium (closed system): forward rate = reverse rate; concentrations remain constant.

Le Chatelier's principle: if a system at equilibrium is disturbed, it shifts to oppose the change.

Temperature: increase favours the endothermic direction.

Concentration: increase in [reactant] shifts equilibrium right.

Pressure: increase shifts towards fewer moles of gas.

Catalyst: no effect on position or Kc — just reaches equilibrium faster.

Industrial compromise (Haber): T ~450°C (reasonable rate), P ~200 atm (better yield), iron catalyst.

3.1.6.2 *Kc for homogeneous systems. Construct expressions, calculate values, predict effect of temperature.*

For aA + bB ⇌ cC + dD: Kc = [C]ᶜ[D]ᵈ / [A]ᵃ[B]ᵇ

Products over reactants, raised to stoichiometric coefficients.

Only temperature changes Kc.

Exothermic forward: increasing T decreases Kc.

Endothermic forward: increasing T increases Kc.

Use ICE table (Initial, Change, Equilibrium) to find equilibrium concentrations. Calculate units by substituting (mol dm^{-3}) to appropriate powers.