

AP CHEMISTRY CHEAT SHEET

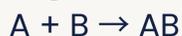
Unit 4 : CHEMICAL REACTIONS

Quick Overview

- **Focus:** reaction types, net ionic equations, stoichiometry, solution chemistry, and predicting products.
- **Exam Lens:** identify reaction type → predict products → balance → write net ionic → justify driving forces.

Reaction Types

1. Synthesis (Combination)



2. Decomposition



3. Single Replacement



Use activity series to check if the reaction occurs.

4. Double Replacement (Metathesis)



Driven by formation of precipitate, gas, or weak electrolyte (water).

5. Combustion



Mnemonic: "So Do Single, Double, Combust" → Synthesis, Decomposition, Single, Double, Combustion.

Net Ionic Equations

1. Write balanced molecular equation.
2. Break all soluble strong electrolytes into ions.
3. Remove spectator ions.
4. What remains = net ionic equation.

Common strong electrolytes: soluble ionic salts, strong acids (HCl, HBr, HI, HNO₃, H₂SO₄, HClO₄), strong bases (Group 1 hydroxides, Ca/Sr/Ba(OH)₂).

Solubility Rules (simplified):

- Nitrates → always soluble
- Group 1 ions → always soluble
- Ammonium → soluble
- Halides → soluble except Ag⁺, Pb²⁺, Hg₂²⁺
- Sulfates → soluble except Ba²⁺, Sr²⁺, Pb²⁺
- Carbonates/Phosphates → insoluble unless Group 1/NH₄⁺
- Hydroxides → mostly insoluble (except Group 1, Ca²⁺/Sr²⁺/Ba²⁺ slightly soluble)

Stoichiometry & Limiting Reactants

- Convert g → mol → mol → g
- Limiting reactant = produces least product
- Excess reactant = leftover after reaction

Mini formula box

Percent Yield
= (actual ÷ theoretical) × 100
Percent Error
= |experimental - true| ÷ true × 100

Electrolytes & Reaction Evidence

- **Strong electrolytes:** completely dissociate → conduct well.
- **Weak electrolytes:** partially dissociate (weak acids/bases).
- **Nonelectrolytes:** do not dissociate (sugars, alcohols).

Evidence a reaction occurs:

- Precipitate forms
- Gas forms
- Color change
- Temperature change
- Weak electrolyte forms (H₂O, HC₂H₃O₂, HF, etc.)

Oxidation–Reduction (Redox)

- Oxidation = loss of electrons
- Reduction = gain of electrons

Rules to assign oxidation numbers:

- Elements = 0
- Monoatomic ions = charge
- O = -2 (except in peroxides)
- H = +1 (-1 in metal hydrides)
- Sum = overall charge

Half-reaction method (acidic):

- Split into half-reactions
- Balance atoms except O/H
- Balance O with H₂O
- Balance H with H⁺
- Balance charge with e⁻
- Combine

In basic solution: add OH⁻ to eliminate H⁺.

Titrations & Solutions

Used to determine unknown concentration via neutralization or redox.

Key formulas:

- M₁V₁ = M₂V₂ (ONLY for 1:1 stoichiometry)

General:

- moles acid × coeff = moles base × coeff
- Indicators: phenolphthalein (pink in base), methyl orange (red in acid).

Equivalence point: moles acid = moles base (stoichiometrically).

Endpoint: indicator color change (approx. equivalence).

Gas-Producing Reactions

- Acid + carbonate → CO₂ + H₂O + salt
- Acid + sulfite → SO₂ + H₂O + salt
- Decomposition of H₂O₂ → O₂ + H₂O

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