

GRADE 11 STUDY GUIDE | 2025

Types of Chemical Reactions

Physical Sciences

1. Acid-Base Reactions

Definitions

- Arrhenius: acid produces H^+ in water; base produces OH^- in water
- Bronsted-Lowry: acid is a proton (H^+) DONOR; base is a proton ACCEPTOR
- Conjugate acid-base pairs: $HA + B = A^- + BH^+$; HA/A^- and B/BH^+ are conjugate pairs

Acid + base $\Rightarrow$ salt + water **$HCl + NaOH \Rightarrow NaCl + H_2O$** **$H_2SO_4 + 2KOH \Rightarrow K_2SO_4 + 2H_2O$**

Strong vs Weak Acids/Bases

Strong acids/bases COMPLETELY ionise in water. Weak acids/bases only PARTIALLY ionise.

KEY: Strong acids: HCl , HBr , HI , HNO_3 , H_2SO_4 , $HClO_4$. Strong bases: Group 1 hydroxides ($NaOH$, KOH , $LiOH$) and some Group 2 hydroxides ($Ca(OH)_2$). Everything else is weak.

2. Redox Reactions (Electron Transfer)

Oxidation: loss of electrons (OIL - Oxidation Is Loss)**Reduction: gain of electrons (RIG - Reduction Is Gain)****Oxidizing agent: gets REDUCED (gains e^-); Reducing agent: gets OXIDIZED (loses e^-)****Example: $2Na + Cl_2 \Rightarrow 2NaCl$**

$Na: 0 \Rightarrow +1$ (loses e^-) $\Rightarrow$ OXIDIZED; Na is the reducing agent

$Cl: 0 \Rightarrow -1$ (gains e^-) $\Rightarrow$ REDUCED; Cl_2 is the oxidizing agent

3. Oxidation Numbers

- Free elements: oxidation number = 0
- Monoatomic ions: oxidation number = charge (e.g. Na^+ is +1)
- O is usually -2 (except in peroxides -1, OF_2 +2)
- H is usually +1 (except in metal hydrides -1)
- Sum of oxidation numbers in compound = 0; in polyatomic ion = charge

Example: Find oxidation number of Cr in $K_2Cr_2O_7$

K: +1 each, total $2(+1)=+2$. O: -2 each, $7(-2)=-14$

$$2(Cr) + 2 + (-14) = 0$$

$$2(Cr) = 12 \Rightarrow Cr = +6$$

4. Balancing Redox Equations (Half-Reaction Method)

- Step 1: Write separate half-reactions for oxidation and reduction
- Step 2: Balance atoms (not O, H): balance the main atoms first
- Step 3: Balance O by adding H_2O
- Step 4: Balance H by adding H^+ (in acidic) or OH^- (in basic)
- Step 5: Balance charge by adding electrons
- Step 6: Multiply each half-reaction to equalise electrons
- Step 7: Add half-reactions together and cancel electrons and common terms