

Equations and Reaction Types Map

Edexcel A Level Chemistry · Topic 5 Formulae, Equations and Amounts of Substance · Equations and Reaction Types

1 Balancing equations

5.6

- Atoms **rearranged**, never made or destroyed
- Same atoms on **both sides**
- Change **coefficients** only
- Never change a formula
- Combustion: C, then H, then O



2 State symbols

5.6

- (s) solid, (l) liquid, (g) gas
- (aq): dissolved in water
- Water is (l), not (aq)
- Precipitates are (s)
- Fizzing: a (g) product



3 Ionic equations

5.6

- Split **aqueous** ionic substances
- Keep solids, liquids, gases whole
- Cancel **spectator ions**
- Balance atoms **and charge**
- $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$



4 Precipitation

5.15

- Two solutions give an **insoluble solid**
- $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$
- AgCl white, AgBr cream, AgI yellow
- BaSO_4 white; $\text{Cu}(\text{OH})_2$ blue
- $\text{Fe}(\text{OH})_2$ green; $\text{Fe}(\text{OH})_3$ orange-brown



5 Displacement

5.15

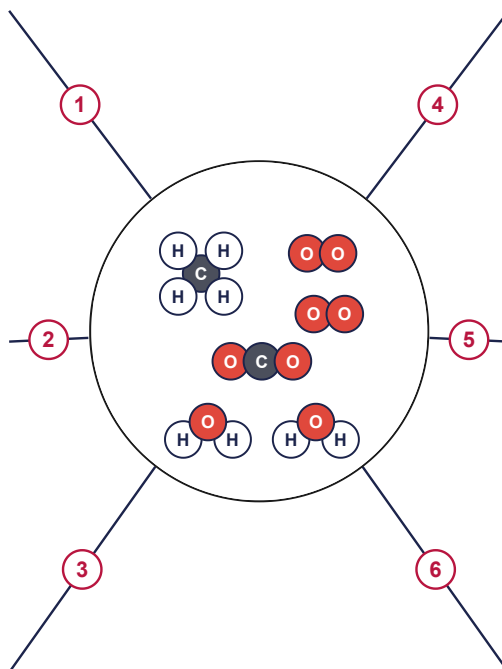
- More reactive** displaces less reactive
- $\text{Zn}(\text{s}) + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu}(\text{s})$
- Blue fades, pink-brown copper
- $\text{Cl}_2 + 2\text{Br}^- \rightarrow 2\text{Cl}^- + \text{Br}_2$ (orange)
- $\text{Br}_2 + 2\text{I}^- \rightarrow 2\text{Br}^- + \text{I}_2$ (brown)



6 Reactions of acids

5.15

- Metal: **salt + hydrogen**
- Base or alkali: **salt + water**
- Carbonate: **salt + water + CO₂**
- CO₂ turns limewater cloudy
- Insoluble bases stay whole: $\text{CuO}(\text{s})$



Ionic equations and observations

the spectator ions are left out of every ionic equation

Reaction	Ionic equation	Observation
Acid + alkali	$\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$	warms; no visible change
Acid + magnesium	$\text{Mg}(\text{s}) + 2\text{H}^+(\text{aq}) \rightarrow \text{Mg}^{2+}(\text{aq}) + \text{H}_2(\text{g})$	fizzing; metal disappears
Acid + carbonate solution	$\text{CO}_3^{2-}(\text{aq}) + 2\text{H}^+(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$	effervescence
Acid + copper(II) oxide	$\text{CuO}(\text{s}) + 2\text{H}^+(\text{aq}) \rightarrow \text{Cu}^{2+}(\text{aq}) + \text{H}_2\text{O}(\text{l})$	black solid gives blue solution
Silver nitrate + bromide	$\text{Ag}^+(\text{aq}) + \text{Br}^-(\text{aq}) \rightarrow \text{AgBr}(\text{s})$	cream precipitate
Hydroxide + iron(III)	$\text{Fe}^{3+}(\text{aq}) + 3\text{OH}^-(\text{aq}) \rightarrow \text{Fe}(\text{OH})_3(\text{s})$	orange-brown precipitate
Zinc + copper(II) sulfate	$\text{Zn}(\text{s}) + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu}(\text{s})$	blue fades; pink-brown solid

Worked examples

Balance it

- $\text{Fe} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$
- O: LCM 6: $3\text{O}_2, 2\text{Fe}_2\text{O}_3$
- $4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$**

Burn it

- $\text{C}_4\text{H}_{10} + 13/2\text{O}_2$
- $\rightarrow 4\text{CO}_2 + 5\text{H}_2\text{O}$
- double: **$2\text{C}_4\text{H}_{10} + 13\text{O}_2$**

Make it ionic

- $\text{BaCl}_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq})$
- Na^+, Cl^- are spectators
- $\text{Ba}^{2+} + \text{SO}_4^{2-} \rightarrow \text{BaSO}_4(\text{s})$**

Balanced equations give the mole ratios for reacting masses (Mole Calculations), gas volumes and titrations (Solutions and Gases).