Equations Map

Cambridge International AS & A Level Chemistry · Topic 2 Atoms, molecules and stoichiometry

1 Balancing equations 2.3.2(a)

- 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 2.3.2(b)

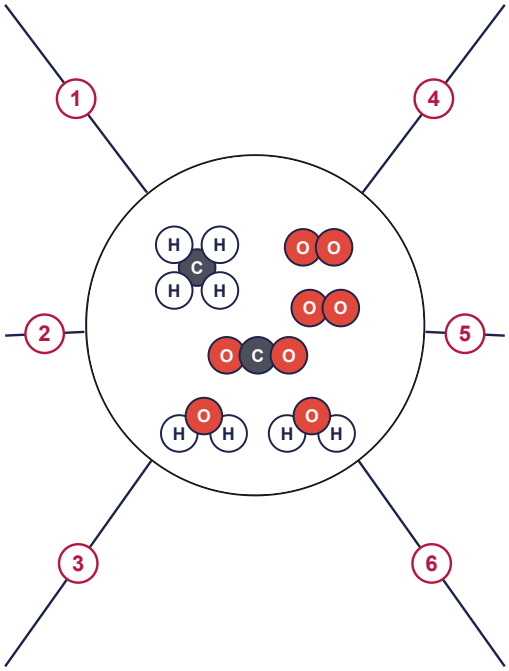
- **(s)** solid, **(l)** liquid, **(g)** gas
- **(aq)**: dissolved in water
- Water is (l), not (aq)
- Precipitates are (s)
- Fizzing: a (g) product



3 Ionic equations 2.3.2(a)

- Split **aqueous** ionic substances
- Keep solids, liquids, gases whole
- Cancel **spectator ions**
- Balance atoms **and charge**
- $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$





4 Precipitation 2.3.2

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



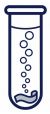
5 Displacement 2.3.2

- **More reactive** displaces less reactive
- $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$
- Blue fades, pink-brown copper
- $Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$ (orange)
- $Br_2 + 2I^- \rightarrow 2Br^- + I_2$ (brown)



6 Reactions of acids 2.3.2

- Metal: **salt + hydrogen**
- Base or alkali: **salt + water**
- Carbonate: **salt + water + CO_2**
- CO_2 turns limewater cloudy
- Insoluble bases stay whole: CuO(s)



Ionic equations and observations

the spectator ions are left out of every ionic equation

Reaction	Ionic equation	Observation
Acid + alkali	$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$	warms; no visible change
Acid + magnesium	$Mg(s) + 2H^+(aq) \rightarrow Mg^{2+}(aq) + H_2(g)$	fizzing; metal disappears
Acid + carbonate solution	$CO_3^{2-}(aq) + 2H^+(aq) \rightarrow H_2O(l) + CO_2(g)$	effervescence
Acid + copper(II) oxide	$CuO(s) + 2H^+(aq) \rightarrow Cu^{2+}(aq) + H_2O(l)$	black solid gives blue solution
Silver nitrate + bromide	$Ag^+(aq) + Br^-(aq) \rightarrow AgBr(s)$	cream precipitate
Hydroxide + iron(III)	$Fe^{3+}(aq) + 3OH^-(aq) \rightarrow Fe(OH)_3(s)$	orange-brown precipitate
Zinc + copper(II) sulfate	$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$	blue fades; pink-brown solid

Worked examples

Balance it

- $Fe + O_2 \rightarrow Fe_2O_3$
- O: LCM 6: $3O_2$, $2Fe_2O_3$
- **$4Fe + 3O_2 \rightarrow 2Fe_2O_3$**

Burn it

- $C_4H_{10} + 13/2O_2$
- $\rightarrow 4CO_2 + 5H_2O$
- double: **$2C_4H_{10} + 13O_2$**

Make it ionic

- $BaCl_2(aq) + Na_2SO_4(aq)$
- Na^+, Cl^- are spectators
- **$Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4(s)$**

Balanced equations give the mole ratios for reacting masses (mole calculations) and for solutions and gases.

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