

ACIDS, BASES & SALTS

ACIDS Release H⁺ ions (protons) in aqueous solution

Hydrochloric **HCl** → H⁺(aq) + Cl⁻(aq) MONOPROTIC 1 replaceable H

Nitric **HNO₃** → H⁺(aq) + NO₃⁻(aq) MONOPROTIC 1 replaceable H

Sulphuric **H₂SO₄** → 2H⁺(aq) + SO₄²⁻(aq) DIPROTIC 2 replaceable H's

Ethanoic **CH₃COOH**(aq) ⇌ CH₃COO⁻(aq) + H⁺(aq) A WEAK ACID

BASES React with acids by accepting H⁺ ions (protons) to form salts

<i>carbonates</i>	K₂CO₃	MgCO₃	CuCO₃
<i>hydrogencarbonates</i>	NaHCO₃		
<i>metal oxides</i>	MgO	ZnO	CuO
<i>metal hydroxides</i>	NaOH	KOH	Ca(OH)₂
<i>ammonia</i>	NH₃		

ALKALIS SOLUBLE BASES which release OH⁻ (hydroxide ions) in aqueous solution

Soluble metal oxides **Na₂O + H₂O(l) → 2Na⁺(aq) + 2OH⁻(aq)**

Soluble metal hydroxides **NaOH → Na⁺(aq) + OH⁻(aq)**
sodium hydroxide

KOH → K⁺(aq) + OH⁻(aq)
potassium hydroxide

Aqueous ammonia **NH₃(aq) + H₂O(l) ⇌ NH₄⁺(aq) + OH⁻(aq)**

SALTS Formed from the reaction between acids and bases

hydrochloric acid	makes	CHLORIDES
nitric acid	makes	NITRATES
sulphuric acid	makes	SULPHATES / HYDROGENSULPHATES

SALT FORMATION

Formation A salt is produced when the H^+ ion of an acid is replaced by...
a **metal ion** or the **ammonium ion** NH_4^+

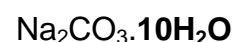
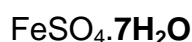
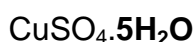
SUMMARY

Acids react with...

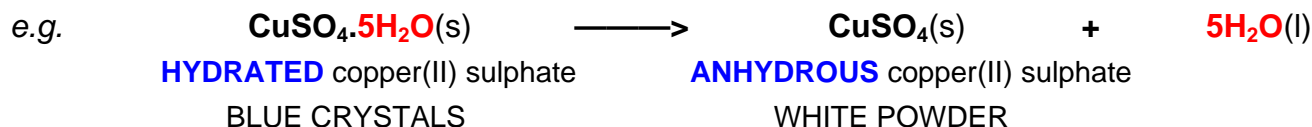
metals	to give	a salt + hydrogen
oxides of metals		a salt + water
hydroxides of metals		a salt + water
carbonates		a salt + water + carbon dioxide
hydrogencarbonates		a salt + water + carbon dioxide
ammonia		an ammonium salt

Water of crystallisation

- loosely bonded water molecules attached to salts



- the water can be driven off by heating

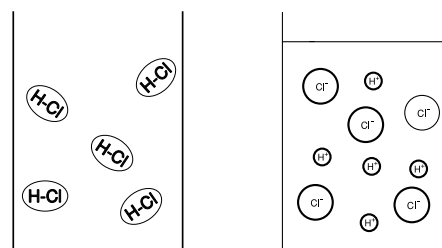


PROPERTIES AND REACTIONS OF HYDROCHLORIC ACID

Hydrochloric acid is a typical acid; in dilute aqueous solution $HCl \rightarrow H^+(aq) + Cl^-(aq)$

Hydrogen chloride is a colourless gas; it is a poor conductor of electricity because there are no free electrons or ions present. It has no action on **dry** litmus paper because there are no aqueous hydrogen ions present.

In water, the covalent hydrogen chloride molecules dissociate into ions. The solution now conducts electricity showing ions are present. For each hydrogen chloride molecule that dissociates one hydrogen ion and one chloride ion are produced. The solution turns litmus paper red because of the presence of the $H^+(aq)$ ion.

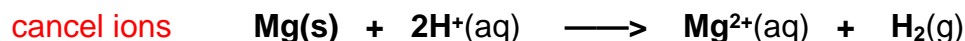
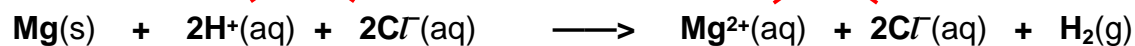
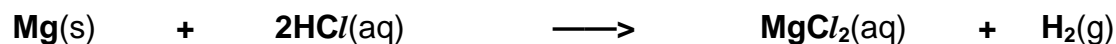


The dissociation of hydrogen chloride into ions when put in water

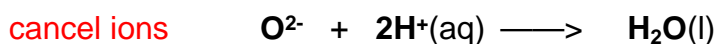
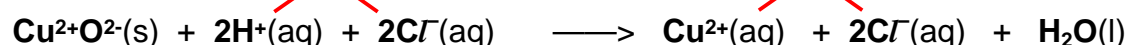
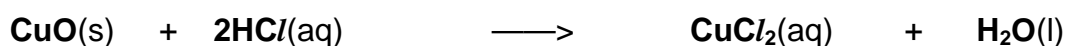
	Appearance	Bonding and formula	Conductivity	Dry litmus
hydrogen chloride	colourless gas	covalent molecule $HCl(g)$	poor	no reaction
hydrochloric acid	colourless soln.	aqueous ions $HCl(aq)$	good	goes red

THE REACTIONS OF ACIDS

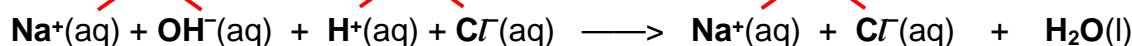
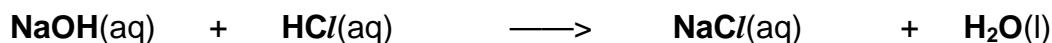
Metals magnesium + hydrochloric acid \longrightarrow magnesium chloride + hydrogen



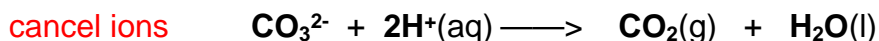
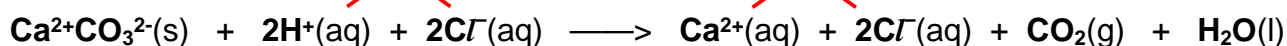
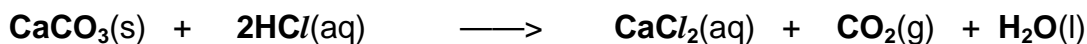
Basic Oxides copper(II) oxide + hydrochloric acid \longrightarrow copper(II) chloride + water



Alkalis sodium hydroxide + hydrochloric acid \longrightarrow sodium chloride + water



Carbonates calcium carbonate + hydrochloric acid \longrightarrow calcium chloride + carbon dioxide + water



Hydrogencarbonates $\mathbf{H^+(aq)} + \mathbf{HCO_3^-} \longrightarrow \mathbf{CO_2(g)} + \mathbf{H_2O(l)}$

Q.1 Write the formulae for...

- | | |
|-----------------------|------------------------|
| a) zinc chloride | b) zinc sulphate |
| c) magnesium sulphate | d) magnesium nitrate |
| e) aluminium sulphate | f) potassium carbonate |
| g) ammonium chloride | h) ammonium sulphate |

Q.2 Write balanced equations for the reactions between...

- zinc and dilute hydrochloric acid
- zinc and dilute sulphuric acid
- magnesium oxide and dilute sulphuric acid
- zinc oxide and dilute nitric acid
- potassium hydroxide and dilute hydrochloric acid
- potassium hydroxide and dilute sulphuric acid
- magnesium carbonate and dilute sulphuric acid
- ammonia solution and dilute hydrochloric acid
- ammonia solution and dilute sulphuric acid

Q.3 Calculate the percentage of water (by mass) in the following hydrated salts;

- $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
- $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$