



eduresourceza.com

C5. Acids, bases and salts

Downloaded from eduresourceza.com

C5.01 What is an acid?

1. The major acids

- corrosive - dangerous on the skin, attack stonework
- powerful acids - mineral acids
- can detect using **indicator**
- uses
 - ethanoic acid CH_3COOH - In vinegar
 - nitric acid- HNO_3 - used in making fertilisers and explosives

2. What are indicators?

Indicator	acid	neutral	alkali
Litmus	red	purple	blue



3. PH scale

Rules for the PH scale

- Acids have a ph less than 7
- The more acidic a solution, the lower PH
- Neutral substances, such as pure water - PH 7
- alkalies - greater than 7

C5.02 Acids and alkali solutions

1. The importance of hydrogen ions

- hydrogen ions(H^+) in acid solutions make litmus go red
 - conduct electricity very well
- hydroxide ions(OH^-) in alkali solutions make litmus go blue
 - conduct electricity very well

2. The importance of water

1. gas hydrogen chloride is made up of covalently bonded molecules
2. if gas is dissolved in organic solvent, it's not acid
3. However in water, conduct electricity, acid solution produced

so does for acidic oxides(sulfur, phosphorus, carbon)

C5.03 Metal oxides and non-metal oxides

1. Acidic oxides

- non-metal is heated with oxygen - acidic oxides eg) $\text{S(g)} + \text{O}_2\text{(g)} = \text{SO}_2\text{(g)}$
- acidic oxides are dissolved and it creates acid

element	How it reacts	Products	+ water then litmus
non-metals			
sulfur	bright blue flame	colourless gas - SO_2	red
Phosphorus	yellow flame	white solid - P_2O_5	red
carbon	glows red	colorless gas - CO_2	slowly red

Downloaded from eduresourceza.com

2. Basic oxides

Downloaded from eduresourceza.com

- metal is heated with oxygen - basic oxides are created eg) $\text{MgO} + \text{H}_2\text{O} \Rightarrow \text{Mg(OH)}_2$
- basic oxides is dissolved and it makes alkaline

element	How it reacts	Products	+ water then litmus
metals			
sodium	yellow flame	Na_2O	blue
magnesium	bright white flame	MgO	slowly blue
calcium	red flame	CaO	blue
iron	yellow sparks	FeO	insoluble
copper	doesn't burn, turns black	CuO	insoluble

3. Neutral and amphoteric oxides

Neutral oxides

- do not react with either acids or alkalis
- carbon monoxide(CO)

amphoteric oxides

- a hydroxide or metal oxide that reacts with both an acid and an alkali to give a salt and water
- zinc hydroxide, aluminium hydroxide
 - $\text{ZnCl}_2(\text{aq}) + 2\text{NaOH}(\text{aq}) = \text{Zn(OH)}_2(\text{s}) + 2\text{NaCl}(\text{aq})$ - white precipitate formed
 - $\text{Zn(OH)}_2(\text{s}) + 2\text{NaOH} = \text{Na}_2\text{ZnO}_2(\text{aq}) + \text{H}_2\text{O}$ - Zn(OH)_2 - amphoteric
 - Zn(OH)_2 - usually metal oxides neutralise acids but this neutralises alkaline
 - ZnO - neutralise acid, Zn(OH)_2 - neutralise alkalis as well

4. Hierarchy

non-metal oxides

- acidic oxides - SO_2
- neutral oxides - CO

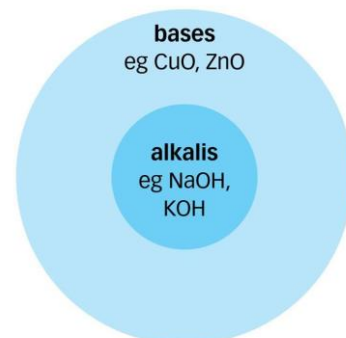
Metal oxides

- amphoteric oxides - ZnO
- Basic oxides - CaO

C5.05 Alkalis and bases

1. What types of substances are alkalis and bases?

- Base**: a substance that reacts with an acid to form a salt and water only
- Alkali**: a base that is soluble in water.
- Neutralisation
 - Acid + base = salt + water



2. Properties and uses of alkalis and bases

Bases	Alkalis	Antacids
-------	---------	----------

Oxides and hydroxides of metal	Bases dissolved in water	used to neutralise acid indigestion
Mainly soluble in water	Feel soapy	MgO, Mg(OH) ₂
	Solution containing OH ⁻	Na ₂ CO ₃ , NaHCO ₃
	Turn litmus blue	CaCO ₃ , MgCO ₃

C5.06 Characteristic reactions of acids

1. The reactions of acids

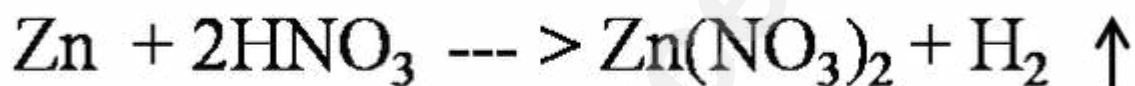
Salt: A compound made from an acid when a metal takes the place of the hydrogen in the acid

- all acid

1. The reaction of acids with metal

✕ If metal is too unreactive (magnesium) => no reaction all too slow

- hydrochloric acids always gives a chloride
- nitric acid always gives a nitrate
- sulfuric acid always gives a sulfate
- ethanoic acids always gives an ethanoate



2. The reaction of acids with bases and alkalis

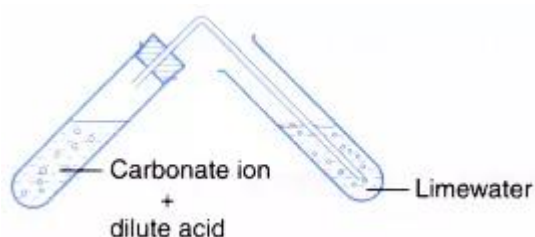


3. The reaction of acids with carbonates



C5.07 Acids and alkalis in chemical analysis

1. The test for carbonates using acid



- All carbonates react with acids to give off carbon dioxide - use this property
- add hydrochloric acid to powdered substance - gas to limewater - cloudy

2. Tests for metal ions in salts using alkalis

- all salts - ionic compounds (positive metal ion, negative non-metal ion)

Coloured hydroxide precipitates

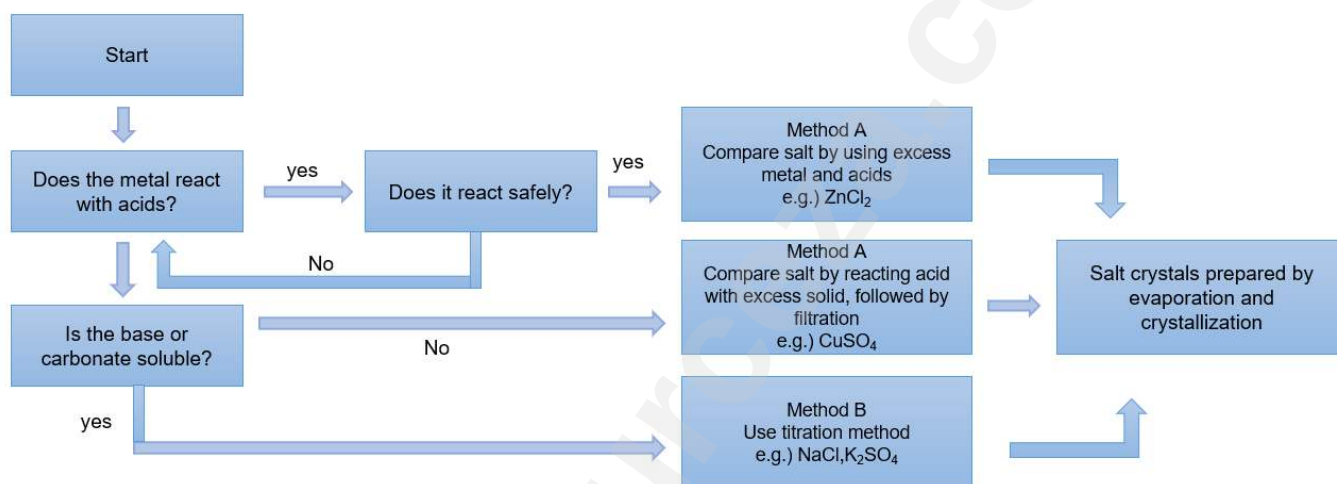
- copper salts - light blue precipitate of copper hydroxide
- iron(II) salt - light green precipitate of iron hydroxide
- iron(III) salts - red-brown precipitate of iron hydroxide

- hydroxide of calcium, zinc, aluminium
 - $\text{ZnSO}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \Rightarrow \text{Zn}(\text{OH})_2(\text{s}) + \text{Na}_2\text{SO}_4(\text{aq})$
- when an excess of sodium hydroxide is added, zinc and aluminium hydroxide precipitates re-dissolve to give colourless solutions
 - exception: calcium does not re-dissolve
- To distinguish zinc and aluminium - use **ammonia** solution
 - with excess ammonia solution - only zinc hydroxide precipitate re-dissolve
 - aluminium hydroxide does not re-dissolve

3. The test for ammonium salts using alkali

- to detect NH_4 ions, produce **ammonia** gas, which turns damp **red litmus paper blue**
 - $\text{NH}_4\text{NO}_3(\text{s}) + 2\text{NaOH}(\text{aq}) \Rightarrow \text{NaNO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{NH}_3(\text{g})$
 - it occurs because ammonia is more volatile base than sodium hydroxide $\Rightarrow$ good displacement

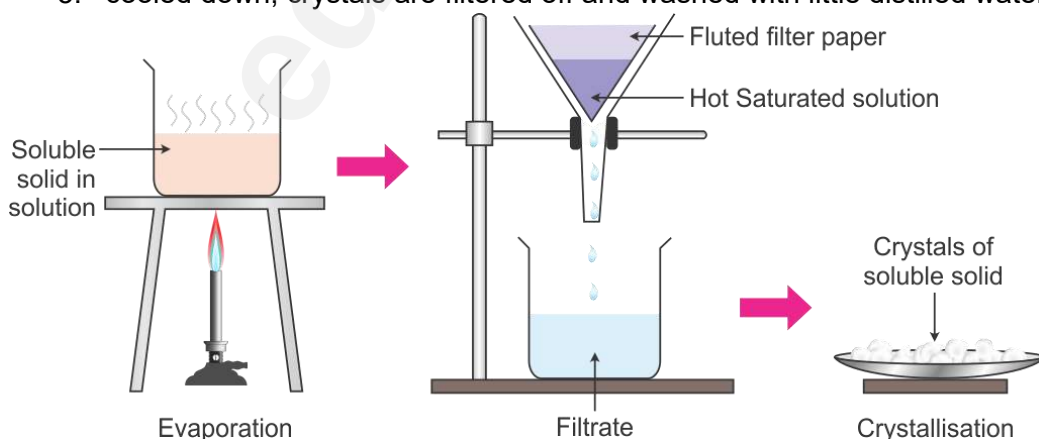
C5.09 Preparing soluble salts



- react safely - does it react safely when touching acids? - no - dissolve in the water - use titration

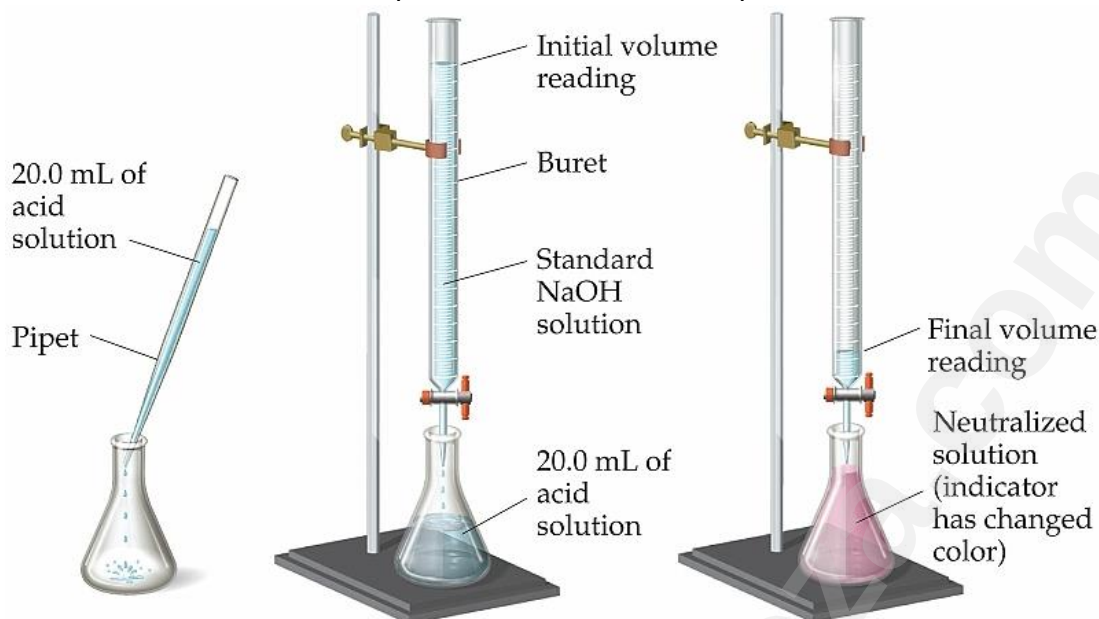
Method A - acid plus solid metal, base or carbonate

- an excess of the solid is added to the acid and allowed to react
 - using excess to make sure that all acid is used up
 - or acid would become more concentrated when the water is evaporated later
- the excess solid is filtered out
- filtrate is gently evaporated to concentrate salt solution, by heated water bath
- when crystals can be seen forming (crystallisation point), stop heating
- cooled down, crystals are filtered off and washed with little distilled water



titration - neutralisation of an acid with an alkali (indicator is used for detecting end-point)

1. Acid solution is poured into burette, measure the volume of solution
2. using pipette, deliver alkali solution
3. keep doing it to obtain accurate volume
4. then without indicator, put same volume, and evaporate



C5.10 Choosing a method of salt preparation

1. Soluble salts

- is the metal reactive enough to displace the hydrogen in the acid? too reactive?
- Is the base or carbonate soluble or insoluble?

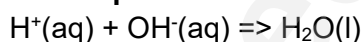
2. Making salts by precipitation

- some insoluble salts - precipitated - crystallisation methods can't be used
- so we can use precipitation e.g) Barium nitrate
 - $\text{Ba}(\text{NO}_3)_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq}) \Rightarrow \text{BaSO}_4(\text{s}) + 2\text{NaNO}_3(\text{aq})$

3. What happens to ions in neutralisation



Ionic equation



- **Acid:** a molecule or ion that is able to donate a proton(H^+)
- **base:** a molecule or ion that is able to accept a proton