

O-level

SALTS

A salt is a compound formed when the replaceable hydrogen atom(s) of an acid are replaced by a metal or ammonium ion (NH_4^+)

Types of salts

There two different types of salts

- Normal salt
- Acidic salt

Normal salt

It is the one in which all the replaceable hydrogen from the acid has been replaceable by the metal ion(s).

Example

Sodium chloride	NaCl
Sodium sulphate	Na_2SO_4
Calcium carbonate	CaCO_3
Calcium sulphate	CaSO_4
Calcium chloride	CaCl_2
Ammonium chloride	NH_4Cl

The formation of the normal salt is illustrated by the equation below;



Acidic salt

Is a salt in which part of replaceable hydrogen of the acid has been replaced by a metal

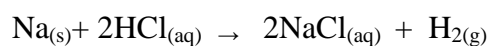


Examples include

- sodium hydrogen carbonate (NaHCO_3)
- Sodium hydrogen sulphate NaHSO_4
- Calcium hydrogen sulphate $\text{Ca}(\text{HSO}_4)_2$
- Calcium hydrogen carbonate $\text{Ca}(\text{HCO}_3)_2$ etc.

Preparation of salts

1. From metal salt by direct combination of metals or oxide with acid e.g.



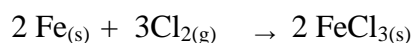
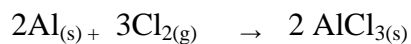
The mixture is dried using a drying agent or evaporating to dryness

2. **By neutralisation;** this is the process by which a base reacts with an acid to form a salt and water only e.g. Sodium chloride can be prepared from sodium hydroxide and dilute hydrochloric acid .



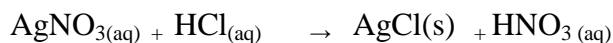
3. **Direct combination(synthesis);**

Aluminium chloride and iron (III)chloride can be prepared from the element directly



Precipitation

Insoluble zinc carbonate, silver chloride (AgCl), and lead chloride can be prepared by precipitation e.g. silver chloride is prepared from solution of silver nitrate and dilute hydrochloric acid where a precipitate of silver chloride is formed.



The precipitate of AgCl is washed several times with distilled water.

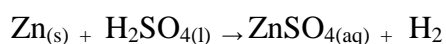
NOTE: insoluble salts can be prepared by either precipitation method or direct synthesis

Other examples of salts prepared by precipitation include;

- Lead chloride (PbCl₂)
- Lead sulphate (PbSO₄), barium sulphate (BaSO₄) etc.

Preparation of zinc sulphate from zinc

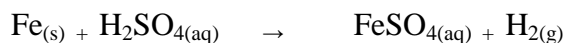
- Add dilute H₂SO_{4(s)} mixed with little copper sulphate to zinc in a beaker
- Add more zinc to saturate the solution
- Filter to remove the un dissolved zinc
- Warm the filtrate to concentrate it
- Cool to room temperature
- Filter the crystals of zinc sulphate-7-water
- Wash the crystals with little cold distilled water
- Dry the crystals between filter papers



Preparation of iron (II) sulphate-7-water (FeSO₄·7H₂O)

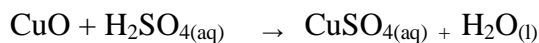
- Add warm dilute sulphuric acid to iron filling in a beaker
- Add more iron fillings to saturate the solution
- Filter to remove the un dissolved iron filings
- Warm the filtrate slightly to concentrate it

- Cool to room temperature
- Filter the crystals of iron (II) sulphate-7-water
- Wash the crystals with cold distilled water
- Dry the crystals between filter papers

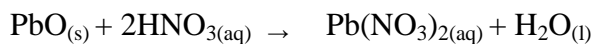
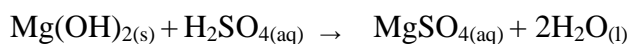


Preparation of copper (II) sulphate-5-water from copper oxide

- Pour dilute sulphuric acid in a beaker, warm gently. (to increase on the solubility)
- Add copper oxide to the warm acid.
- Add more copper oxide to saturate the solution.
- Filter to remove the un dissolved copper oxide
- Evaporate the filtrate concentrate it cool to room temperature
- Filter the crystals of copper (II) sulphate-5-water
- Wash the crystals with little cold distilled water
- Dry the crystals between the filter paper

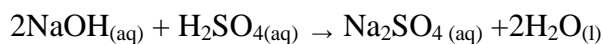


N.B: Magnesium sulphate, zinc sulphate, and lead (II) nitrate can be prepared in the same way.



Preparation of sodium hydrogen sulphate.

- Add 20cm³ of 2M NaOH in a clean conical flask.
- Titrate with 2M H₂SO₄ from a burette using methyl orange indicator.
- The solution formed contains sodium sulphate.



- Note the volume of H₂SO₄ used, say x cm³.

- Measure another 20 cm³ of 2M NaOH in a clean beaker.
- Add 2x cm³ of 2M H₂SO₄
- The solution formed contains sodium hydrogen sulphate.



EXERCISE

1(a) Nitric acid is a strong monobasic acid. Explain what is meant by the term;

(i) Strong acid

(ii) Basicity

(a) State two properties of Nitric acid as an acid.

1. Define the following terms. Giving two examples in each case;

(i) Normal salt

(ii) Acid salt

(b) Write an equation for the reaction between NaOH(aq) and dilute H_2SO_4

2002: 2₍₂₎; 2003: 44, 13, 31, 14₍₂₎; 1989: 12, 3, 41, 1, 9; 1990: 23; 1992: 28, 14, 13₍₂₎; 1994: 4, 5, 14; 1996: 9, 10; 1995: 11, 15, 8₍₂₎, 35; 1999: 14; 2004: 12₍₂₎; 2012: 12₍₂₎, 13₍₂₎, 8; 2006: 13, 11, 2₍₂₎; 12₍₂₎; 2000: 43, 45; 2001: 19; 1991: 20; 1993: 8, 26; 1998: 4, 9, 33, 48; 1999: 13, 3; 2007: 7, 41, 47, 3₍₂₎; 2005: 15, 20, 23, 28; 2008: 16, 49; 2009: 12, 15, 20, 21, 23, 32, 36, 39; 1997: 3, 7, 20, 1₍₂₎; 2010: 9₍₂₎. ; 2015: 7