

Practical Work

Test for hydrogen (H_2):

- A burning wooden splint when brought near this gas gets off and burns with a pale blue flame producing a pop sound.

Test for oxygen (O_2):

- A burning wooden splint when brought near this gas re-lights brightly which shows that it is a supporter of combustion.

Test for water vapour (H_2O):

- It turns anhydrous copper sulphate to blue.
- It turns blue copper chloride to pink.

Test for ammonia (NH_3):

- Dense white fumes are formed when a rod dipped in HCl is brought near this gas.

Test for carbon dioxide (CO_2):

- A burning wooden splint when brought near this gas goes off which shows that it is not a supporter of combustion.

Test for sulphur dioxide (SO_2):

- It turns potassium permanganate solution colourless.
- It changes the colour of acidified potassium dichromate from orange to green.

Test for hydrogen sulphide (H_2S):

- It is a colourless gas having rotten egg like smell.
- It turns lead acetate solution silvery black.
- It turns moist blue litmus paper red. This shows that it is acidic in nature.

Test for nitrogen dioxide (NO_2):

- It is a reddish-brown in colour.
- It has pungent and irritating odour.
- It turns moist blue litmus paper red. This shows that it is acidic in nature.
- It turns moist potassium iodide paper brown.

Test for chlorine (Cl_2):

- It is a greenish-yellow in colour.
- It has sharp pungent choking odour.
- It turns moist blue litmus paper red followed by bleaching it. This shows that it is acidic in nature.
- It turns moist starch iodide paper blue black.
- It forms a white precipitate when passed through silver nitrate solution.

Test for hydrogen chloride (HCl):

- It is colourless.
- It has pungent choking odour.
- It turns moist blue litmus paper red.
- It produced dense white fumes when a rod dipped in ammonia solution is brought near the gas.
- It forms a white precipitate when passed through silver nitrate solution. This precipitate is soluble in excess of ammonium hydroxide solution.

1. Colour and Odour

Physical property	Experiment	Observation	Inference
Colour	Observe colour of the salt	Pink Blue Light green Dark brown Flesh colour White	Co^{2+} Cu^{2+} Fe^{2+} Fe^{3+} Mn^{2+} $\text{Pb}^{2+}, \text{Zn}^{2+}, \text{Ca}^{2+}, \text{Na}^+, \text{K}^+, \text{NH}_4^+, \text{NH}_4^+$
Odour	Rub a pinch of salt between the fingers with a drop of water	Ammoniacal smell Vinegar like smell Rotten egg like smell Smell of sulphur dioxide gas	NH_4^+ CH_3COO^- S^{2-} SO_3^{2-} SO_3^{2-}

2. Dry heating test

	Observation/ Gas evolved	Infer
1	CO_2 gas :- Colourless and odourless gas which turns lime water milky.	CO_3^{2-} or C_2O_4
2	H_2S gas :- Colourless gas with smell like rotten egg, turns lead acetate paper black.	S^{2-}
3	SO_2 gas:- Colourless gas with smell like burning sulphur, turns acidified potassium dichromate paper green.	SO_3^{2-}
4	HCl gas :-	Cl^-

	Colourless gas with pungent smell, forms white fumes with ammonia and white ppt. with silver nitrate.	
5	Colourless gas with vinegar like smell	CH_3COO^-
6	NH_3 gas :- Colourless gas with characteristic smell, turns Nessler's reagent brown.	NH_4^+
7	NO_2 gas:- Reddish brown gas, turns ferrous sulphate solution black.	NO_2^- or NO_3^-
8	Br_2 gas :- Reddish brown vapours.	Br^-
9	I_2 gas:- Dark violet vapours.	I^-
10	O_2 gas:- Supports combustion, glowing wooden splinter burns.	O^{2-}
11	H_2O vapours:- Droplets of water on the cooler part of the test tube	Hydrated salt

3. Flame test

	Colour of flame	Inference
1	Brick red	Calcium
2	Crimson red	Strontium
3	Grassy-green	Barium
4	Bright-bluish green	Copper
5	Green flashes	Zn or Mn
6	Bull bluish	Lead

4. Solubility test

Anion→ Cation ↓	NO ₃ ⁻	CH ₃ COO ⁻	Cl ⁻	SO ₄ ²⁻	OH ⁻	S ²⁻	CO ₃ ²⁻	SO ₃ ²⁻	PO ₄ ³⁻
Al ³⁺	√	√	√	√	×	Not exist	Not exist	Not exist	×
Na ⁺	√	√	√	√	√	√	√	√	√
Ba ²⁺	√	√	√		√	√	×	×	×
Ca ²⁺	√	√	√	√	√	√	×	×	×
Mg ²⁺	√	√	√	√	√	√	×	×	×
K ⁺	√	√	√	√	√	√	√	√	√
Zn ²⁺	√	√	√	√	×	×	×	×	×
Hg ²⁺	√	√	√	√	Not exist	×	×	×	×
Fe ³⁺	√	√	√	√	×	Not exist	×	×	×
Mn ²⁺	√	√	√	√	×	×	×	×	×
Pb ²⁺	√	√	×	×	×	×	×	×	×
Cu ²⁺	√	√	√	√	×	×	×	×	×
Ag ²⁺	√	√	×	√	×	×	×	×	×
Fe ²⁺	√	√	√	√	×	×	×	Not exist	×

Identification of cations:

- by using of sodium/potassium hydroxide solution
 - Pb and Zn are soluble while Ca, Cu, Fe (II) and Fe (III) are insoluble in the solution.
- by using of ammonia solution
 - Zn and Cu are soluble while Pb, Fe (II) and Fe(III) are insoluble.
 - Ca shows no change in the excess of ammonium hydroxide solution.

Identification of anions:

- by using dilute sulphuric acid
 - CO₃²⁻, S²⁻, NO₂⁻ and SO₃²⁻ react with dil. H₂SO₄ to give out CO₂, H₂S, NO₂ and SO₂ gases respectively.
- by using concentrated sulphuric acid
 - Cl⁻, Br⁻, I⁻, NO₃⁻ and C₂O₄²⁻ and CH₃COO⁻ react with conc. H₂SO₄ but not with dil. H₂SO₄ to produce characteristic gases.
- SO₄²⁻ and PO₄³⁻ react neither with dil H₂SO₄ nor with conc. H₂SO₄. These are, therefore, identified by individual tests (by using nitric acid and barium chloride).
- Based on the smell and colour of the gas, the inferences are made.