# 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<br>Blue<br>Light green<br>Dark brown<br>Flesh colour<br>White | $Co^{2+}$<br>$Cu^{2+}$<br>$Fe^{2+}$<br>$Fe^{3+}$<br>$Mn^{2+}$<br>$Pb^{2+}$, $Zn^{2+}$, $Ca^{2+}$, $Na^{+}$, $K^{+}$, $NH_4^+$ NH4+ |
| Odour | Rub a pinch of salt between the fingers with a drop of water | Ammoniacal smell<br>Vinegar like smell<br>Rotten egg like smell<br>Smell of sulphur dioxide gas | $NH_4^+$<br>$CH_3COO^-$<br>$S^{2-}$<br>$SO_3^{2-}$ SO32- |

**2. Dry heating test**

| | | |
|---|---|---|
| | **Observation/ Gas evolved** | **Infer** |
| 1 | *$CO_2$ gas* :-<br>Colourless and odourless gas which turns lime water milky. | $CO_3^{2-}$ or $C_2O_4$ |
| 2 | *$H_2S$ gas* :-<br>Colourless gas with smell like rotten egg,<br>turns lead acetate paper black. | $S^{2-}$ |
| 3 | *$SO_2$ gas*:-<br>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,<br>forms white fumes with ammonia and white ppt. with silver nitrate. | |
| 5 | Colourless gas with vinegar like smell | $CH_3COO^-$ |
| 6 | *$NH_3$ gas* :-<br>Colourless gas with characteristic smell, turns Nessler's reagent brown. | $NH_4^+$ |
| 7 | *$NO_2$ gas*:-<br>Reddish brown gas, turns ferrous sulphate solution black. | $NO_2^-$ or $NO_3^-$ |
| 8 | *$Br_2$ gas* :-<br>Reddish brown vapours. | $Br^-$ |
| 9 | *$I_2$ gas*:-<br>Dark violet vapours. | $I^-$ |
| 10 | *$O_2$ gas*:-<br>Supports combustion, glowing wooden splinter burns. | $O^{2-}$ |
| 11 | *$H_2O$* vapours:-<br>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 ↓ | $NO_3^-$ | $CH_3COO^-$ | $Cl^-$ | $SO_4^{2-}$ | $OH^-$ | $S^{2-}$ | $CO_3^{2-}$ | $SO_3^{2-}$ | $PO_4^{3-}$ |
|---|---|---|---|---|---|---|---|---|---|
| $Al^{3+}$ | √ | √ | √ | √ | × | 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.