



# PUNNA International School

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Class – XII

Subject: Chemistry (Practical)

Experiments (2023\_24)

| Exp. No                         | Aim   |
|---------------------------------|---|
| <b>QUANTITATIVE ANALYSIS</b>    |   |
| 1                               | Prepare 250 ml of 0.1M Solution of Oxalic Acid From Crystalline Oxalic Acid   |
| 2                               | Determination of Concentration/Molarity of $\text{KMnO}_4$ Solution by Titrating it against a 0.1M Standard Solution of Oxalic acid   |
| 3                               | Determination of Concentration/Molarity of $\text{KMnO}_4$ Solution by Titrating it against a Standard Solution of Ferrous ammonium sulphate                                    |
| <b>QUALITATIVE ANALYSIS</b>     |   |
| 4                               | To Identify the given inorganic salt $[\text{Ba}(\text{NO}_3)_2]$   |
| 5                               | To Identify the given inorganic salt $[\text{ZnCO}_3]$  |
| 6                               | To Identify the given inorganic salt $[\text{Pb}(\text{NO}_3)_2]$   |
| 7                               | To Identify the given inorganic salt $\text{PbCl}_2$  |
| 8                               | To Identify the given inorganic salt $\text{MgSO}_4$  |
| 9                               | To Identify the given inorganic salt $[\text{BaSO}_4]$  |
| 10                              | To Identify the given inorganic salt $[\text{Sr}(\text{NO}_3)_2]$   |
| <b>Content based Experiment</b> |   |
| 11                              | Test for functional group present in organic compound: Aldehyde, Ketone, Alcohol, Carboxylic Acid, Phenol, Amine  |
| 12                              | Preparation of inorganic compound, Ferrous ammonium sulphate (potash alum)  |
| 13                              | Chromatography<br>Separation of constituents present in an inorganic mixture containing two cations only (constituents having large difference in $R_f$ values to be provided). |
| 14.                             | Preparation of one lyophilic sol of Starch.   |

## EXPERIMENT-1

**Aim:** Prepare 250 ml of M/10 Solution of Oxalic Acid From Crystalline Oxalic Acid

**Theory**

Molecular mass of crystalline oxalic acid  $\left( \begin{array}{c} \text{COOH} \\ | \\ \text{COOH} \end{array} \cdot 2\text{H}_2\text{O} \right) = 126$

Hence, for preparing 1000 ml of 1M oxalic acid, weight of oxalic acid crystals required = 126 g

∴ For preparing 250 ml of 0.1M solution,

$$\text{oxalic acid crystals required} = \frac{126}{1000} \times 250 \times 0.1 = 3.150 \text{ g.}$$

### **Apparatus**

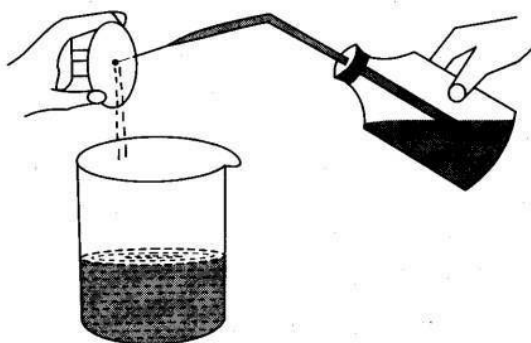
Watch glass, analytical balance, weight box, fractional weight box, 250 ml beaker, glass rod, 250 ml measuring flask and wash bottle.

### **Chemical Required**

Oxalic acid crystals and distilled water.

### **Procedure**

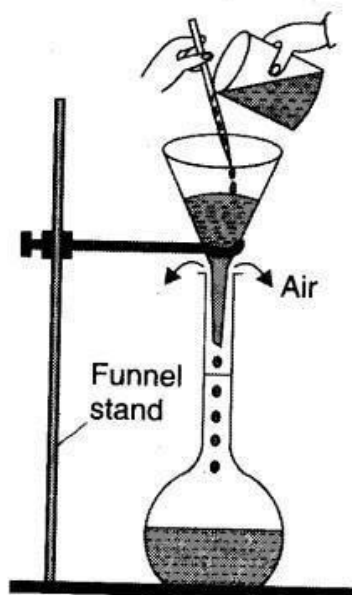
1. Take a watch glass, wash it with distilled water and then dry it.



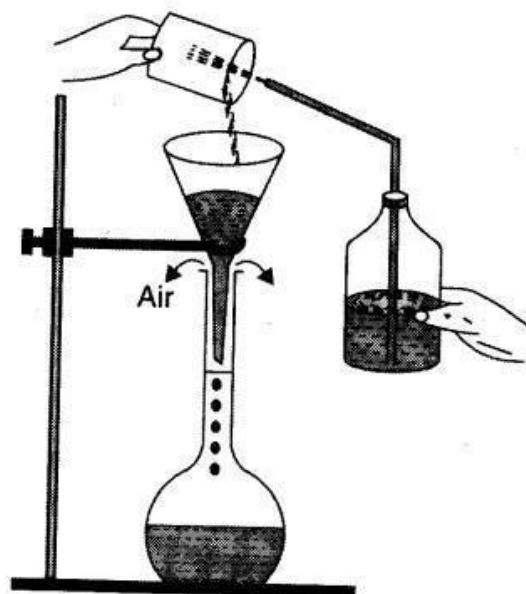
**Fig.** Washing of watch glass to transfer sticking particles to beaker.

2. Weigh the clean and dried watch glass accurately and record its weight in the notebook.

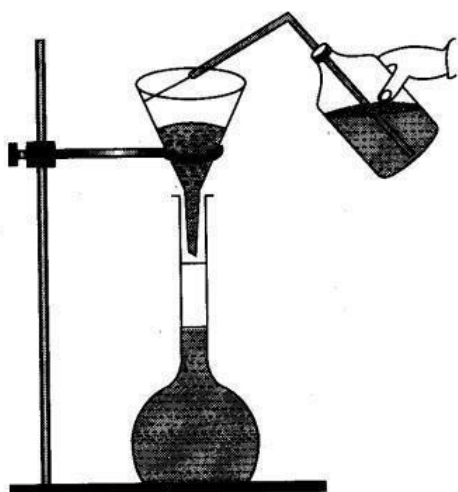
3. Weigh 3.150 g oxalic acid on the watch glass accurately and record this weight in the note-book.
4. Transfer gently and carefully the oxalic acid from the watch glass into a clean 250 ml beaker. Wash the watch glass with distilled water with the help of a wash bottle to transfer the particles sticking to it into the beaker [Fig].  
The volume of distilled water for this purpose should not be more than 50 ml.
5. Dissolve oxalic acid crystals in the beaker by gentle stirring with a clean glass rod.
6. When the oxalic acid in the beaker is completely dissolved, transfer carefully the entire solution from the beaker into a 250 ml measuring flask (volumetric flask) with the help of a funnel [Fig].



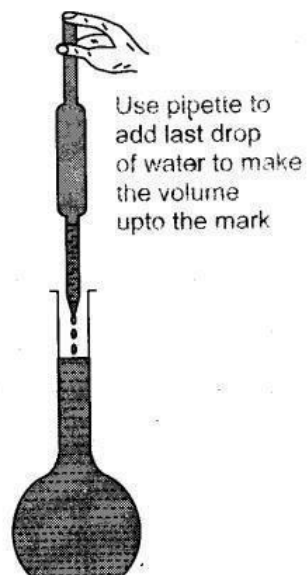
**Fig.** Transferring solution to measuring flask



**Fig.** Transferring last traces of



**Fig.** Washing last traces of solution from funnel to the measuring flask.



**Fig.** Using pipette to add last drop of water to make the volume upto the mark.

7. Wash the beaker with distilled water. Transfer the washings into the measuring flask [Fig].

8. Finally wash the funnel well with distilled water with the help of a wash bottle to transfer the solution sticking to the funnel into the measuring flask [Fig].
9. Add enough distilled water to the measuring flask carefully, up to just below the etched mark on it, with the help of a wash bottle.
  
10. Add the last few drops of distilled water with a pipette until the lower level of the meniscus just touches the mark on the measuring flask [Fig].
11. Stopper the measuring flask and shake gently to make the solution uniform throughout. Label it as oxalic acid solution.

**Result:-** 250 ml of M/10 Solution of Oxalic Acid From Crystalline Oxalic Acid is prepared.

## EXPERIMENT-2

**AIM:** To determine the strength of potassium permanganate by titrating it against the standard solution of 0.1M oxalic acid.

Theory:

Potassium permanganate is a strong oxidising agent and in the presence of sulfuric acid it acts as a powerful oxidising agent. In acidic medium the oxidising ability of  $\text{KMnO}_4$  is represented by the following equation.

In acidic solution,



Solution containing  $\text{MnO}_4^-$  ions are purple in colour and the solution containing  $\text{Mn}^{2+}$  ions are colourless and hence permanganate solution is decolourised when added to a solution of a reducing agent. The moment there is an excess of potassium permanganate present the solution becomes purple.

Thus,  **$\text{KMnO}_4$  serves as self indicator** in acidic solution.

Potassium permanganate is standardized against pure oxalic acid. It involves a redox reaction. Oxalic acid is oxidised to carbon dioxide by  $\text{KMnO}_4$ , which itself gets reduced to  $\text{MnSO}_4$ . Oxalic acid reacts with potassium permanganate in the following way.

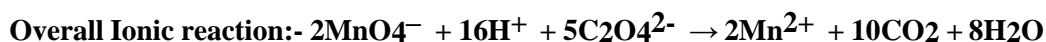
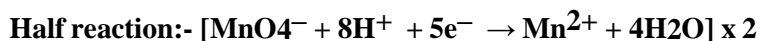
The chemical reaction at room temperature is given below.



The overall reaction takes place in the process is



The **ionic equation** involved in the process is given below. **Reduction**



This titration cannot be carried out in the presence of acids like nitric acid or hydrochloric acid because itself is an oxidising agent. So hydrochloric acid chemically reacts with  $\text{KMnO}_4$  solution forming chlorine which is also an oxidising agent.

**Materials Required:**

1. Oxalic acid
2. Potassium permanganate solution
3. 1.0M sulfuric acid
4. Chemical balance
5. Burette
6. Burette stand
7. Pipette
8. Conical flask
9. Funnel
10. Measuring flask
11. Weighing bottle
12. White tile
13. Burnet
14. Wire gauze

**Apparatus Setup:**

1. In burette –  $\text{KMnO}_4$  solution
2. In Conical flask – 10ml of oxalic acid + Sulfuric acid
3. Indicator – Self indicator ( $\text{KMnO}_4$ )
4. End Point – Appearance of permanent pale pink colour.

**Procedure:**

**(a) Preparation of 0.1N standard solution of oxalic acid:**

The quantity of oxalic acid required for the 250ml of the solution having a normality of 0.1N can be calculated as follows.

Equivalent weight of oxalic acid = Molecular weight/No of electrons lost by one molecule  
Equivalent weight of oxalic acid =  $126/2 = 63$

Strength = Normality x Equivalent weight

Strength =  $1/10 \times 63 = 6.3 \text{ g/l}$

For the preparation of 1 litre of N/10 oxalic acid solution amount of oxalic acid required = 6.3 g

1. Weigh an empty watch glass using a chemical balance.
2. Weigh 6.3g of oxalic acid accurately in the watch glass.
3. With the help of a funnel transfer the oxalic acid into the measuring flask.
4. Now wash the funnel with distilled water without removing the funnel from the flask.
5. Make the solution up to the marked point with distilled water and make sure the oxalic acid is fully dissolved.
6. This solution is 0.1N standard solution of oxalic acid.

**(b) Titration of potassium permanganate solution against standard oxalic acid solution:**

1. Rinse the burette with the potassium permanganate solution and fill the burette with potassium permanganate solution.
2. Fix the burette in the burette stand and place the white tile below the burette in order to find the end point correctly.
3. Pipette out 10ml of 0.1N standard oxalic acid solution in a conical flask.

- Add a test tube full of sulfuric acid in order to prevent oxidation of manganese to form manganese dioxide.
- Heat the mixture upto 60°C before titrating with potassium permanganate.
- Note down the initial reading in the burette before starting the titration.
- The hot solution is titrated against potassium permanganate solution and simultaneously swirl the solution in the flask gently.
- Initially the purple colour of KMnO<sub>4</sub> is discharged with oxalic acid. The appearance of permanent pink colour reveals the end point.
- Repeat the titration until concordant values are obtained.
- Note down the upper meniscus on the burette readings. Record the reading in the observation table given below in order to calculate the molarity of KMnO<sub>4</sub> given.

Observation:

| S.No | Volume of oxalic acid in ml | Burette Reading |          | Volume(V) of KMnO <sub>4</sub> used<br>V = (y-x)ml |
|------|-----------------------------|-----------------|----------|--|
|      |                             | Initial(x)      | Final(y) |  |
|      |                             |                 |          |  |
|      |                             |                 |          |  |
|      |                             |                 |          |  |
|      |                             |                 |          |  |
|      |                             |                 |          |  |

Calculations:

To calculate the strength of given KMnO<sub>4</sub> in terms of molarity the following formula is used

$$a_1M_1V_1 = a_2M_2V_2$$

Where a<sub>1</sub> and a<sub>2</sub> are stoichiometric coefficient of oxalic acid and KMnO<sub>4</sub> in a balanced chemical equation.

$$a_1 = 2$$

$$a_2 = 5$$

Where

M<sub>2</sub> and M<sub>1</sub> are molarities of potassium permanganate and oxalic acid solutions used in the titration.

V<sub>2</sub> and V<sub>1</sub> are the volume of potassium permanganate and oxalic acid solutions used in the titration.

Therefore,

$$\text{KMnO}_4 = \text{Oxalic acid}$$

$$5M_2V_2 = 2M_1V_1$$

$$M_2 = (2M_1V_1/5M_2V_2)$$

The strength of KMnO<sub>4</sub> is calculated by using the molarity.

$$\text{Strength} = \text{Molarity} \times \text{Molar mass}$$

Results and Discussion:

- Molarity of KMnO<sub>4</sub> is \_\_\_\_\_ M
- The Strength of KMnO<sub>4</sub> is \_\_\_\_\_ g/l.

**Precautions:**

1. Clean all the apparatus with distilled water before starting the experiment and then rinse with the solution to be taken in them.
2. Rinse the pipette and burette before use.
3. Potassium permanganate is dark in colour, so always read the upper meniscus.
4. Use dilute sulfuric acid for acidifying the potassium permanganate.
5. Take accurate readings once it reaches the end point and don't go with average readings.
6. Use antiparallex card or autoparallex card while taking the burette readings.
7. Do not use rubber cork burette as it is can be attacked by  $\text{KMnO}_4$ .
8. The strength of the unknown solution should be taken upto two decimal places only.



### EXPERIMENT-3

#### Aim:

To determine the strength of a given potassium permanganate solution against a standard ferrous ammonium sulfate (Mohr's salt) solution.

#### Theory:

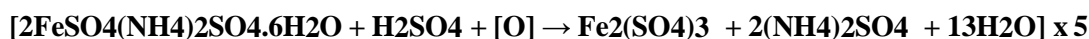
Potassium permanganate is a strong oxidant in the presence of sulfuric acid. Mohr salt is a double salt forming a single crystalline structure having the formula  $(\text{NH}_4)_2 \cdot \text{FeSO}_4 \cdot 6\text{H}_2\text{O}$ . The chemical name for Mohr's salt is ferrous ammonium sulfate.

In this titration Mohr salt acts as a reducing agent and potassium permanganate acts as an oxidising agent. So, the reaction between Mohr's salt and potassium permanganate is a redox reaction. In this redox reaction, ferrous ion from Mohr's salt gets oxidised and pink coloured of manganese present in potassium permanganate, which is in the +7 oxidation state gets reduced to colourless  $\text{Mn}^{2+}$  state.

The chemical reaction and the molecular chemical equation is given below. Reduction half reaction –



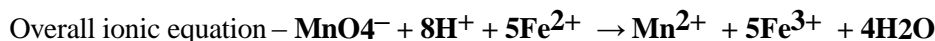
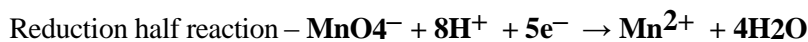
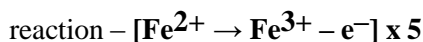
Oxidation half reaction –



Overall reaction –



The ionic equation involved in the process is given below. Oxidation half



This titration is based upon oxidation-reduction titrations. When ferrous ammonium sulfate solution is titrated against potassium permanganate in the presence of acidic medium by sulfuric acid. Acidic medium is necessary in order to prevent precipitation of manganese oxide. Here  $\text{KMnO}_4$  acts as a self indicator and this titration is called permanganate titration.

#### Materials Required:

1. Mohr's salt (ferrous ammonium sulfate)
2. Potassium permanganate solution
3. Dilute sulfuric acid
4. Chemical balance
5. Burette
6. Burette stand
7. Pipette
8. Conical flask
9. Funnel
10. Measuring flask
11. Weighing bottle
12. White tile
13. Burnet
14. Wire gauze
- 15.

Apparatus Setup:

1. In burette –  $\text{KMnO}_4$  solution
2. In Conical flask – 10ml of Ferrous Ammonium Sulfate (Mohr's salt) + Sulfuric acid
3. Indicator – Self indicator ( $\text{KMnO}_4$ )

4. End Point – Colourless to permanent pale pink colour.

**Procedure:**

**(a) Preparation of 0.05M standard solution of ferrous ammonium sulfate:**

The quantity of Mohr's salt required for the 250ml of the solution having a normality of 0.05N can be calculated as follows.

The molar mass of Mohr's salt = 392 g/mol

Strength = Normality x Equivalent weight  
= (1/20) x 392 = 19.6 g/L

For preparing 250ml of N/20 Mohr's salt solution, Mohr salt required  
= (19.6/1000) x 250 = 4.9 gm

1. Weigh an empty watch glass using a chemical balance.
2. Weigh accurately 4.9gm of Mohr's salt in a chemical balance.
3. With the help of a funnel transfer the Mohr's salt into the measuring flask.
4. Now wash the funnel with distilled water without removing the funnel from the flask.
5. Make the solution up to the marked point with distilled water and make sure the Mohr's salt is fully dissolved.
6. This solution is 0.05N standard solution of Mohr's salt.

**(b) Titration of potassium permanganate solution against standard ferrous ammonium sulfate (Mohr's salt) solution:**

1. Wash and rinse the burette and pipette with distilled water and then rinse with the corresponding solution to be filled in them.
2. Rinse the burette with the potassium permanganate solution and fill the burette with potassium permanganate solution.
3. Fix the burette in the burette stand and place the white tile below the burette in order to find the endpoint correctly.
4. Rinse the pipette and conical flask with standard ferrous sulfate solution.
5. Pipette out 10ml of 0.05N standard Mohr's salt solution into the conical flask.
6. Add a test tube full of sulfuric acid in order to prevent oxidation of manganese to form manganese dioxide.
7. Note down the initial reading in the burette before starting the titration.
8. Now start the titration, titrate against potassium permanganate solution and simultaneously swirl the solution in the flask gently.
9. Initially, the purple colour of  $\text{KMnO}_4$  is discharged with ferrous ammonium sulfate. The appearance of a permanent pink colour reveals the endpoint.
10. Repeat the titration until concordant values are obtained.
11. Note down the upper meniscus on the burette readings.
12. Record the reading in the observation table given below in order to calculate the molarity of  $\text{KMnO}_4$  given.

Observations:

| S.No | Volume of ferrous ammonium sulfate (Mohr's salt) used | Burette Reading |          | Volume (V) of $\text{KMnO}_4$ used<br><br>$V = (y-x)\text{ml}$ |
|------|---|-----------------|----------|--|
|      |   | Initial(x)      | Final(y) |  |
|      |   |                 |          |  |
|      |   |                 |          |  |
|      |   |                 |          |  |
|      |   |                 |          |  |
|      |   |                 |          |  |

### Calculations:

To calculate the strength of given  $\text{KMnO}_4$  in terms of molarity the following formula is used

$$a_1 M_1 V_1 = a_2 M_2 V_2$$

Where  $a_1$  and  $a_2$  are stoichiometric coefficient of **ferrous ammonium sulfate** and  $\text{KMnO}_4$  in a balanced chemical equation.

$$a_1 = 1$$

$$a_2 = 5$$

Where

$M_2$  and  $M_1$  are molarities of potassium permanganate and **ferrous ammonium sulfate** solutions used in the titration.

$V_2$  and  $V_1$  are the volume of potassium permanganate and **ferrous ammonium sulfate** solutions used in the titration.

Therefore,

$$\text{KMnO}_4 = \text{ferrous ammonium sulfate}$$

$$5M_2V_2 = 1M_1V_1$$

$$M_2 = (1M_1V_1/5M_2V_2)$$

The strength of  $\text{KMnO}_4$  is calculated by using the molarity.

$$\text{Strength} = \text{Molarity} \times \text{Molar mass}$$

### Results and Discussion:

1. Molarity of  $\text{KMnO}_4$  is \_\_\_\_\_ M
2. The Strength of  $\text{KMnO}_4$  is \_\_\_\_\_ g/l.

### Precautions:

1. Clean all the apparatus with distilled water before starting the experiment and then rinse with the solution to be taken in them.
2. Rinse the pipette and burette before use.
3. Potassium permanganate is dark in colour, so always read the upper meniscus.
4. Use dilute sulfuric acid for acidifying the potassium permanganate.
5. Take accurate readings once it reaches the end point and don't go with average readings.
6. Use antiparallex card or autoparallex card while taking the burette readings.
7. Do not use rubber cork burette as it is can be attacked by  $\text{KMnO}_4$ .
8. The strength of the unknown solution should be taken upto two decimal places only.

## EXPERIMENT-4

**Aim: To analyse the given salt for acidic and basic radicals.**

| Experiment   | Observations   | Inference  |
|--|--|--|
| <p><b>1. Physical examination :</b></p> <p>(a) Noted the colour of the given salt.</p> <p>(b) Noted the smell of the salt.</p> <p><b>2. Dry heating test</b></p> <p>Heated a pinch of the salt in a dry test tube and noted the following observations :</p> <p>(a) Gas evolved</p> <p>(b) Sublimation</p> <p>(c) Decrepitation</p> <p>(d) Fusion</p> <p>(e) Colour of the residue</p> | <p>White</p> <p>No specific odour</p> <p>A reddish brown gas evolved which turned freshly prepared FeSO<sub>4</sub> solution black.</p> <p>No sublimate formed.</p> <p>No crackling sound observed.</p> <p>Salt does not fuse. White</p> | <p>Cu<sup>2+</sup>, Fe<sup>2+</sup>, Fe<sup>3+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Co<sup>2+</sup> absent.</p> <p>NH<sub>4</sub><sup>+</sup>, S<sup>2-</sup> and CH<sub>3</sub>COO<sup>-</sup> may be absent.</p> <p>NO<sub>3</sub><sup>-</sup> may be present.</p> <p>Ammonium halides, aluminium chloride, iodide may be absent.</p> <p>Lead nitrate, barium nitrate, sodium chloride, potassium chloride and potassium iodide may be absent.</p> <p>Alkali (sodium, potassium) salts may be absent.</p> <p>Zn<sup>2+</sup>, Pb<sup>2+</sup> may be absent.</p> |

| Experiment  | Observations   | Inference  |
|---|--|--|
| <p><b>5. Flame test</b><br/>Prepared a paste of the salt in conc. HCl and performed flame test.</p> <p><b>6. Borax bead test</b><br/>Did not perform this test since the given salt was white.</p> <p><b>7. Dil. sulphuric acid test</b><br/>Treated a pinch of the salt with dil. H<sub>2</sub>SO<sub>4</sub> and warmed.</p> <p><b>8. KMnO<sub>4</sub> test</b><br/>To a pinch of the salt added dil. H<sub>2</sub>SO<sub>4</sub> warm and then a drop of KMnO<sub>4</sub> solution.</p> <p><b>9. Conc. sulphuric acid test</b><br/>Heated a pinch of the salt with conc. sulphuric acid and added to it a paper pellet.</p> <p><b>10. Confirmatory test for nitrate</b><br/>(a) Copper chips test. Heated a pinch of the salt with conc. sulphuric acid and a few copper chips.<br/>(b) Ring test. To 2–3 ml of the salt solution, added freshly prepared FeSO<sub>4</sub> solution. Now added conc. sulphuric acid along the sides of the test tube.</p> <p><b>11. Heated a pinch of salt with conc. NaOH solution</b></p> <p><b>12. Preparation of Original Solution (O.S.)</b><br/>Shook a pinch of the salt with water.</p> <p><b>13.</b> To a part of the O.S. added 1–2 mls of dilute hydrochloric acid.</p> <p><b>14.</b> Through a part of the above solution, passed H<sub>2</sub>S gas.</p> <p><b>15.</b> To the remaining solution, added a pinch of solid ammonium chloride. Boiled the solution, cooled it and added excess of ammonium hydroxide solution.</p> | <p>Persistent grassy green flame on prolonged heating.</p> <p>—</p> <p>No gas evolved.</p> <p>Pink colour of KMnO<sub>4</sub> was not discharged.</p> <p>A reddish brown gas evolved which turned FeSO<sub>4</sub> solution black.</p> <p>Reddish brown gas evolved.</p> <p>A dark brown ring formed at the junction of the two liquids.</p> <p>No ammonia gas evolved.</p> <p>Solution obtained No ppt. formed.</p> <p>No ppt. formed.</p> <p>No ppt. formed.</p> | <p>Ba<sup>2+</sup> present.</p> <p>Cu<sup>2+</sup>, Ni<sup>2+</sup>, Fe<sup>3+</sup>, Mn<sup>2+</sup>, Co<sup>2+</sup> may be absent.</p> <p>CO<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, NO<sub>2</sub><sup>-</sup>, SO<sub>3</sub><sup>2-</sup> may be absent.</p> <p>Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup>, CO<sub>3</sub><sup>2-</sup>, Fe<sup>2+</sup> may be absent.</p> <p>NO<sub>3</sub><sup>-</sup> may be present.</p> <p>NO<sub>3</sub><sup>-</sup> confirmed.</p> <p>NO<sub>3</sub><sup>-</sup> confirmed.</p> <p>NH<sub>4</sub><sup>+</sup> absent.</p> <p>Labelled it as Original Solution (O.S.)<br/>Group I absent. (Pb<sup>2+</sup> absent)</p> <p>Group II absent (Pb<sup>2+</sup>, Cu<sup>2+</sup>, As<sup>3+</sup>, absent)</p> <p>Group III absent. (Fe<sup>3+</sup>, Al<sup>3+</sup> absent)</p> |

| Experiment   | Observations  | Inference  |
|--|---|--|
| 16. Through a part of this solution, passed H <sub>2</sub> S gas.  | No ppt. formed.                                     | Group IV absent.<br>(Zn <sup>2+</sup> , Mn <sup>2+</sup> , Ni <sup>2+</sup> , Co <sup>2+</sup> , absent) |
| 17. To the remaining ammonical solution added ammonium carbonate solution.   | White ppt. formed.                                  | Group V present.<br>(Ca <sup>2+</sup> , Ba <sup>2+</sup> , Sr <sup>2+</sup> may be present)              |
| <b>18. Confirmatory test for Barium</b><br>Filtered the above white ppt. Dissolved the ppt. in hot dilute acetic acid. | Yellow ppt.   | Ba <sup>2+</sup> confirmed.  |
| (a) Pot. chromate test. To one part of the above solution, added a few drops of pot. chromate solution.                | Persistent grassy green flame on prolonged heating. | Ba <sup>2+</sup> confirmed.  |
| (b) Flame test. Performed flame test with the salt.  |   |  |

**Result.** Acid radical: NO<sub>3</sub><sup>-</sup>

Basic radical: Ba<sup>2+</sup>.

Experiment- 5

To analyse the given salt for acidic and basic radicals.

| Experiment   | Observations   | Inference  |
|--|--|--|
| <p><b>1. Physical examination</b></p> <p>(a) Noted the colour of the given salt.</p> <p>(b) Noted the smell of the salt.</p> <p><b>2. Dry heating test</b></p> <p>Heated a pinch of the salt in a dry test tube and noted the following :</p> <p>(a) Gas evolved</p> <p>(b) Sublimation</p> <p>(c) Decrepitation</p> <p>(d) Colour of the residue</p> <p><b>3. Flame test</b></p> <p>Prepared a paste of the salt in conc. HCl and performed flame test.</p> <p><b>4. Borax bead test</b></p> <p>Did not perform this test since the given salt was white.</p> <p><b>5. Dil. Sulphuric acid test</b></p> <p>Treated a pinch of the salt with dil. H<sub>2</sub>SO<sub>4</sub> and warmed.</p> <p>Shook a pinch of salt with water taken in test tube.</p> <p><b>6. KMnO<sub>4</sub> test</b></p> <p>To a pinch of the salt added dilute H<sub>2</sub>SO<sub>4</sub> warm and then a drop of KMnO<sub>4</sub> solution.</p> <p><b>7. Conc. Sulphuric acid test</b></p> <p>Did not perform this test because the salt reacted with dil. H<sub>2</sub>SO<sub>4</sub>.</p> <p><b>8. Confirmatory tests</b></p> | <p>White</p> <p>No specific odour</p> <p>A colourless, odourless gas evolved which turned lime water milky.</p> <p>No sublimate formed.</p> <p>No crackling sound observed.</p> <p>Yellow when hot and white when cold.</p> <p>Green flashes seen with naked eye.</p> <p>—</p> <p>Colourless, odourless gas evolved with brisk effervescence, turned lime water milky.</p> <p>Salt did not dissolve.</p> <p>Pink colour of KMnO<sub>4</sub> was not discharged.</p> <p>—</p> <p>Salt did not dissolve.</p> <p>Brisk effervescence with evolution of colourless, odourless gas which turned lime water milky.</p> | <p>Cu<sup>2+</sup>, Fe<sup>3+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Co<sup>2+</sup> absent.</p> <p>NH<sub>4</sub><sup>+</sup>, S<sup>2-</sup> and CH<sub>3</sub>COO<sup>-</sup> may be absent.</p> <p>CO<sub>3</sub><sup>2-</sup> may be present.</p> <p>Ammonium halides, iodide may be absent.</p> <p>Lead nitrate, barium nitrate, sodium chloride, potassium chloride and potassium iodide may be absent.</p> <p>Zn<sup>2+</sup> may be present.</p> <p>Zn<sup>2+</sup> may be present.</p> <p>Cu<sup>2+</sup>, Ni<sup>2+</sup>, Fe<sup>2+</sup>, Fe<sup>3+</sup>, Mn<sup>2+</sup>, Co<sup>2+</sup> may be absent.</p> <p>CO<sub>3</sub><sup>2-</sup> present</p> <p>Insoluble CO<sub>3</sub><sup>2-</sup> indicated.</p> <p>Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup>, Fe<sup>2+</sup>, CO<sub>3</sub><sup>2-</sup> are absent.</p> <p>Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, C<sub>2</sub>O<sub>4</sub><sup>2-</sup> are absent.</p> |





- (a) Shook a pinch of the salt with water.
- (b) To the salt added dil. HCl.

**11. Heated a pinch of salt with conc. NaOH solution**

No ammonia gas evolved.

Insoluble carbonate indicated.

Insoluble carbonate confirmed.

$\text{NH}_4^+$  absent.

| Experiment  | Observations   | Inference   |
|---|--|---|
| <p><b>12. Preparation of Original solution (O.S.)</b></p> <p>(a) Shook a pinch of the salt with water.</p> <p>(b) Shook a pinch of the salt in dil. HCl.</p> <p>13. As the O.S. is prepared in dil. HCl.</p> <p>14. Through a part of O.S. passed H<sub>2</sub>S gas.</p> <p>15. To the remaining solution, added a pinch of solid ammonium chloride. Boiled the solution, cooled it and added excess of ammonium hydroxide solution.</p> <p>16. Through a part of this solution, passed H<sub>2</sub>S gas.</p> <p><b>17. Confirmatory tests for Zn<sup>2+</sup> ion</b></p> <p>Dissolved the above dull white ppt. in dil HCl. Boiled off H<sub>2</sub>S.</p> <p>Divided the solution into two parts.</p> <p>(a) To one part added NaOH solution dropwise.</p> <p>(b) To another part, added potassium ferrocyanide solution.</p> | <p>Insoluble</p> <p>Clear solution obtained.</p> <p>No ppt. formed.</p> <p>No ppt. formed</p> <p>Dull white ppt. formed.</p> <p>White ppt. soluble in excess of NaOH.</p> <p>Bluish white ppt.</p> | <p>Labelled it as O.S.</p> <p>Group I absent. (Pb<sup>2+</sup> absent)</p> <p>Group II absent (Pb<sup>2+</sup>, Hg<sup>2+</sup>, Cu<sup>2+</sup>, As<sup>3+</sup> absent).</p> <p>Group III absent. (Fe<sup>3+</sup>, Al<sup>3+</sup> absent).</p> <p>Group IV present. (Zn<sup>2+</sup> present)</p> <p>Zn<sup>2+</sup> confirmed.</p> <p>Zn<sup>2+</sup> confirmed.</p> |

**Result.** Acid Radical : CO<sub>3</sub><sup>2-</sup>

Basic Radical : Zn<sup>2+</sup>.

## EXPERIMENT-6

**Aim:**To analyse the given salt for acidic and basic radicals.

| Experiment   | Observations   | Inference  |
|--|--|--|
| <p><b>1. Physical examination :</b></p> <p>(c) Noted the colour of the given salt.</p> <p>(d) Noted the smell of the salt.</p> <p><b>2. Dry heating test</b></p> <p>Heated a pinch of the salt in a dry test tube and noted the following observations :</p> <p>(f) Gas evolved</p> <p>(g) Sublimation</p> <p>(h) Decrepitation</p> <p>(i) Fusion</p> <p>(j) Colour of the residue</p> | <p>White</p> <p>No specific odour</p> <p>A reddish brown gas evolved which turned freshly prepared FeSO<sub>4</sub> solution black.</p> <p>No sublimate formed.</p> <p>No crackling sound observed.</p> <p>Salt does not fuse. White</p> | <p>Cu<sup>2+</sup>, Fe<sup>2+</sup>, Fe<sup>3+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Co<sup>2+</sup> absent.</p> <p>NH<sub>4</sub><sup>+</sup>, S<sup>2-</sup> and CH<sub>3</sub>COO<sup>-</sup> may be absent.</p> <p>NO<sub>3</sub><sup>-</sup> may be present.</p> <p>Ammonium halides, aluminium chloride, iodide may be absent.</p> <p>Lead nitrate, barium nitrate, sodium chloride, potassium chloride and potassium iodide may be absent.</p> <p>Alkali (sodium, potassium) salts may be absent.</p> <p>Zn<sup>2+</sup>, Pb<sup>2+</sup> may be absent.</p> |

| Experiment  | Observations   | Inference   |
|---|--|---|
| <p><b>11. Flame test</b><br/>Prepared a paste of the salt in conc. HCl and performed flame test.</p>  | Persistent grassy green flame on prolonged heating.          | Ba <sup>2+</sup> present.   |
| <p><b>12. Borax bead test</b><br/>Did not perform this test since the given salt was white.</p>   | —  | Cu <sup>2+</sup> , Ni <sup>2+</sup> , Fe <sup>3+</sup> , Mn <sup>2+</sup> , Co <sup>2+</sup> may be absent.                   |
| <p><b>13. Dil. sulphuric acid test</b><br/>Treated a pinch of the salt with dil. H<sub>2</sub>SO<sub>4</sub> and warmed.</p>  | No gas evolved.  | CO <sub>3</sub> <sup>2-</sup> , S <sup>2-</sup> , NO <sub>2</sub> <sup>-</sup> , SO <sub>3</sub> <sup>2-</sup> may be absent. |
| <p><b>14. KMnO<sub>4</sub> test</b><br/>To a pinch of the salt added dil. H<sub>2</sub>SO<sub>4</sub> warm and then a drop of KMnO<sub>4</sub> solution.</p>  | Pink colour of KMnO <sub>4</sub> was not discharged.         | Cl <sup>-</sup> , Br <sup>-</sup> , I <sup>-</sup> , C O <sub>2</sub> <sup>2-</sup> , Fe <sup>2+</sup> may be absent.         |
| <p><b>15. Conc. sulphuric acid test</b><br/>Heated a pinch of the salt with conc. sulphuric acid and added to it a paper pellet.</p>  | Reddish brown gas evolved.                                   | NO <sub>3</sub> <sup>-</sup> may be present.  |
| <p><b>16. Confirmatory test for nitrate</b><br/>(c) Copper chips test. Heated a pinch of the salt with conc. sulphuric acid and a few copper chips.<br/>(d) Ring test. To 2–3 ml of the salt solution, added freshly pre- pared FeSO<sub>4</sub> solution. Now added conc. sulphuric acid along the sides of the test tube.</p> | A dark brown ring formed at the junction of the two liquids. | NO <sub>3</sub> <sup>-</sup> confirmed.   |
| <p><b>16. Heated a pinch of salt with conc. NaOH solution</b></p>   | No ammonia gasevolved.                                       | NO <sub>3</sub> <sup>-</sup> confirmed.   |
| <p><b>17. Preparation of Original Solution (O.S.)</b><br/>Shook a pinch of the salt with water.</p>   | Solution obtained ppt. formed.                               | NH <sub>4</sub> <sup>+</sup> absent.  |
| <p><b>18. Confirmatory test for Barium</b><br/>Add KI in original Solution</p>  | Yellow ppt formed  | Labelled it as Original Solution (O.S.)<br>Group I absent. (Pb <sup>2+</sup> present)<br><br>Pb <sup>2+</sup> conformed       |

**Result.** Acid radical: NO<sub>3</sub><sup>-</sup>

Basic radical: Pb<sup>2+</sup>.

Experiment-7

To analyse the given salt for acidic and basic radicals.

| Experiment  | Observations  | Inference  |
|---|---|--|
| <p><b>1. Physical examination</b></p> <p>(a) Noted the colour of the given salt.</p> <p>(b) Noted the smell of the salt.</p> <p><b>2. Dry heating test</b></p> <p>Heated a pinch of the salt in a dry test tube and noted the following :</p> <p>(a) Gas evolved</p> <p>(b) Sublimation</p> <p>(c) Decrepitation</p> <p>(d) Colour of the residue</p> <p><b>3. Flame test</b></p> <p>Prepared a paste of the salt in conc. HCl and performed flame test.</p> <p><b>4. Borax bead test</b></p> <p>Did not perform this test since the given salt was white.</p> <p><b>5. Dil. Sulphuric acid test</b></p> <p>Treated a pinch of the salt with dil. H<sub>2</sub>SO<sub>4</sub> and warmed.</p> <p><b>6. Conc. Sulphuric acid test</b></p> <p>Did not perform this test because the salt reacted with dil. H<sub>2</sub>SO<sub>4</sub>.</p> <p><b>7. Confirmatory tests for carbonate</b></p> <p><b>8. Silver nitrate test</b> Acidify a portion of</p> | <p>White</p> <p>No specific odour</p> <p>A colourless, odourless gas evolved</p> <p>No sublimate formed.</p> <p>No crackling sound observed.</p> <p>Yellow when hot and white when cold.</p> <p>White Flame observed with naked eye.</p> <p>—</p> <p>Colourless, odourless gas evolved</p> <p>—</p> <p>A white ppt. is formed which is soluble in ammonium hydroxide.</p> | <p>Cu<sup>2+</sup>, Fe<sup>3+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Co<sup>2+</sup> absent.</p> <p>NH<sub>4</sub><sup>+</sup>, S<sup>2-</sup> and CH<sub>3</sub>COO<sup>-</sup> may be absent.</p> <p>Cl<sup>-</sup> may be present.</p> <p>Ammonium halides, iodide may be absent.</p> <p>Lead nitrate, barium nitrate, sodium chloride, potassium chloride and potassium iodide may be absent.</p> <p>Zn<sup>2+</sup> may be present.</p> <p>Pb<sup>2+</sup> may be present.</p> <p>Cu<sup>2+</sup>, Ni<sup>2+</sup>, Fe<sup>2+</sup>, Fe<sup>3+</sup>, Mn<sup>2+</sup>, Co<sup>2+</sup> may be absent.</p> <p>Cl<sup>-</sup></p> <p>present</p> <p>Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, C<sub>2</sub>O<sub>4</sub><sup>2-</sup> are absent.</p> |

aqueous solution  
(or sodium  
carbonate extract)  
with dil. HNO<sub>3</sub>. Boil  
for some time, cool  
and add silver  
nitrate solution.

**9. Manganese dioxide**  
**test** Heat a pinch of the  
salt with a small  
quantity of  
manganese dioxide  
and

Evolution of **greenish  
yellow gas** having a  
pungent irritating  
smell. It turns moist  
starch-

Cl<sup>-</sup> is Confirmed

Cl<sup>-</sup> is Confirmed

|  |  |                                   |
|--|--|-----------------------------------|
| <p>conc. <math>H_2SO_4</math>.</p> <p><b>10. Heated a pinch of salt with conc. NaOH solution</b></p> | <p>iodide paper blue.</p> <p>No ammonia gas evolved.</p> | <p><math>NH_4^+</math> absent</p> |
|--|--|-----------------------------------|

| Experiment  | Observations  | Inference   |
|---|---|---|
| <p><b>12. Preparation of Original solution (O.S.)</b></p> <p>(a) Shook a pinch of the salt with water.</p> <p>(b) Shook a pinch of the salt in dil. HCl.</p> <p>13. As the O.S. is prepared in dil. HCl.</p> <p><b>17. Confirmatory tests for <math>Pb^{2+}</math> ion</b></p> <p>Add KI in original Solution</p> | <p>Insoluble</p> <p>Clear solution obtained.</p> <p>ppt. formed.</p> <p>Yellow ppt formed</p> | <p>Labelled it as O.S.</p> <p>Group I present. (<math>Pb^{2+}</math> present)</p> <p><math>Pb^{2+}</math> conformed</p> |

**Result.** Acid Radical :  $Cl^-$

Basic Radical :  $Pb^{2+}$ .

### Experiment- 8

**Aim To analyses the given salt for one anion and one cation present in it.**

| Sl. No. | Experiment  | Observation  | Inference   |
|---------|---|--|---|
| 1.      | Noted the colour of the salt.   | White  | $\text{Cu}^{2+}$ , $\text{Fe}^{2+}$ , $\text{Ni}^{2+}$ , $\text{Co}^{2+}$ , $\text{Mn}^{2+}$ are absent.  |
| 2.      | Noted the smell of the salt.  | No specific smell.   | $\text{S}^{2-}$ , $\text{SO}_3^{2-}$ , $\text{CH}_3\text{COO}^-$ may be absent.   |
| 3.      | Heated 0.5 g of the salt in a dry test tube and noted the colour of the gas evolved and change in the colour of the residue on heating and cooling. | (i) No gas was evolved.<br><br>(ii) No particular change in colour of the residue is observed when heated and when cooled. | (i) $\text{CO}_3^{2-}$ may be present, $\text{NO}_3^-$ , $\text{NO}_2^-$ , $\text{Br}^-$ may be absent.<br>(ii) $\text{Zn}^{2+}$ may be absent. |
| 4.      | Prepared a paste of the salt with conc. HCl and performed the flame test.   | No distinct colour of the flame seen.  | $\text{Ca}^{2+}$ , $\text{Sr}^{2+}$ , $\text{Ba}^{2+}$ , $\text{Cu}^{2+}$ may be absent.  |
| 5.      | Borax bead test was not performed as the salt was white in colour.  | —  | —   |
| 6.      | Treated 0.1 g of salt with 1 mL dil. $\text{H}_2\text{SO}_4$ and warmed.  | No effervescence and evolution of vapours.   | $\text{CO}_3^{2-}$ , $\text{SO}_3^{2-}$ , $\text{S}^{2-}$ , $\text{NO}_2^-$ , $\text{CH}_3\text{COO}^-$ absent.                                 |
| 7.      | Heated 0.1 g of salt with 1 mL conc. $\text{H}_2\text{SO}_4$ .  | No gas evolved.  | $\text{Cl}^-$ , $\text{Br}^-$ , $\text{I}^-$ , $\text{NO}_3^-$ , $\text{C}_2\text{O}_4^{2-}$ are absent.  |
| 8.      | Acidified 1 mL of aqueous salt solution with conc. $\text{HNO}_3$ . Warmed the contents   | No yellow precipitate  | $\text{PO}_4^{3-}$ absent.  |



|     |  |  |  |
|-----|--|--|--|
| 9.  | Acidified water extract of the salt with dil. HCl and then added 2mL of BaCl <sub>2</sub> solution.  | A white ppt. is obtained which is insoluble in conc. HNO <sub>3</sub> and conc. HCl. | SO <sub>4</sub> <sup>2-</sup> present. |
| 10. | Heated 0.1 g of salt with 2mL NaOH solution.   | Ammonia gas is not evolved.  | NH <sub>4</sub> <sup>+</sup> absent.   |
| 11. | Attempted to prepare original solution of the salt by dissolving 1g of it in 20 mL water.  | Clear solution formed  | Water soluble salt is present.         |
| 12. | To a small part of the above salt solution added 2 mL of dil. HCl.   | No white precipitate formed.   | Group-I absent.                        |
| 13. | Passed H <sub>2</sub> S gas through one portion of the solution of step 12.  | No precipitate formed.   | Group-II absent.                       |
| 14. | Since salt is white, heating with conc. HNO <sub>3</sub> is not required. Added about 0.2 g of solid ammonium chloride and then added excess of ammonium hydroxide to the solution of step 12. | No precipitate formed.   | Group-III absent.                      |
| 15. | Passed H <sub>2</sub> S gas through the above solution.  | No precipitate formed.   | Group-IV absent.                       |
| 16. | Added excess of ammonium hydroxide solution to the original solution and then added 0.5 g of ammonium carbonate.   | No precipitate formed.   | Group-V absent.                        |
| 17. | To the original solution of salt added ammonium hydroxide solution, followed by disodium hydrogen phosphate solution. Heated and scratched the sides of the test tube.                         | White precipitate.   | Mg <sup>2+</sup> confirmed.            |

Result

The given salt contains:

**Result.** Acid Radical : SO<sub>4</sub><sup>2-</sup>

Basic Radical : Mg<sup>2+</sup>.

### Experiment-9

**Aim To analyses the given salt for one anion and one cation present in it.**

| Sl. No. | Experiment  | Observation  | Inference   |
|---------|---|--|---|
| 1.      | Noted the colour of the salt.   | White  | $\text{Cu}^{2+}$ , $\text{Fe}^{2+}$ , $\text{Ni}^{2+}$ , $\text{Co}^{2+}$ , $\text{Mn}^{2+}$ are absent.                        |
| 2.      | Noted the smell of the salt.  | No specific smell.   | $\text{S}^{2-}$ , $\text{SO}_3^{2-}$ , $\text{CH}_3\text{COO}^-$ may be absent.   |
| 3.      | Heated 0.5 g of the salt in a dry test tube and noted the colour of the gas evolved and change in the colour of the residue on heating and cooling. | (i) No gas was evolved.<br><br>(ii) No particular change in colour of the residue is observed when heated and when cooled. | (iii) $\text{CO}_3^{2-}$ may be present, $\text{NO}_3^-$ , $\text{Br}^-$ may be absent.<br>(iv) $\text{Zn}^{2+}$ may be absent. |
| 4.      | Prepared a paste of the salt with conc. HCl and performed the flame test.   | Green colour of the flame seen.  | $\text{Ba}^{2+}$ may be present.  |
| 5.      | Borax bead test was not performed as the salt was white in colour.  | —  | —   |
| 6.      | Treated 0.1 g of salt with 1 mL dil. $\text{H}_2\text{SO}_4$ and warmed.  | No effervescence and evolution of vapours.   | $\text{CO}_3^{2-}$ , $\text{SO}_3^{2-}$ , $\text{S}^{2-}$ , $\text{NO}_3^-$ , $\text{CH}_3\text{COO}^-$ absent.                 |
| 7.      | Heated 0.1 g of salt with 1 mL conc. $\text{H}_2\text{SO}_4$ .  | No gas evolved.  | $\text{Cl}^-$ , $\text{Br}^-$ , $\text{I}^-$ , $\text{NO}_3^-$ , $\text{C}_2\text{O}_4^{2-}$ are absent.                        |
| 8.      | Acidified 1 mL of aqueous salt solution with conc. $\text{HNO}_3$ . Warmed the contents   | No yellow precipitate  | $\text{PO}_4^{3-}$ absent.  |

|     |  |  |  |
|-----|--|--|--|
| 9.  | Acidified water extract of the salt with dil. HCl and then added 2mL of BaCl <sub>2</sub> solution.  | A white ppt. is obtained which is insoluble in conc. HNO <sub>3</sub> and conc. HCl. | SO <sub>4</sub> <sup>2-</sup> present. |
| 10. | Heated 0.1 g of salt with 2 mL NaOH solution.  | Ammonia gas is not evolved.  | NH <sub>4</sub> <sup>+</sup> absent.   |
| 11. | Attempted to prepare original solution of the salt by dissolving 1g of it in 20 mL water.  | Clear solution formed  | Water soluble salt is present.         |
| 12. | To a small part of the above salt solution added 2 mL of dil. HCl.   | No white precipitate formed.   | Group-I absent.                        |
| 13. | Passed H <sub>2</sub> S gas through one portion of the solution of step 12.  | No precipitate formed.   | Group-II absent.                       |
| 14. | Since salt is white, heating with conc. HNO <sub>3</sub> is not required. Added about 0.2 g of solid ammonium chloride and then added excess of ammonium hydroxide to the solution of step 12. | No precipitate formed.   | Group-III absent.                      |
| 15. | Passed H <sub>2</sub> S gas through the above solution.  | No precipitate formed.   | Group-IV absent.                       |
| 16. | Added excess of ammonium hydroxide solution to the original solution and then added 0.5 g of ammonium carbonate.   | No precipitate formed.   | Group-V present.                       |
| 17. | <b>Confirmatory test for Barium</b>  |  |  |
|     | (a) Pot. chromate test. To one part of the above solution, added a few drops of pot. chromate solution.  | Yellow ppt.  | Ba <sup>2+</sup> conformed             |
|     | (b) Flame test. Performed flame test with the salt.  | Persistent grassy green flame on prolonged heating.                                  | Ba <sup>2+</sup> conformed             |

Result

The given salt contains:

Acid Radical : SO<sub>4</sub><sup>2-</sup> Basic Radical

: Ba<sup>2+</sup>.



## EXPERIMENT-10

**Aim: To analyse the given salt for acidic and basic radicals.**

| Experiment   | Observations   | Inference   |
|--|--|---|
| <p><b>1. Physical examination :</b></p> <p>(e) Noted the colour of the given salt.</p> <p>(f) Noted the smell of the salt.</p> <p><b>2. Dry heating test</b></p> <p>Heated a pinch of the salt in a dry test tube and noted the following observations :</p> <p>(k) Gas evolved</p> <p>(l) Sublimation</p> <p>(m) Decrepitation</p> <p>(n) Fusion</p> <p>(o) Colour of the residue</p> | <p>White</p> <p>No specific odour</p> <p>A reddish brown gas evolved which turned freshly prepared FeSO<sub>4</sub> solution black.</p> <p>No sublimate formed.</p> <p>No crackling sound observed.</p> <p>Salt does not fuse. White</p> | <p>Cu<sup>2+</sup>, Fe<sup>2+</sup>, Fe<sup>3+</sup>, Ni<sup>2+</sup>, Mn<sup>2+</sup>, Co<sup>2+</sup> absent.</p> <p>NH<sub>4</sub><sup>+</sup>, S<sup>2-</sup> and CH<sub>3</sub>COO<sup>-</sup> may be absent.</p> <p>NO<sub>3</sub><sup>-</sup> may be present.</p> <p>Ammonium halides, aluminium chloride, iodide maybe absent.</p> <p>Lead nitrate, barium nitrate, sodium chloride, potassium chloride and potassium iodide may be absent.</p> <p>Alkali (sodium, potassium) salts may be absent.</p> <p>Zn<sup>2+</sup>, Pb<sup>2+</sup> may be absent.</p> |

| Experiment  | Observations   | Inference   |
|---|--|---|
| <p><b>17. Flame test</b><br/>Prepared a paste of the salt in conc. HCl and performed flame test.</p>  | Red flame on prolonged heating.                              | Sr <sup>2+</sup> present.   |
| <p><b>18. Borax bead test</b><br/>Did not perform this test since the given salt was white.</p>   | —  | Cu <sup>2+</sup> , Ni <sup>2+</sup> , Fe <sup>3+</sup> , Mn <sup>2+</sup> , Co <sup>2+</sup> may be absent.                   |
| <p><b>19. Dil. sulphuric acid test</b><br/>Treated a pinch of the salt with dil. H<sub>2</sub>SO<sub>4</sub> and warmed.</p>  | No gas evolved.  | CO <sub>3</sub> <sup>2-</sup> , S <sup>2-</sup> , NO <sub>2</sub> <sup>-</sup> , SO <sub>3</sub> <sup>2-</sup> may be absent. |
| <p><b>20. KMnO<sub>4</sub> test</b><br/>To a pinch of the salt added dil. H<sub>2</sub>SO<sub>4</sub> warm and then a drop of KMnO<sub>4</sub> solution.</p>  | Pink colour of KMnO <sub>4</sub> was not discharged.         | Cl <sup>-</sup> , Br <sup>-</sup> , I <sup>-</sup> , CO <sub>3</sub> <sup>2-</sup> , Fe <sup>2+</sup> may be absent.          |
| <p><b>21. Conc. sulphuric acid test</b><br/>Heated a pinch of the salt with conc. sulphuric acid and added to it a paper pellet.</p>  | Reddish brown gas evolved.                                   | NO <sub>3</sub> <sup>-</sup> may be present.  |
| <p><b>22. Confirmatory test for nitrate</b><br/>(e) Copper chips test. Heated a pinch of the salt with conc. sulphuric acid and a few copper chips.<br/>(f) Ring test. To 2–3 ml of the salt solution, added freshly prepared FeSO<sub>4</sub> solution. Now added conc. sulphuric acid along the sides of the test tube.</p> | A dark brown ring formed at the junction of the two liquids. | NO <sub>3</sub> <sup>-</sup> confirmed.   |
| <p><b>18. Heated a pinch of salt with conc. NaOH solution</b></p>   | No ammonia gas evolved.                                      | NO <sub>3</sub> <sup>-</sup> confirmed.   |
| <p><b>19. Preparation of Original Solution (O.S.)</b><br/>Shook a pinch of the salt with water.</p>   | Solution obtained  | NH <sub>4</sub> <sup>+</sup> absent.  |
| <p><b>20.</b> To a part of the O.S. added 1–2 mls of dilute hydrochloric acid.</p>  | No ppt. formed.  | Labelled it as Original Solution (O.S.)<br>Group I absent. (Pb <sup>2+</sup> absent)  |
| <p><b>21.</b> Through a part of the above solution, passed H<sub>2</sub>S gas.</p>  | No ppt. formed.  | Group II absent (Pb <sup>2+</sup> , Cu <sup>2+</sup> , As <sup>3+</sup> , absent)   |
| <p><b>22.</b> To the remaining solution, added a pinch of solid ammonium chloride. Boiled the solution, cooled it and added excess of ammonium hydroxide solution.</p>  |  | Group III absent. (Fe <sup>3+</sup> , Al <sup>3+</sup> absent)  |

| Experiment   | Observations   | Inference   |
|--|--|---|
| <p>16. Through a part of this solution, passed H<sub>2</sub>S gas.</p> <p>17. To the remaining ammonical solution added ammonium carbonate solution.</p> <p><b>18. Confirmatory test for</b></p> <p><b>1. Amm. sulphate test</b><br/>To the second part of the solution, add 1 ml of amm. sulphate solution and warm.</p> <p><b>2. Flame test</b><br/>Perform the flame test with the original salt.</p> | <p>No ppt. formed.</p> <p>White ppt. formed.</p> <p><b>White ppt.</b></p> <p><b>Crimson red flame.</b></p> | <p>Group IV absent.<br/>(Zn<sup>2+</sup>, Mn<sup>2+</sup>, Ni<sup>2+</sup>, Co<sup>2+</sup>, absent)</p> <p>Group V present.<br/>(Ca<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup> may be present)</p> <p>Sr<sup>2+</sup> confirmed.</p> <p>Sr<sup>2+</sup> confirmed.</p> |

**Result.** Acid radical: NO<sub>3</sub><sup>-</sup>

Basic radical: Sr<sup>2+</sup>.

### EXPERIMENT- 11A

**To identify the functional group present in the given organic compound.**

| Experiment  | Observations  | Inference  |
|---|---|--|
| <p>1. <b>Test for unsaturation</b> Dissolved 0.2 ml of organic compound in 2 ml CCl<sub>4</sub>. Then added bromine-water dropwise.</p> <p>2. <b>Test for carboxylic group</b> Added a pinch of NaHCO<sub>3</sub> to 0.2 ml of organic compound in a test tube.</p> <p>3. <b>Test for phenolic group</b><br/>Added 0.2 ml of organic compound to 2–3 ml neutral FeCl<sub>3</sub> solution in a test tube.</p> <p>4. <b>Test for alcoholic group</b> Added a small piece of sodium to 1 ml of the given liquid in a dry test tube.</p> <p>5. <b>Test for carbonyl group</b><br/>Shook 0.2 ml of organic compound with 2–3 ml of 2, 3-dinitrophenylhydrazine in a test tube.</p> <p>6. <b>Test for aldehydic group</b> Warmed 1 ml of organic compound with 1 ml of Tollen's reagent in a test tube over a water bath.</p> <p>7. <b>Test for amine group</b><br/>To a small amount of organic liquid in test tube, added 1 ml conc. of HCl and a few drops of CHCl<sub>3</sub>. Then, added 2 ml of alc. KOH solution and warmed test tube.</p> | <p>Brown colour of bromine not discharged.</p> <p>No effervescence.</p> <p>No green or violet colour obtained.</p> <p>No effervescence.</p> <p>Orange-yellow ppt. formed.</p> <p>Silver mirror formed on inner side of the test tube.</p> <p>No offensive smelling gas evolved.</p> | <p>No unsaturation is present.</p> <p>Carboxylic group is absent. Phenolic group is absent. Alcoholic group is absent.</p> <p>Carbonyl group is present. Maybe an aldehyde or a ketone.</p> <p>Aldehyde is present.</p> <p>Amino group absent.</p> |

RESULT : - Aldehyde group (—CHO).

## EXPERIMENT - 11B

**To identify the functional group present in the given organic compound.**

| Experiment   | Observations   | Inference   |
|--|--|---|
| <p><b>1. Test for unsaturation</b> Dissolved 0.2 ml of organic compound in 2ml CCl<sub>4</sub>. Then added bromine-water dropwise.</p> <p><b>2. Test for carboxylic group</b> Added a pinch of NaHCO<sub>3</sub> to 0.2 ml of organic compound in a test tube.</p> <p><b>3. Test for phenolic group</b><br/>Added 0.2 ml of organic compound to 2–3 ml neutral FeCl<sub>3</sub> solution in a test tube.</p> <p><b>4. Test for alcoholic group</b> Added a small piece of sodium to 1 ml of the given liquid in a dry test tube.</p> <p><b>5. Test for carbonyl group</b><br/>Shook 0.2 ml of organic compound with 2–3 ml of 2, 3-dinitrophenylhydrazine in a test tube.</p> <p><b>6. Test for aldehydic group</b> Warmed 1 ml of organic compound with 1ml of Tollen's reagent in a test tube over a water bath.</p> <p><b>7. Test for amine group</b><br/>To a small amount of organic liquid in test tube, added 1 ml conc. of HCl and a few drops of CHCl<sub>3</sub>. Then, added 2 ml of alc. KOH solution and warmed test tube.</p> <p><b>8. TESTS FOR KETONES</b></p> <p>Place 0.5 ml of the given liquid (or 0.5 g of solid) in a clean test tube and add about 0.1 g of finely powdered m-dinitrobenzene. Now add about 1 ml of dilute sodium hydroxide solution and shake.</p> | <p>Brown colour of bromine not discharged.</p> <p>No effervescence.</p> <p>No green or violet colour obtained.</p> <p>No effervescence.</p> <p>Orange-yellow ppt. formed.</p> <p>Silver mirror formed on inner side of the test tube.</p> <p>No offensive smelling gas evolved.</p> <p><b>Appearance of violet colour which slowly fades</b></p> | <p>No unsaturation is present.</p> <p>Carboxylic group is absent. Phenolic group is absent. Alcoholic group is absent.</p> <p>Carbonyl group is present. May be an aldehyde or ketone.</p> <p>Aldehyde is present.</p> <p>Amino group absent.</p> <p><b>confirms ketonic group.</b></p> |

RESULT : - Ketone (-CO-)



### EXPERIMENT-11 C

**To identify the functional group present in the given organic compound.**

| Experiment   | Observations                            | Inference   |
|--|---|---|
| 4. <b>Test for unsaturation</b> Dissolved 0.2 ml of organic compound in 2ml CCl <sub>4</sub> . Then added bromine-water dropwise.  | Brown colour of bromine not discharged. | No unsaturation is present.                               |
| 5. <b>Test for carboxylic group</b> Added a pinch of NaHCO <sub>3</sub> to 0.2 ml of organic compound in a test tube.  | No effervescence.                       | Carboxylic group is absent.                               |
| 6. <b>Test for phenolic group</b><br>Added 0.2 ml of organic compound to 2–3 ml neutral FeCl <sub>3</sub> solution in a test tube.   | No green or violet colour obtained.     | Phenolic group is absent.                                 |
| 6. <b>Test for alcoholic group</b> Added a small piece of sodium to 1 ml of the given liquid in a dry test tube.   | Brisk effervescence.                    | Alcoholic group is present.                               |
| 7. <b>Test for carbonyl group</b><br>Shook 0.2 ml of organic compound with 2–3 ml of 2, 3-dinitrophenylhydrazine in a test tube.   | Orange-yellow ppt. formed.              | Carbonyl group is present. Maybe an aldehyde or a ketone. |
| 8. <b>Test for aldehydic group</b> Warmed 1 ml of organic compound with 1 ml of Tollen's reagent in a test tube over a water bath.   | No observation                          | Aldehyde is absent.                                       |
| 9. <b>Test for amine group</b><br>To a small amount of organic liquid in test tube, added 1 ml conc. of HCl and a few drops of CHCl <sub>3</sub> . Then, added 2 ml of alc. KOH solution and warmed test tube. | No offensive smelling gas evolved.      | Amino group absent.                                       |

RESULT : - Alcohol (-OH)

### EXPERIMENT-11 D

**To identify the functional group present in the given organic compound.**

| Experiment  | Observations   | Inference   |
|---|--|---|
| <p><b>1. Test for unsaturation</b> Dissolved 0.2 ml of organic compound in 2ml CCl<sub>4</sub>. Then added bromine-water dropwise.</p> <p><b>2. Test for carboxylic group</b> Added a pinch of NaHCO<sub>3</sub> to 0.2 ml of organic compound in a test tube.</p> <p><b>3. Test for phenolic group</b><br/>Added 0.2 ml of organic compound to 2–3 ml neutral FeCl<sub>3</sub> solution in a test tube.</p> <p><b>4. Test for alcoholic group</b> Added a small piece of sodium to 1 ml of the given liquid in a dry test tube.</p> <p><b>5. Test for carbonyl group</b><br/>Shook 0.2 ml of organic compound with 2–3 ml of 2, 3-dinitrophenylhydrazine in a test tube.</p> <p><b>6. Test for aldehydic group</b> Warmed 1 ml of organic compound with 1ml of Tollen's reagent in a test tube over a water bath.</p> <p><b>7. Test for amine group</b><br/>To a small amount of organic liquid in test tube, added 1 ml conc. of HCl and a few drops of CHCl<sub>3</sub>. Then, added 2 ml of alc. KOH solution and warmed test tube.</p> | <p>Brown color of bromine not discharged.</p> <p>Brisk effervescence.</p> <p>No green or violet colour obtained.</p> <p>No effervescence.</p> <p>Orange-yellow ppt. formed. No observation</p> <p>No offensive smelling gas evolved.</p> | <p>No unsaturation is present.</p> <p>Carboxylic group is present. Phenolic group is absent.</p> <p>Alcoholic group is absent.</p> <p>Carbonyl group is present. Maybe an aldehyde or a ketone.</p> <p>Aldehyde is absent.</p> <p>Amino group absent.</p> |

RESULT : - Carboxylic acid ( -COOH )

### EXPERIMENT-11 E

**To identify the functional group present in the given organic compound.**

| Experiment  | Observations  | Inference   |
|---|---|---|
| <p><b>1. Test for unsaturation</b> Dissolved 0.2 ml of organic compound in 2 ml CCl<sub>4</sub>. Then added bromine-water dropwise.</p> <p><b>2. Test for carboxylic group</b> Added a pinch of NaHCO<sub>3</sub> to 0.2 ml of organic compound in a test tube.</p> <p><b>3. Test for phenolic group</b><br/>Added 0.2 ml of organic compound to 2–3 ml neutral FeCl<sub>3</sub> solution in a test tube.</p> <p><b>4. Test for alcoholic group</b> Added a small piece of sodium to 1 ml of the given liquid in a dry test tube.</p> <p><b>5. Test for carbonyl group</b><br/>Shook 0.2 ml of organic compound with 2–3 ml of 2, 3-dinitrophenylhydrazine in a test tube.</p> <p><b>6. Test for aldehydic group</b> Warmed 1 ml of organic compound with 1 ml of Tollen's reagent in a test tube over a water bath.</p> <p><b>7. Test for amine group</b><br/>To a small amount of organic liquid in test tube, added 1 ml conc. of HCl and a few drops of CHCl<sub>3</sub>. Then, added 2 ml of alc. KOH solution and warmed test tube.</p> | <p>Brown color of bromine not discharged.</p> <p>No observation</p> <p>green or violet colour obtained.</p> <p>No effervescence.</p> <p>Orange-yellow ppt. formed. No observation</p> <p>No offensive smelling gas evolved.</p> | <p>No unsaturation is present.</p> <p>Carboxylic group absent</p> <p>Phenolic group is present</p> <p>Alcoholic group is absent.</p> <p>Carbonyl group is present. Maybe an aldehyde or a ketone.</p> <p>Aldehyde is absent.</p> <p>Amino group absent.</p> |

RESULT : - Phenol(-OH)

### EXPERIMENT-11 F

**To identify the functional group present in the given organic compound.**

| Experiment  | Observations   | Inference   |
|---|--|---|
| <p><b>1. Test for unsaturation</b> Dissolved 0.2 ml of organic compound in 2 ml CCl<sub>4</sub>. Then added bromine-water dropwise.</p> <p><b>2. Test for carboxylic group</b> Added a pinch of NaHCO<sub>3</sub> to 0.2 ml of organic compound in a test tube.</p> <p><b>3. Test for phenolic group</b><br/>Added 0.2 ml of organic compound to 2–3 ml neutral FeCl<sub>3</sub> solution in a test tube.</p> <p><b>4. Test for alcoholic group</b> Added a small piece of sodium to 1 ml of the given liquid in a dry test tube.</p> <p><b>5. Test for carbonyl group</b><br/>Shook 0.2 ml of organic compound with 2–3 ml of 2, 3-dinitrophenylhydrazine in a test tube.</p> <p><b>6. Test for aldehydic group</b> Warmed 1 ml of organic compound with 1 ml of Tollen's reagent in a test tube over a water bath.</p> <p><b>7. Test for amine group</b><br/>To a small amount of organic liquid in test tube, added 1 ml conc. of HCl and a few drops of CHCl<sub>3</sub>. Then, added 2 ml of alc. KOH solution and warmed test tube.</p> | <p>Brown color of bromine not discharged.</p> <p>No observation</p> <p>No green or violet colour obtained.</p> <p>No effervescence.</p> <p>Orange-yellow ppt. formed.</p> <p>No observation</p> <p>offensive smelling gas evolved.</p> | <p>No unsaturation is present.</p> <p>Carboxylic group absent</p> <p>Phenolic group is absent</p> <p>Alcoholic group is absent.</p> <p>Carbonyl group is absent. May be an aldehyde or a ketone.</p> <p>Aldehyde is absent.</p> <p>Amino group present.</p> |

RESULT : - Amine(-NH<sub>2</sub>)

## EXPERIMENT-12

Aim:

Preparation of pure sample of Ferrous ammonium sulphate (Mohr's salt)  $[\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}]$

### Materials Required

- Ferrous sulphate
- Ammonium sulphate
- Dil. Sulphuric acid
- Ethyl alcohol
- Distilled water
- Beakers
- China dish
- Funnel
- Glass rod
- Tripod stand
- Wire gauze
- Burner
- Wash bottle
- Measuring jar
- Electronic balance

### Procedure

1. We'll first take 7g ferrous sulphate 3.5g ammonium sulphate in a clean 250ml beaker.
2. To this add about 2-3ml of dil.sulphuric acid to prevent the hydrolysis of ferrous sulphate.
3. In another beaker, boil about 20ml of water for 5 minutes.
4. Add the boiling hot water to the contents in the first beaker in small quantities at a time.
5. Stir the contents of the beaker with a glass rod until the salts have completely dissolved.
6. Filter the solution into a china dish.
7. Now heat the solution in the china dish until its crystallization point is reached. Then transfer the solution into a crystallising dish and keep it undisturbed.
8. On cooling, crystals of Mohr's salt separate.
9. Decant the mother liquor and wash the crystals with a small quantity of alcohol and then dry the crystals by placing them between filter paper pads.
10. Find the weight of the crystals.

### Observations

1. Weight of the crystals obtained = .....g
2. Colour of the crystals = ....
3. Shape of the crystals = ....

### EXPERIMENT-13

**Aim:-** Separation of constituents present in an inorganic mixture containing two cations only (constituents having large difference in  $R_f$  values to be provided).

**Materials Required:-** Chromatographic chamber, measuring jar, filter paper, pencil, scale, glass rod, IPA, mixture of cations, distilled water

#### **Procedure**

- Take a Whatman filter paper strip and using a pencil draw a horizontal line 4cm from one end of the paper. Then draw another line lengthwise (vertically) from the centre of the paper. Name the point at which the two lines intersect as P.
- Using a fine capillary tube, put a drop of the mixture of red and blue inks at the point P. Let it dry in air.
- Put another drop on the same spot and dry again, so that the spot is rich in the mixture.
- Pour equal amounts of isopropyl alcohol and distilled water into a chromatographic chamber and mix it well using a glass rod. This is used as the solvent.
- Suspend the filter paper vertically in the chromatographic chamber containing the solvent in such a way that the pencil line remains about 2cm above the solvent level.
- Close the jar with its lid and keep it undisturbed.
- Notice the rising solvent along with the red and blue inks. After the solvent has risen about 15 cm you will notice two different spots of blue and red colors on the filter paper.
- Take the filter paper out of the jar and using a pencil mark the distance that the solvent has risen on the paper. This is called the solvent front.
- Dry the filter paper and put pencil marks at the centre of the red and blue ink spots.
- Measure the distance of the two spots from the original line and the distance of the solvent from the original line.
- Calculate the  $R_f$  values of the red and blue inks using the formula,

$$R_f = \frac{\text{Distance travelled by the component from the original line}}{\text{Distance travelled by the solvent from the original line}}$$

#### **Observation**

Observations can be recorded as shown.

| SI No. | Components | Distance travelled by the component from the original line (cm) | Distance travelled by the solvent from the original line (cm) | $R_f$ value |
|--------|------------|---|---|-------------|
| 1.     | Red        |   |   |             |
| 2.     | Blue       |   |   |             |

#### **Inference**

- $R_f$  value of red ink = .....
- $R_f$  value of blue ink = .....

## Experiment - 14

**Aim:-** Preparation of one lyophilic sol of Starch.

### **Theory**

Starch forms a lyophilic sol when water is used as the dispersion medium. The formation of sol is accelerated by heating. The starch sol can be prepared by heating starch and water at about 100°C. It is quite stable and is not affected by the presence of any electrolytic impurity.

### **Apparatus**

Beakers (250 ml and 50 ml), glass rod, funnel, filter-paper, pestle and mortar, tripod stand, wire-gauze and burner.

### **Materials Required**

Soluble starch (500 mg) and distilled water.

### **Procedure**

1. Take 500 mg of starch in a mortar and add few ml of distilled water.
2. Grind the starch to make a thin paste and transfer this paste to a 50 ml beaker.
3. Take about 100 ml of distilled water in a 250 ml beaker and heat the beaker so that water starts boiling.
4. Pour the paste slowly with stirring into boiling water in the beaker (Fig. 2.1).
5. Continue boiling for about 10 minutes and then allow the beaker to cool.
6. Filter the contents of the beaker through a filter-paper, fixed in a funnel.  
Label the filtrate 'Starch Sol'.

### **Precautions**

1. The apparatus used for preparing sol should be properly cleaned.
2. Distilled water should be used for preparing sols in water.
3. Starch should be converted into a fine paste before adding to boiling water