

S.N.	Name of the Experiment	Date	Page	Remarks
1.	TO STUDY DIFFERENT APPARATUS USED IN CHEMISTRY LABORATORY	2080/08/14	1-6	<i>Done</i> <i>2080/08/21</i>
2.	TO SEPARATE THE MIXTURE OF SAND AND SALT AND TO OBTAIN THE SAND IN PURE AND DRY FORM	2080/08/21	7-10	<i>Done</i> <i>2080/09/12</i>
3.	TO SEPARATE THE MIXTURE OF SAND AND CAMPHOR BY SUBLIMATION PROCESS	2080/09/12	11-13	<i>2080/09/19</i>
4.	TO PREPARE PURE AND DRY CRYSTALS OF BLUE VITRIOL FROM IMPURE BAZZAR COPPER SULPHATE	2080/09/19	14-16	
5.	TO PREPARE PURE AND DRY PRECIPITATE OF BARIUM SULPHATE (BaSO_4) FROM THE REACTION BETWEEN BaCl_2 SOLUTION AND DILUTE H_2SO_4	2080/09/26	17-19	<i>2080/09/26</i>
				<i>2080/10/04</i>

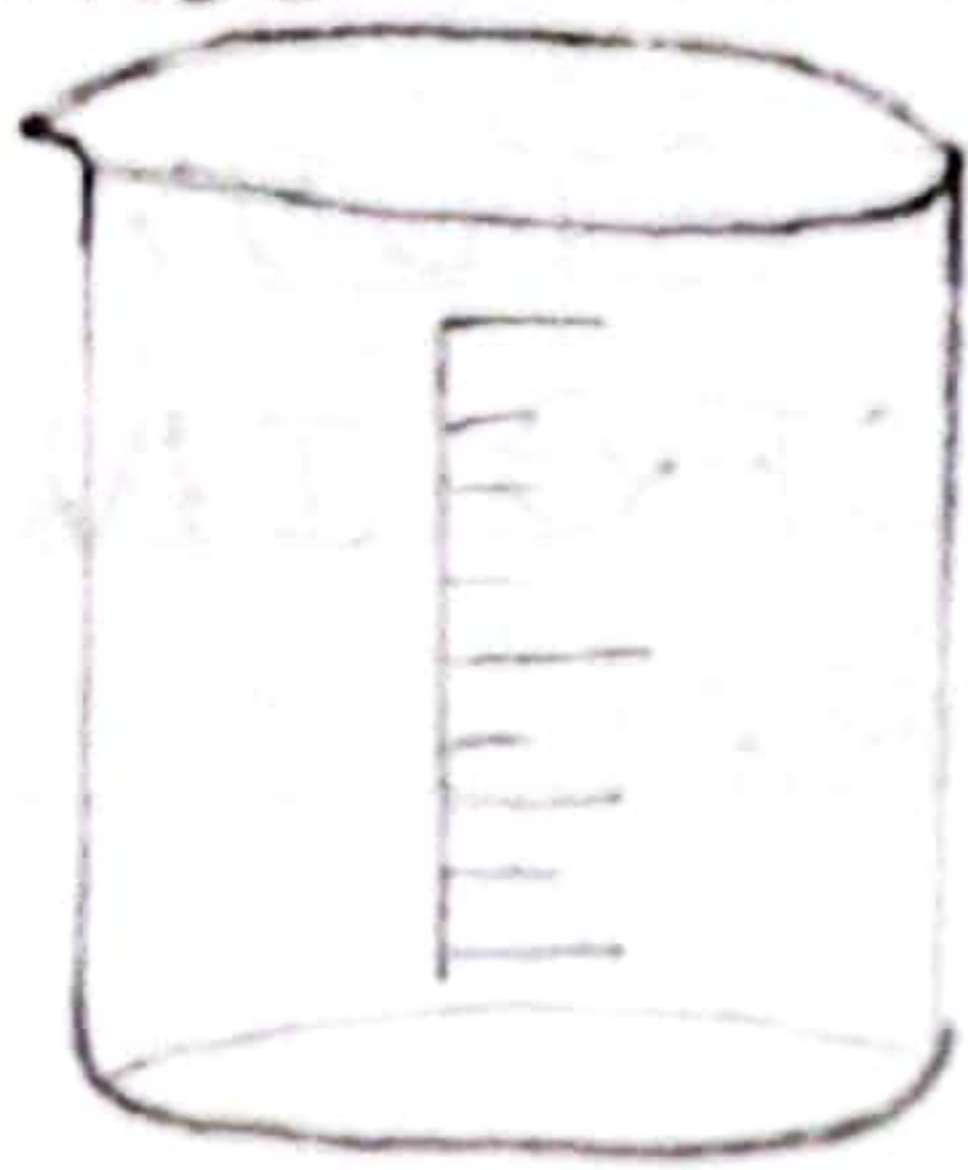
EXPERIMENT NO. 1

NAME OF EXPERIMENT: TO STUDY DIFFERENT APPARATUS USED IN CHEMISTRY LABORATORY

APPARATUS

1. Beaker
2. Conical flask
3. Conical funnel
4. Round bottom flask
5. Test tube
6. Test tube holder
7. Test tube rack
8. Bunsen
9. Tripod stand
10. Wire gauze
11. Porcelain basin
12. Tong
13. Woulfe's bottle
14. Thistle funnel
15. Delivery tube
16. Gas jar
17. Beehive shelf
18. Water trough
19. Wash bottle
20. Spatula
21. Watch glass
22. Measuring cylinder
23. Mortar and pestle
24. Glass rod
25. Glass pipe
26. Brush

① Beaker



② Conical flask



③ Conical funnel



④ Round bottom flask



⑤ Test tube



Note Mandir

1. Beaker

- It is made up of glass.
- It is used to prepare solutions and for boiling water.

2. Conical flask

- It is made up of glass.
- It is used to prepare solutions and during titration.

3. Conical funnel

- It is made up of glass.
- It is used during filtration process.

4. Round bottom flask

- It is made up of glass.
- It is used to prepare reaction and gas preparation.

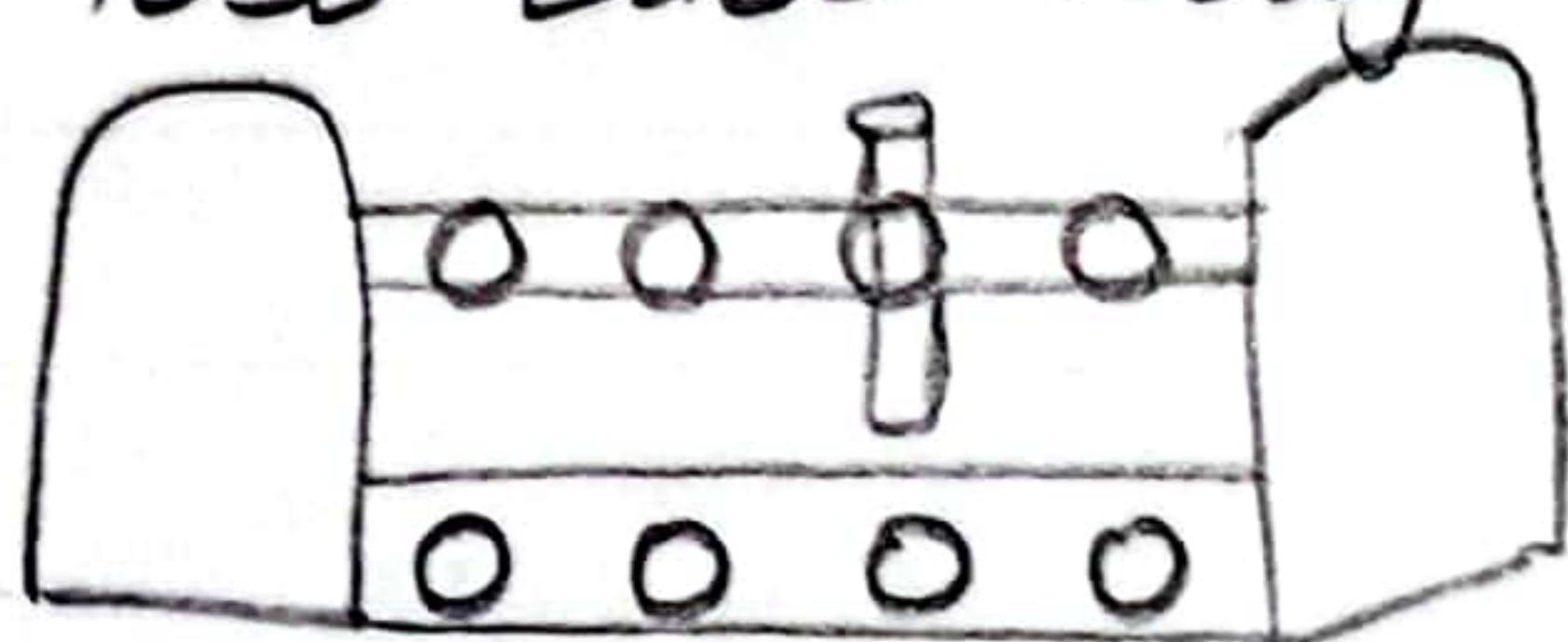
5. Test tube

- It is made up of glass.
- It is used to test the chemical reaction.

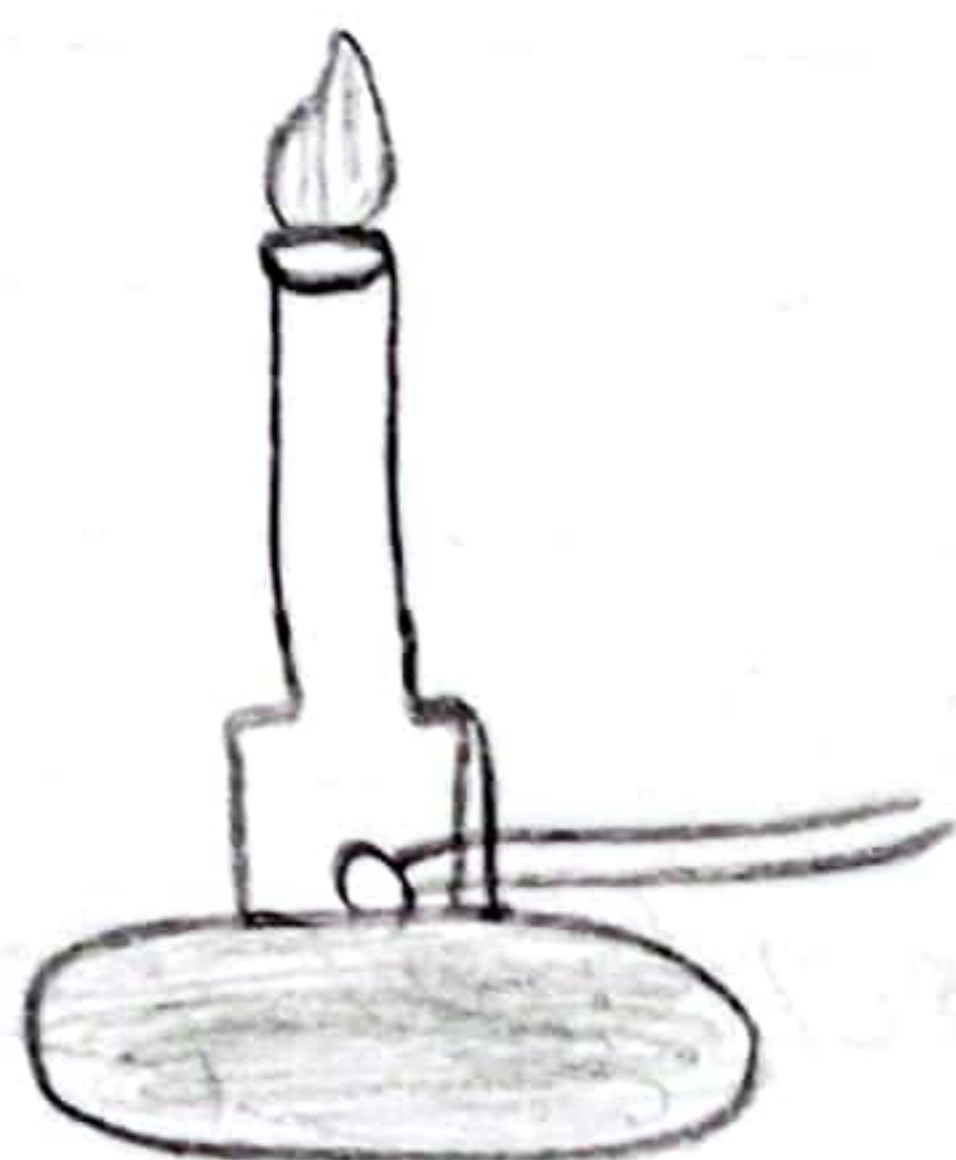
⑥ Test tube holder



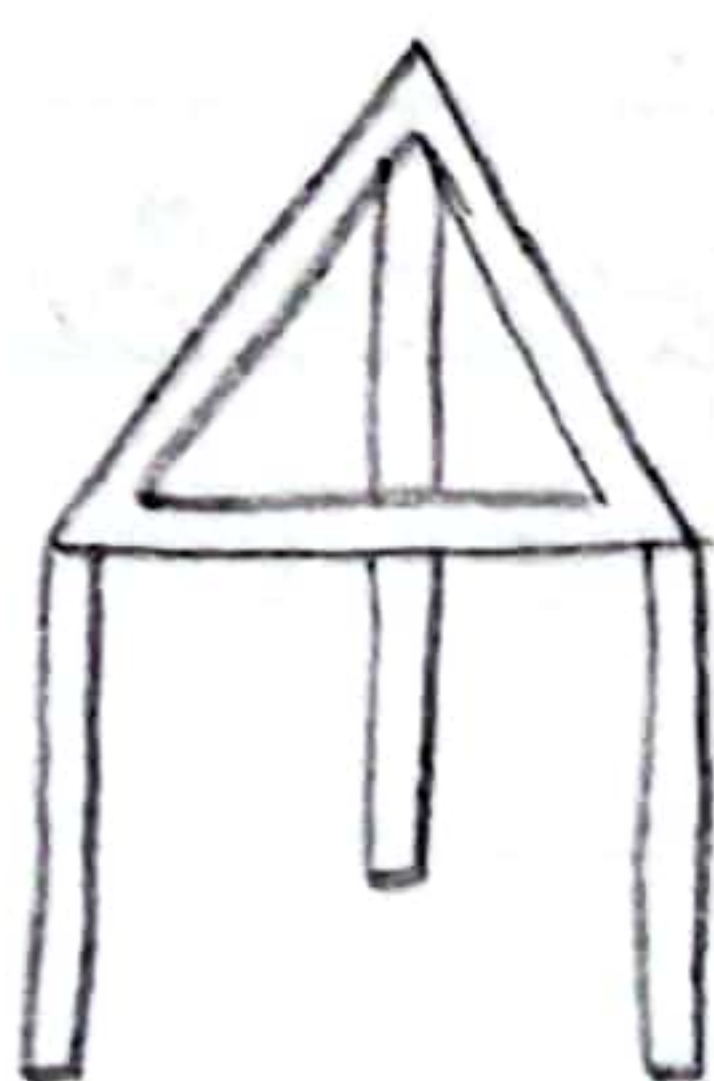
⑦ Test tube rack



⑧ Bunsen



⑨ Tripod stand



⑩ Wire gauze



Note Mandir

6. Test tube holder

- It is made up of metal.
- It is used to hold the test tube.

7. Test tube rack

- It is made up of plastic.
- It is used to place the test tube.

8. Bunsen

- It is made up of metal and wood.
- It is used for heating purpose.

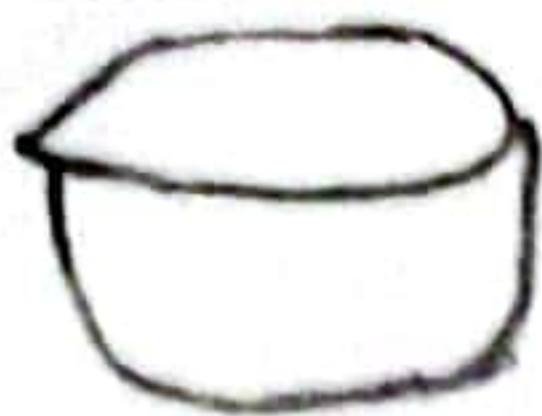
9. Tripod stand

- It is made up of metal.
- It is used as stand for heating purpose of chemical solution.

10. Wire gauze

- It is made up of metal wire.
- It is used during the heating of chemical reaction.

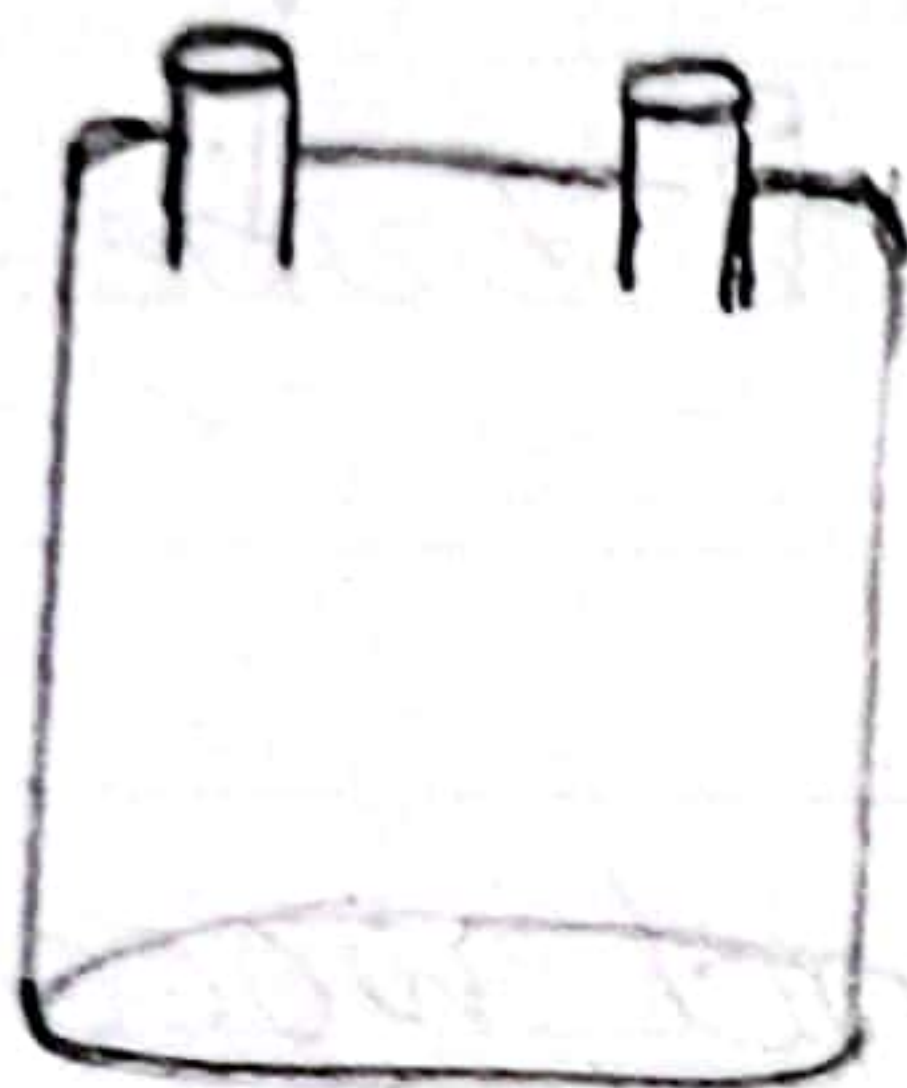
(11) Porcelain basin



(12) Tong



(13) Woulfe's bottle



(14) Thistle funnel



(15) Delivery tube



(16) Gas jar



Note Mandir

11. Porcelain basin

- It is made up of ceramics.
- It is used during heating.

12. Tong

- It is made up of metal.
- It is used to hold hot objects.

13. Woulfe's bottle

- It is made up of glass.
- It is used during gas preparation.

14. Thistle funnel

- It is made up of glass.
- It is used to supply the acid.

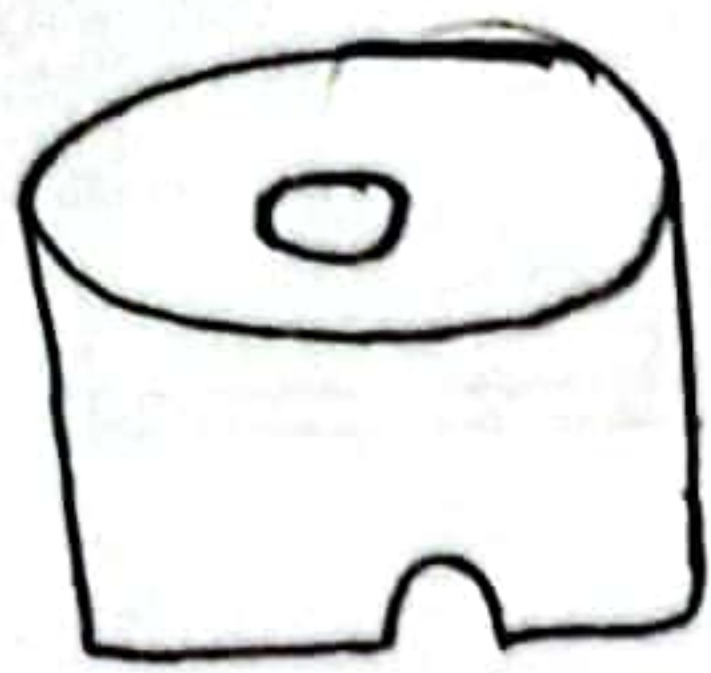
15. Delivery tube

- It is made up of glass.
- It is used to supply the gas into gas jar.

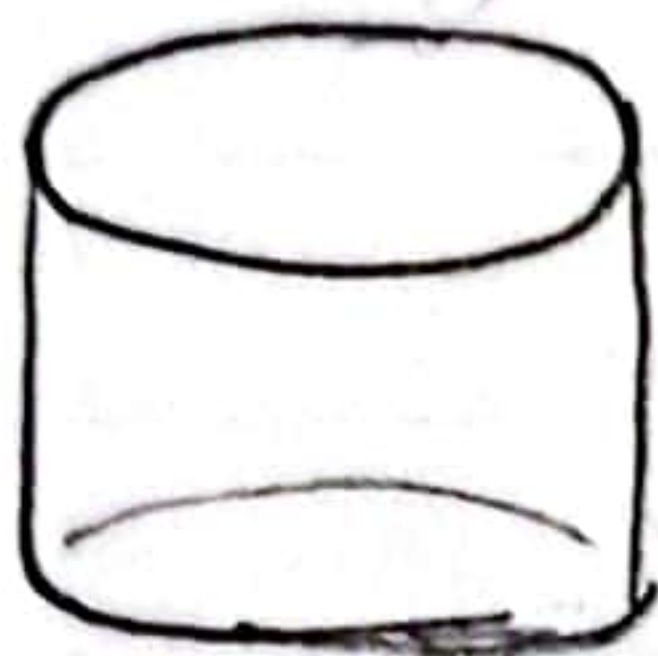
16. Gas jar

- It is made up of glass.
- It is used to collect the gas.

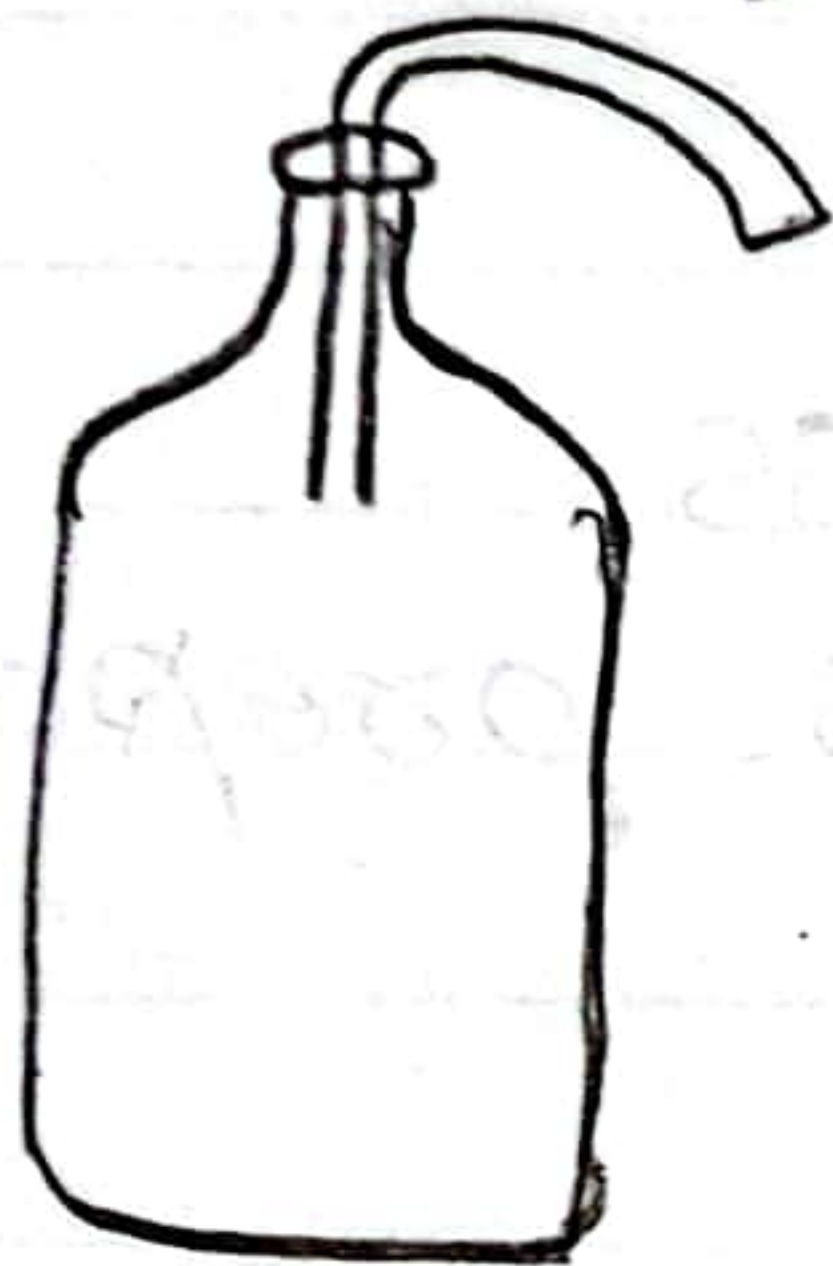
(17) Bechhoff shelf



(18) Water trough



(19) Wash bottle



(20) Spatula



(21) Watch glass



Note Mandir

17. Beehive shelf

- It is made up of ceramics.
- It is used for gas preparation.

18. Water trough

- It is made up of plastic.
- It is used during hydrogen gas preparation and crystallization.

19. Wash bottle

- It is made up of plastic.
- It is used to wash apparatus.

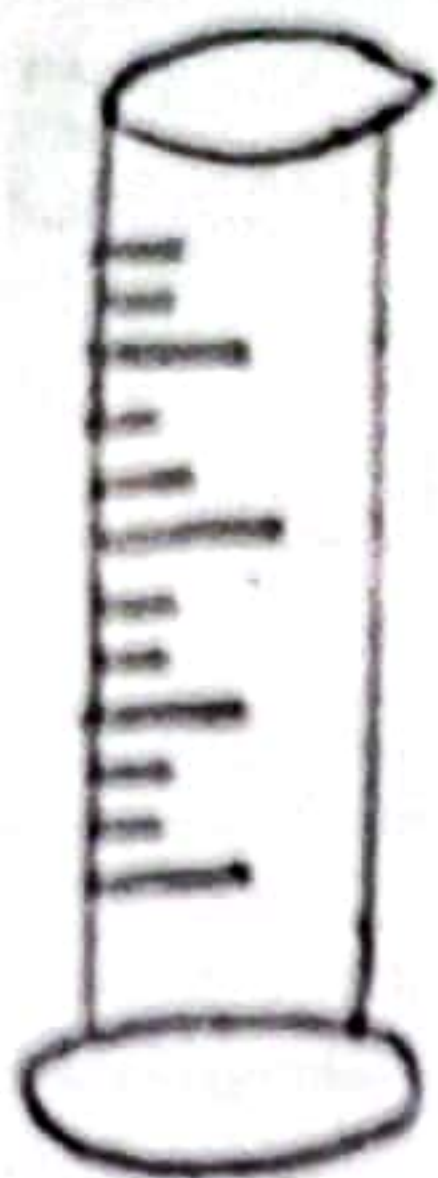
20. Spatula

- It is made up of metal.
- It is used to take the chemical from the bottle.

21. Watch glass

- It is made up of glass.
- It is used to weigh the chemical.

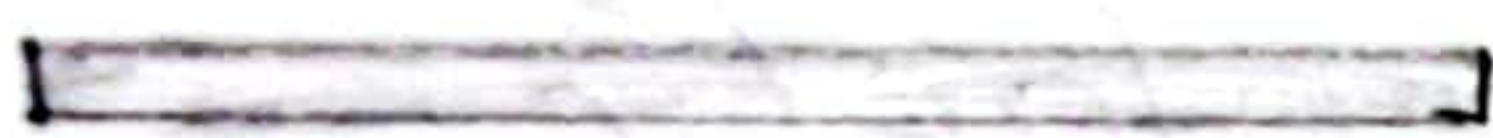
(22) Measuring cylinder



(23) Mortar and Pestle



(24) Glass rod



(25) Glass pipe



(26) Brush



Note Mandir

22. Measuring cylinder

- It is made up of glass.
- It is used to measure the definite volume of chemical substances.

23. Mortar and pestle

- It is made up of ceramics.
- It is used for grinding purpose.

24. Glass rod

- It is made up of solid glass.
- It is used during preparation of solution (stirring purpose).

25. Glass pipe

- It is made up of hollow glass.
- It is used as dropper.

26. Brush

- It is made up of metal plastic.
- It is used for cleaning apparatus

RESULT:-

Hence, from the experiment different apparatus used in chemistry laboratory were studied.

(Signature)
08/08/21

EXPERIMENT NO. 2

7

NAME OF EXPERIMENT: TO SEPARATE THE MIXTURE OF SAND AND SALT AND TO OBTAIN THE SAND IN PURE AND DRY FORM.

APPARATUS REQUIRED

Sand and Salt

Conical funnel

Glass rod

Tripod stand

Test tube

Wise gauge

CHEMICALS REQUIRED

Mixture of sand and salt

Silver Nitrate Solution

THEORY

In the mixture of sand and common salt, the mixture is treated with minimum quantity of solvent water where common salt dissolves but not sand. Then is filtered, decanted and washed with water till sand is free from Cl^- . Presence of Cl^- ions is indicated by the appearance of a curdy white precipitate upon addition of AgNO_3 solution into the wash filtrate of sand residue.

Pure sand remains as residue in the filter paper and is collected. Crystals of sodium chloride are obtained by evaporating the filtrate in a basin heating carefully up to crystallization point. Crystal of common salt (NaCl) has cubic shape. Filtrate is the clear liquid obtained after the process of filtration. Residue is the solid or insoluble component left in the filter after the process of filtration. The process of settling down of heavier insoluble particles at the bottom of a liquid is called sedimentation. Decantation is the process of separation of liquid from solid and other immiscible liquids, by removing the liquid layer at the top from the layer of solid or liquid below.

PROCEDURE

1. The mixture of sand and common salt was taken in a beaker and just sufficient amount of water to dissolve the salt completely was added.
2. The filter paper was set up in funnel and was fitted on a stand.
3. The mixture solution was slowly transferred into the filter paper fitted in the funnel.

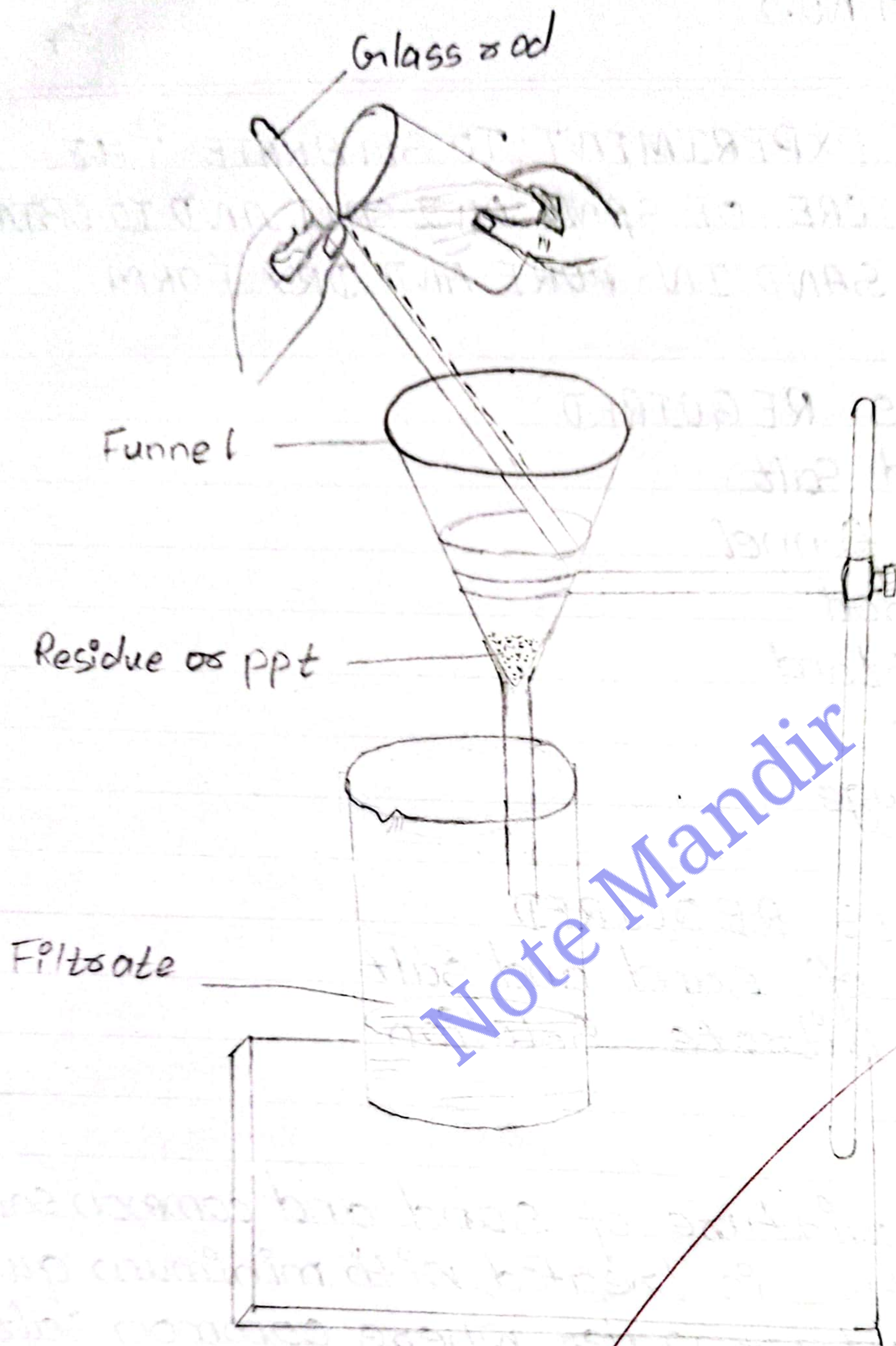


Fig:- Filtration

***NOTE:- Write this on line page**

Reaction



Observation table

Experiment	Observation	Inference
a) Add few drops of AgNO_3 solutions to the last filtrate drops.	a) White precipitate appears. b) No white precipitate appears.	a) Sand is not free from Cl^- ions. b) Sand is free from Cl^- ions.

with the help of glass rod.

4. The sand was washed few times with water to remove sodium chloride completely.
5. To test whether the sand was free from the salt or not, few drops of filtrate was taken in a clean test-tube and about two drops of silver nitrate solution was added. We continued the process till the filtrate gave no white precipitate with AgNO_3 solution.
6. The filter paper was carefully removed from the funnel and was spreaded on the asbestos sheet and was dried.
7. Sodium Chloride solution was evaporated by heating up to crystallization point and was allowed to cool to obtain cubic crystal of sodium chloride.

RESULT

Hence sand (water insoluble) and common salt (water soluble) components are separated from the given mixture in pure state by dissolution in water followed by filtration and evaporation of the filtrate up to crystallization.

CONCLUSION

Any mixture containing water insoluble and water soluble components can be separated by dissolving the soluble component in water followed by filtration and evaporation.

PRECAUTIONS

1. Minimum quantity of solvent should be used for dissolution of mixture.
2. There should not be air bubble between filter paper and inner wall of the funnel.
3. During filtration, solution should be filled well below the brim of folds of filter paper.
4. Purity test should be carried out to make the residue free from soluble salt.


08/09/12

NAME OF EXPERIMENT: TO SEPARATE THE MIXTURE OF SAND AND CAMPHOR BY SUBLIMATION PROCESS.

APPARATUS REQUIRED

1. Porcelain basin
2. Funnel
3. Tripod stand
4. Wire gauze
5. Burner
6. Glass rod

CHEMICALS REQUIRED

Mixture of sand and camphor

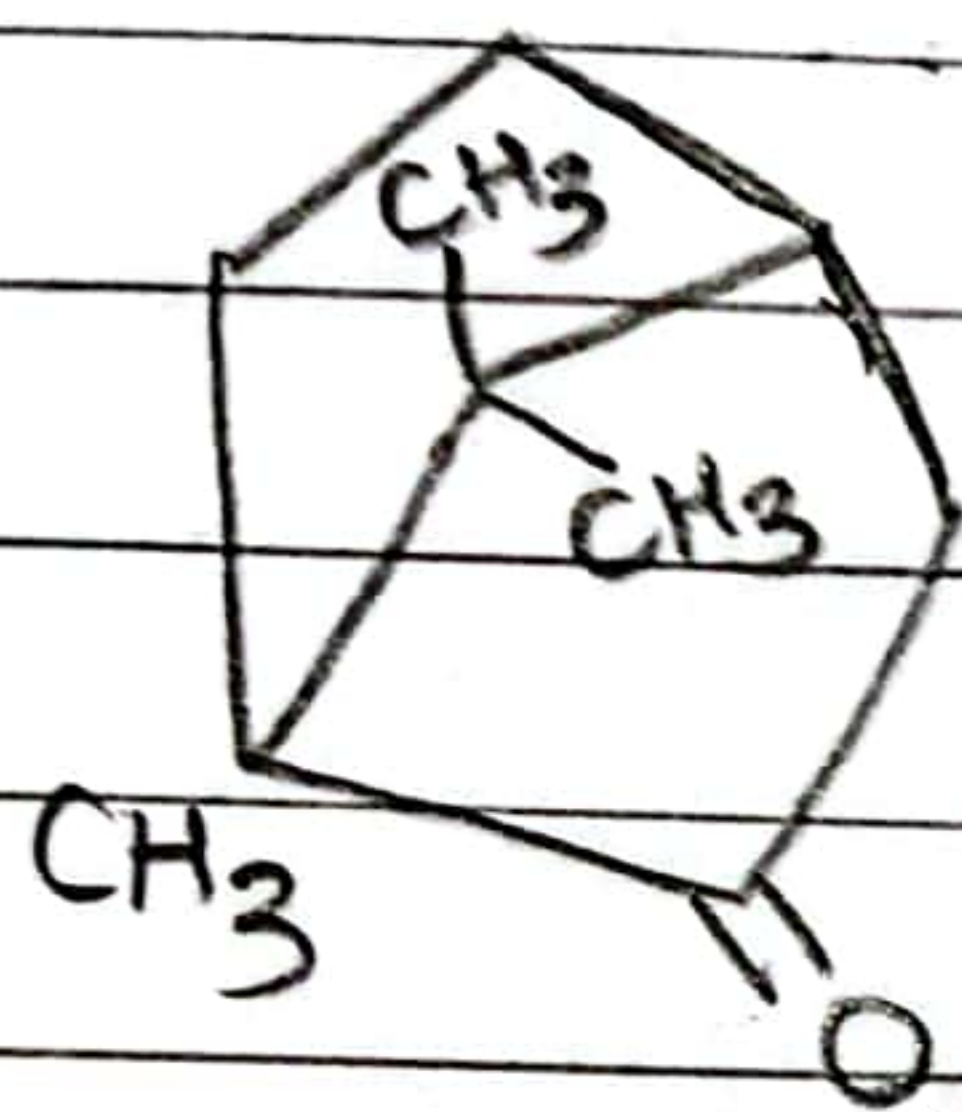
THEORY

Component from a mixture of volatile and non-volatile substance can be separated by sublimation process. In the given mixture, camphor is water insoluble volatile and subliming solid whereas sand is non-volatile water insoluble solid. Such type of components can be separated from the mixture by sublimation process. Sublimation is the process in which a solid substance directly converts into vapour state on heating and the vapour condenses into solid state on cooling without changing into liquid state.

Solid obtained after the process of sublimation is called sublimate. Here, camphor is separated from the mixture as sublimate and pure sand is left over ~~as~~ as residue.

Sand $\rightarrow$ SiO_2

Camphor $\rightarrow$ $\text{C}_{10}\text{H}_{16}\text{O}$



PROCEDURE

1. The ~~g~~ mixture of sand and camphor ^{was} ~~is~~ taken in a clean porcelain basin.
2. A funnel was taken and its open end was plugged up with some pieces of filter paper. The outer side of funnel was wrapped by moist filter paper. The funnel was inverted into the porcelain basin.
3. The porcelain basin was kept on sand bath and heated slowly and smoothly so that volatile component (camphor), start to sublime off and condenses on the inner walls of funnel in a crystalline state.
4. The flame was extinguished, allowed to cool for

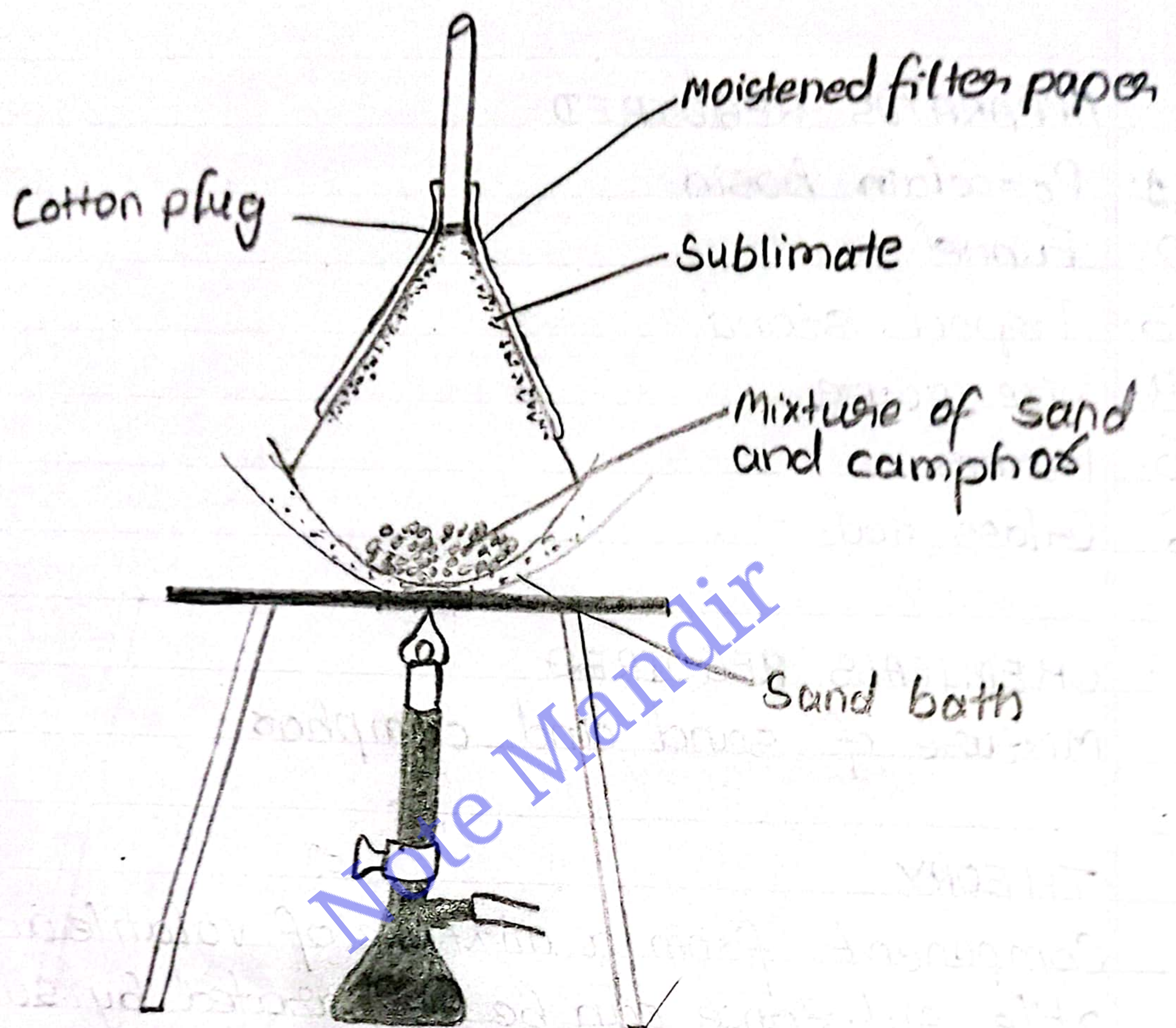


Fig:- Sublimation

some time and was checked whether or not camphor was sublimed off completely from the mixture. Then the funnel was removed and the sublimate was scraped out. Sand was obtained from porcelain basin.

RESULT

Each component from the mixture of camphor and sand is separated successfully by sublimation process.

CONCLUSION

Hence a mixture containing two types of solids; one non-subliming non-volatile and other subliming, can be separated by the process of sublimation.

PRECAUTIONS

1. Proper cotton plugging and proper apparatus set up should be done.
2. The mixture should be heated smoothly and slowly.
3. After extinguishing the flame, the sublimate collecting funnel should not be removed immediately. Let it cool down completely. Otherwise subliming vapour of camphor may be lost.

24/09/19

EXPERIMENT NO. 4

14

NAME OF EXPERIMENT: TO PREPARE PURE AND DRY CRYSTALS OF BLUE VITRIOL FROM IMPURE BAZZAR COPPER SULPHATE.

APPARATUS REQUIRED

1. Porcelain basin
2. Beaker
3. Glass rod
4. Funnel
5. Water trough
6. Burner
7. Tripod stand
8. Wire gauze

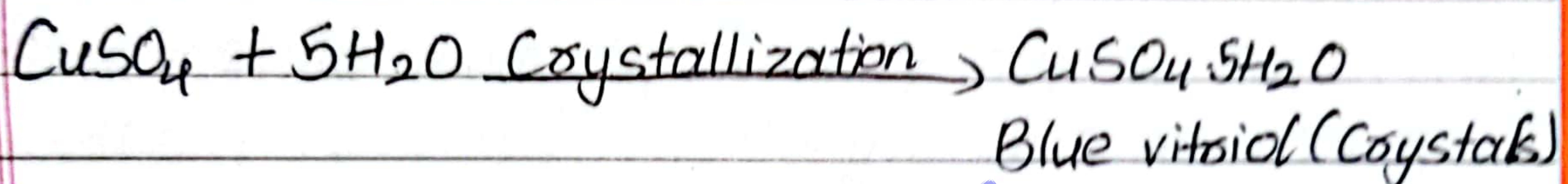
CHEMICALS REQUIRED

Impure bazaar copper sulphate

THEORY

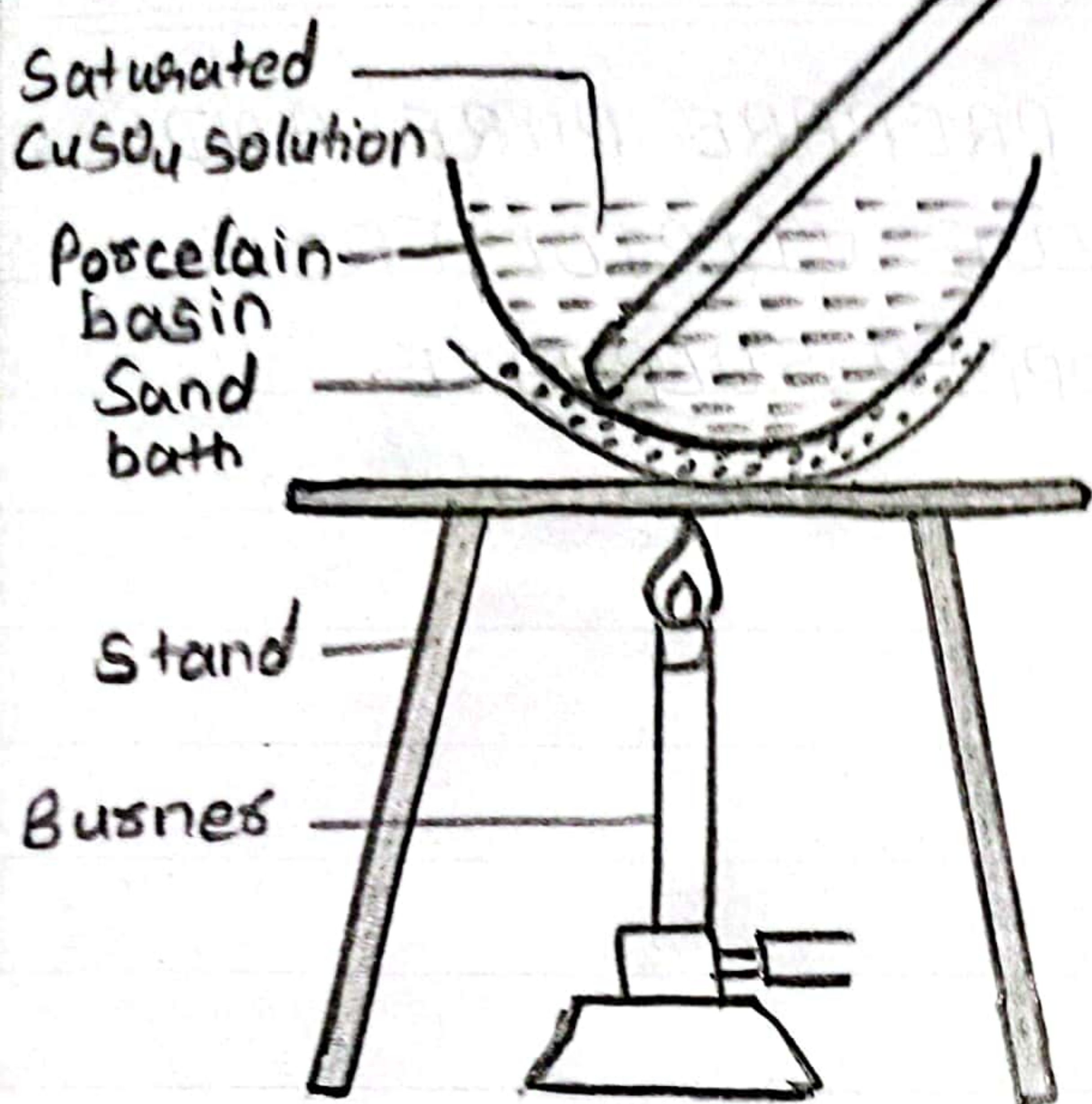
Crystallization is a process of formation of crystals of fine size and shape from its solution by evaporating it carefully to the crystallization point. When a saturated solution prepared at higher temperature is allowed to cool very slowly, then the excess of solid will separate out in the form of geometrical shape called crystals. Crystallization point is the point of formation of

fine crystals when a solution saturated at higher temperature is cooled down to the room temperature. In course of crystallization point, a small amount of solution should remain which is called mother liquor.

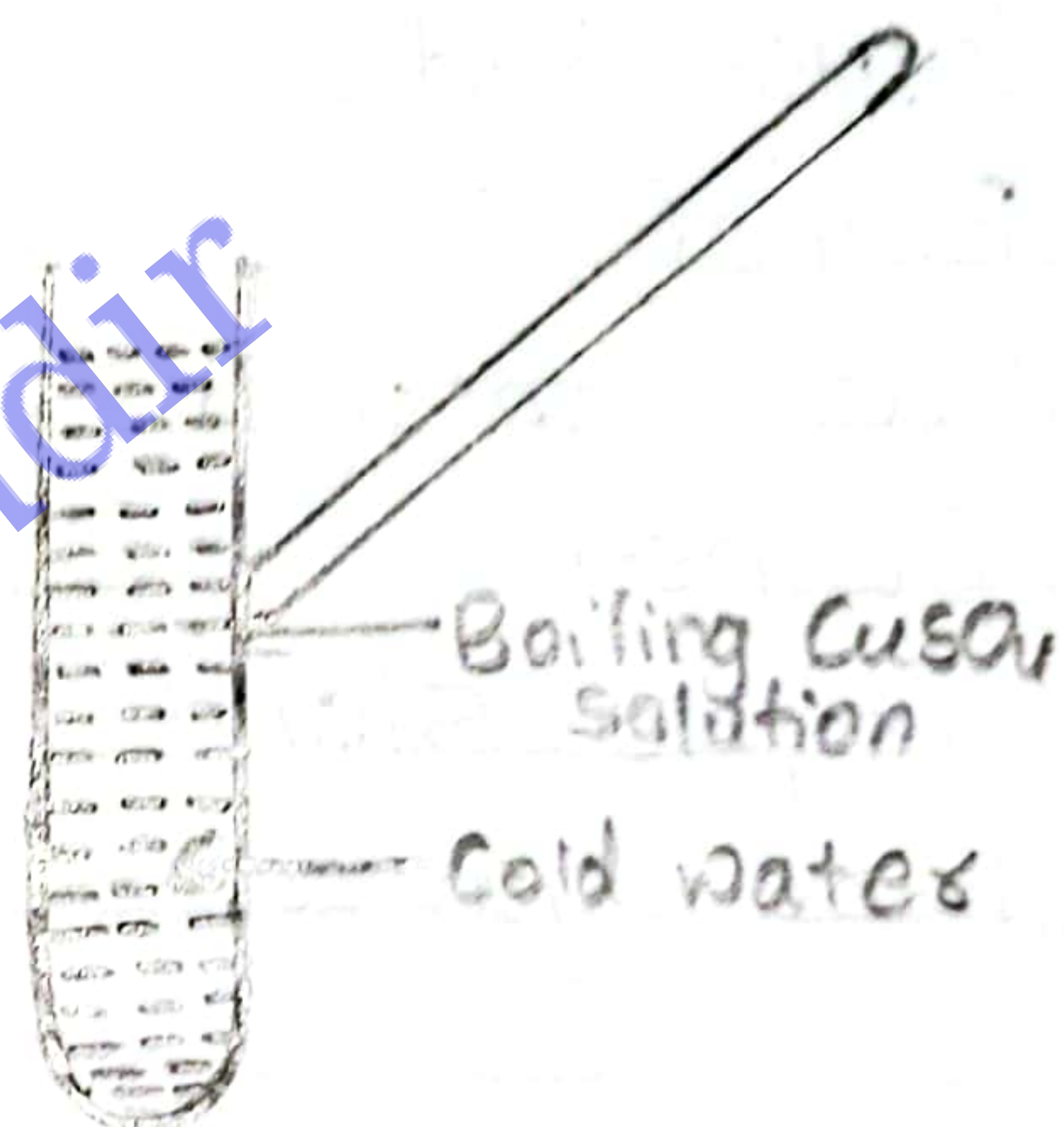


PROCEDURE

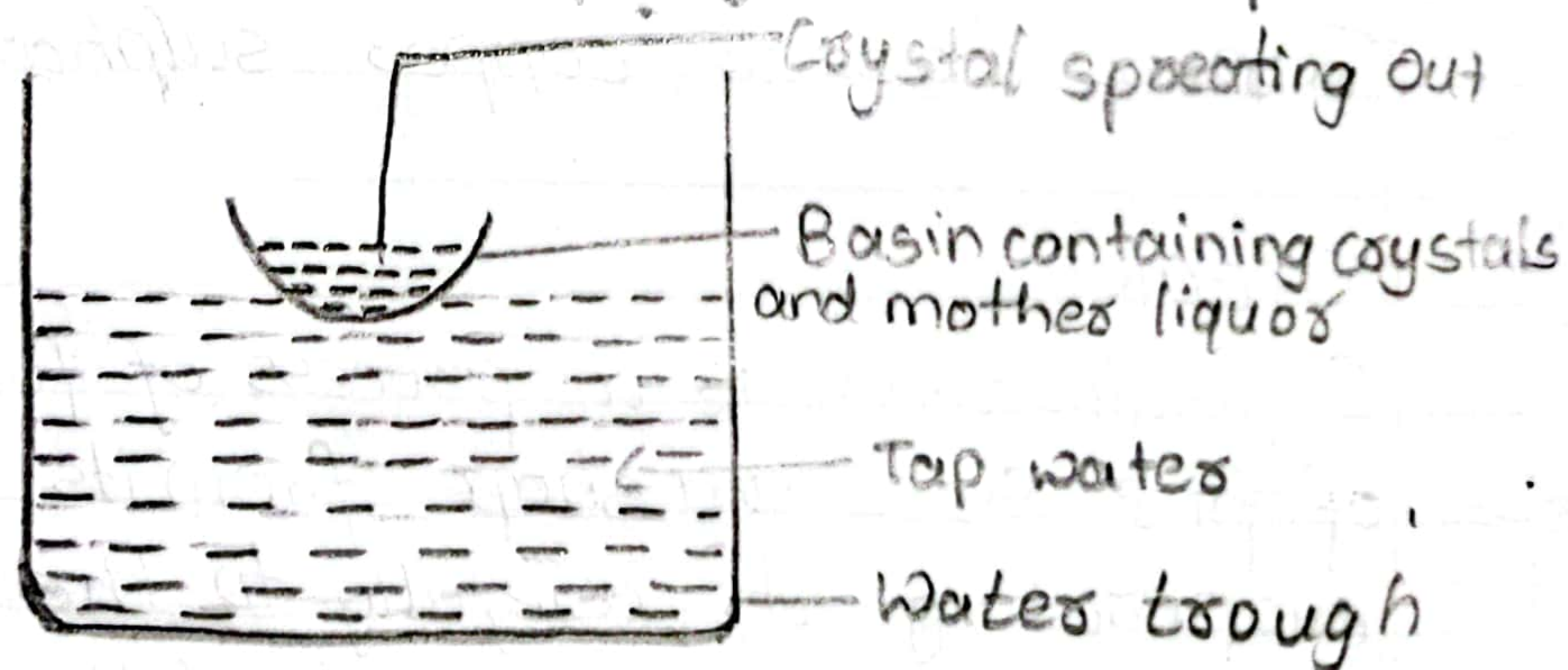
1. About half test tube full of water was put in a beaker. Small amount of impure copper sulphate was added and stirred. Copper sulphate was added repeatedly and stirred till it formed saturated solution. The solution was filtered and the filtrate was collected in a dry porcelain basin.
2. The filtrate ~~to~~ taken in a basin was evaporated for some time. As the solution got heated, it was stirred with glass rod to prevent crust formation. When two third of the solution evaporated, crystals began to appear at the edge of the basin which was the indication of crystallization point. Crystallization point was checked by putting a drop of boiling solution from the basin on the outer wall of test tube containing cold water. If there is



(a) Crystallization process



(b) Test of crystallization point



(c) cooling the concentrated solution

appearance of millicrystal instantly, then it indicates crystallization point has reached. Otherwise further heating should be carried out.

3. The basin was removed from the flame and cooled slowly without disturbance and it was placed on the water trough containing cold water. After sometime, maximum deposition of crystal will be seen in the porcelain basin along with some liquid which is known as mother liquor.
4. The crystals were removed from mother liquor with the help of spatula and was dried carefully between filter paper.
5. The crystals were collected and submitted for inspection.

RESULT

Hence pure crystals of copper sulphate is obtained by the crystallization of saturated solution of impure copper sulphate.

PRECAUTIONS

1. The solution should be saturated.
2. Crystallization point should be detected sharply.
3. Soaking of water from crystals should be done without pressing the crystals.

EXPERIMENT NO. 5

NAME OF EXPERIMENT: TO PREPARE PURE AND DRY PRECIPITATE OF BARIUM SULPHATE (BaSO_4) FROM THE REACTION BETWEEN BaCl_2 SOLUTION AND DILUTE H_2SO_4 .

APPARATUS REQUIRED

1. Beaker
2. Funnel
3. Glass rod
4. Tripod stand
5. Bunsen
6. Wire gauze
7. Test tube
8. Test tube stand
9. Tong
10. Test tube holder
11. Glass pipe

CHEMICALS REQUIRED

1. BaCl_2 solution
2. Dil. H_2SO_4
3. AgNO_3 solution

THEORY

When sulphuric acid is added to barium chloride solution then barium sulphate is obtained in the form of white precipitate. The pure and dry solid obtained after the chemical reaction is called precipitate. The type of reaction where two reagents react to give a precipitate is called precipitation reaction.

Chemical reaction: $\text{BaCl}_2(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4\downarrow + 2\text{HCl}(\text{aq})$
white ppt.

Ionic reaction: $\text{Ba}^{++} + \text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4\downarrow$
white ppt.

Reaction for purity test:

$\text{Cl}^- + \text{AgNO}_3 \rightarrow \text{AgCl}\downarrow + \text{NO}_3^-$
White ppt.

PROCEDURE

1. About 1 test-tube barium chloride was taken in a beaker and warmed up.
2. Small quantity of dilute sulphuric acid was added at a time with stirring the solution with glass rod. The mixture was heated and the precipitate was allowed to settle. Then clear supernatant liquid was taken, it was tested for complete precipitation of Ba^{++} ions. Dilute sulphuric acid was added till the supernatant liquid gave fresh precipitate.
3. After complete precipitation, the mixture was heated to allow the precipitate to settle down and the supernatant liquid was filtered off carefully. The precipitate was transferred into filter paper with the help of jet of water from the wash bottle and was washed with hot water till it was free from Cl^- .

mixture of BaCl_2 and H_2SO_4

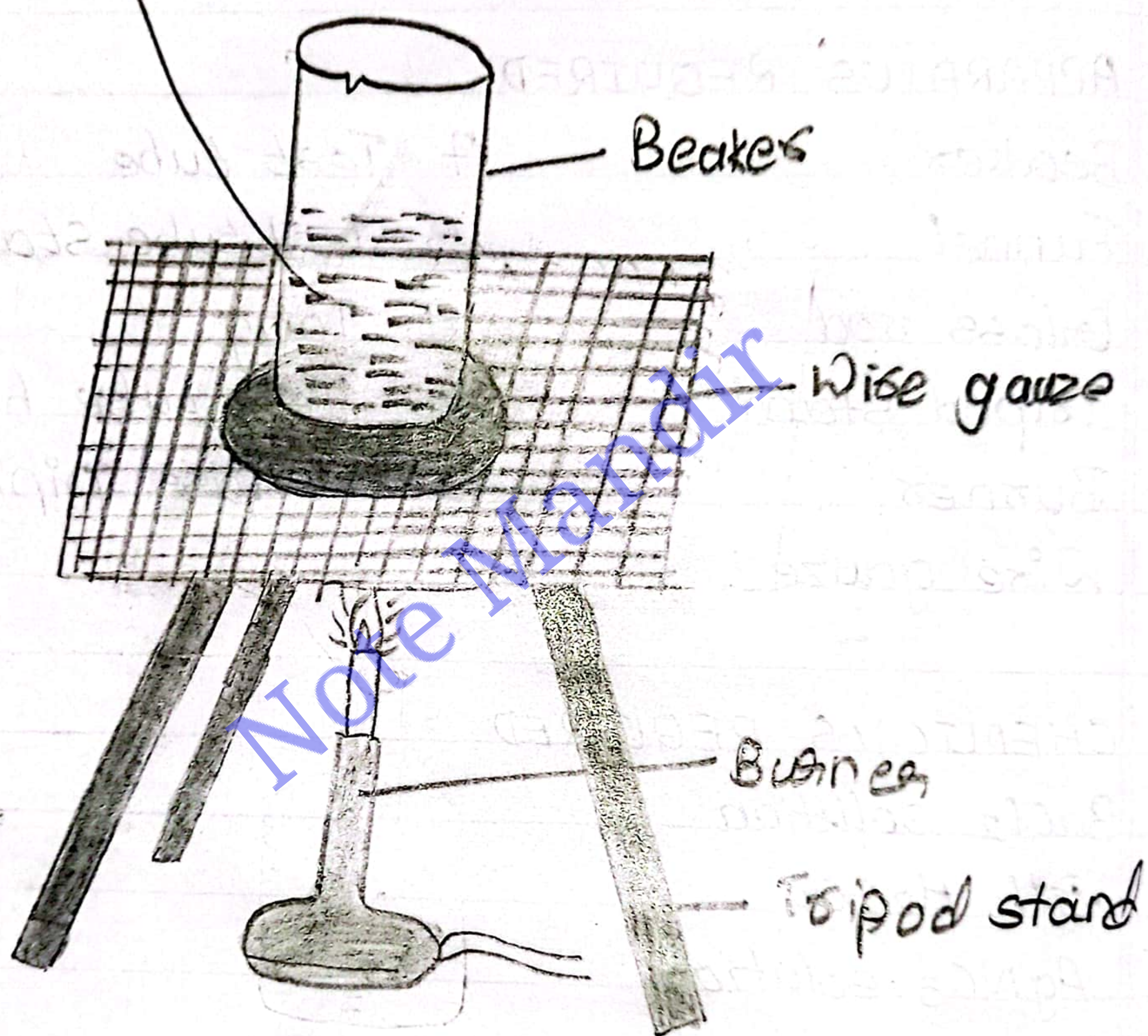


fig:- heating of mixture of BaCl_2 and H_2SO_4

4. The purity of BaSO_4 was checked by silver nitrate solution.
5. The precipitate was dried and submitted for inspection.

RESULT

Barium sulphate is prepared by the reaction of barium chloride and sulphuric acid.

CONCLUSION

Chemical compounds can be prepared by precipitation reaction.

PRECAUTION

1. The precipitation should be complete.
2. During washing by decantation, there should not be any loss of the precipitate.
3. While drying the ppt. over burner, care should be taken so that the filter paper doesn't burn.
4. The precipitant should never be added in excess amount.

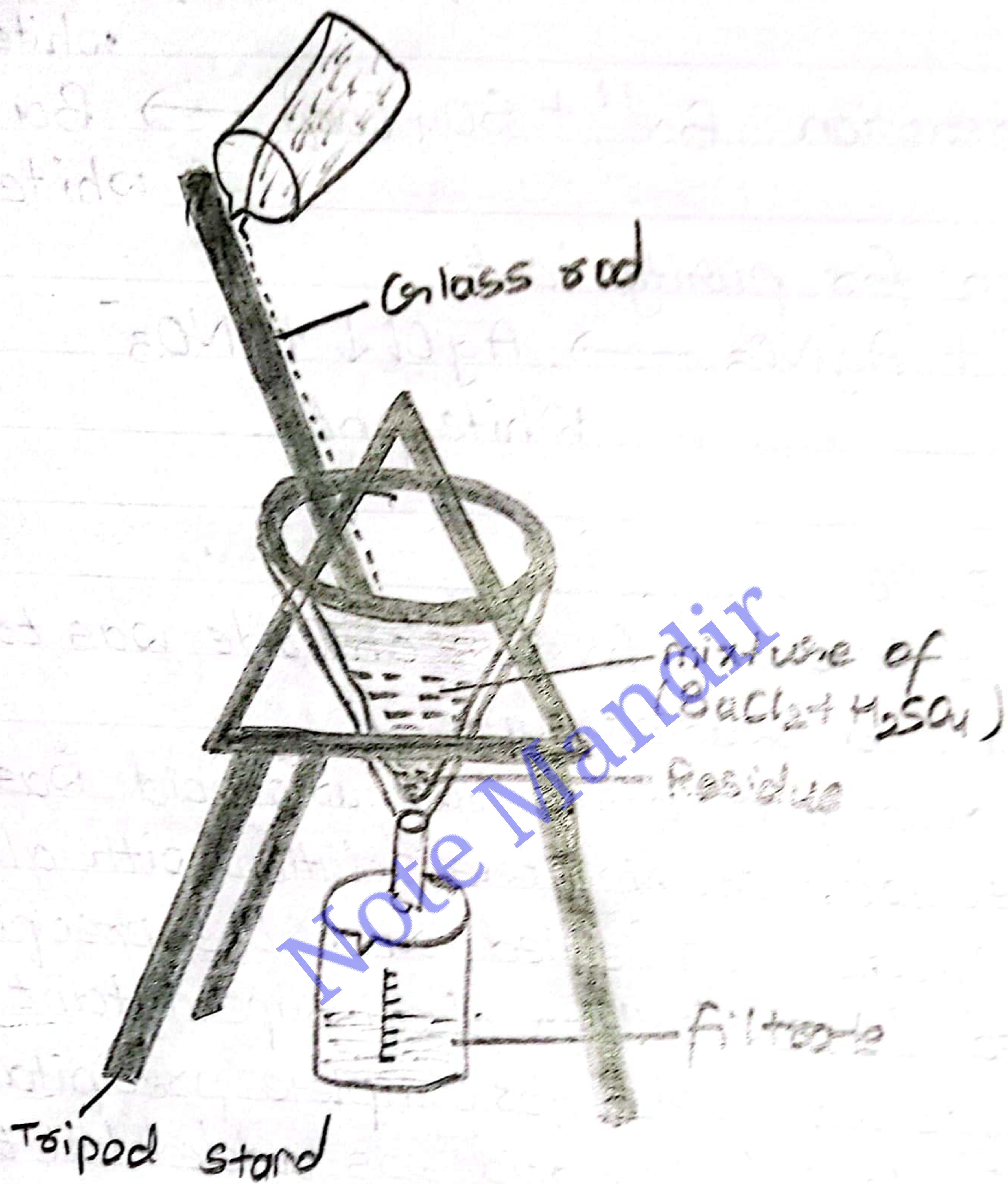


fig:- filtration of $\text{BaCl}_2 + \text{H}_2\text{SO}_4$ solution.

EXPERIMENT NO-6

NAME OF EXPERIMENT: TO OBTAIN COMMON SALT (NaCl)
FROM THE REACTION BETWEEN DILUTE HCl AND DILUTE
NaOH BY NEUTRALIZATION REACTION.

APPARATUS REQUIRED

- | | |
|---------------------|-------------------|
| i) Porcelain basin | vii) Tripod stand |
| ii) Glass rod | viii) Wire gauze |
| iii) Test tube rack | ix) Funnel |
| iv) Test tube | |
| v) Glass pipe | |
| vi) Burner | |

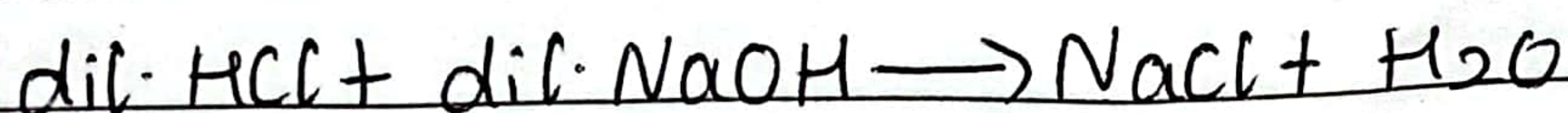
CHEMICALS REQUIRED

- i) Dil. HCl
- ii) Dil. NaOH
- iii) Litmus paper (Red and Blue)

THEORY

A neutralization reaction is defined as the chemical reaction in which an acid and base quantitatively react together to form a salt and water as products.

Evaporation is the process of changing liquid to a gas form or vapour form.



PROCEDURE

1. A half test tube full of bench HCl was taken in a porcelain basin.
2. A half test tube full of bench NaOH was added a little at a time with the help of glass rod.
3. The mixture was stirred constantly with a glass rod.
4. The mixture solution was introduced on the piece of both red and blue litmus paper with the help of a glass rod.
5. If the blue litmus turned into red, the alkali was introduced dropwise. Similarly, if the red litmus turned blue the acid was introduced dropwise. In that way the neutral point was ascertained by the trial-and-error method.
6. The solution was filtered and evaporated to get dry and solid sodium chloride.
7. A pinch of the common salt was taken in a test tube and dissolved in water. Then a few drops of silver nitrate solution were added to the test tube. The cloudy white precipitate was formed indicating the presence of chloride salt.

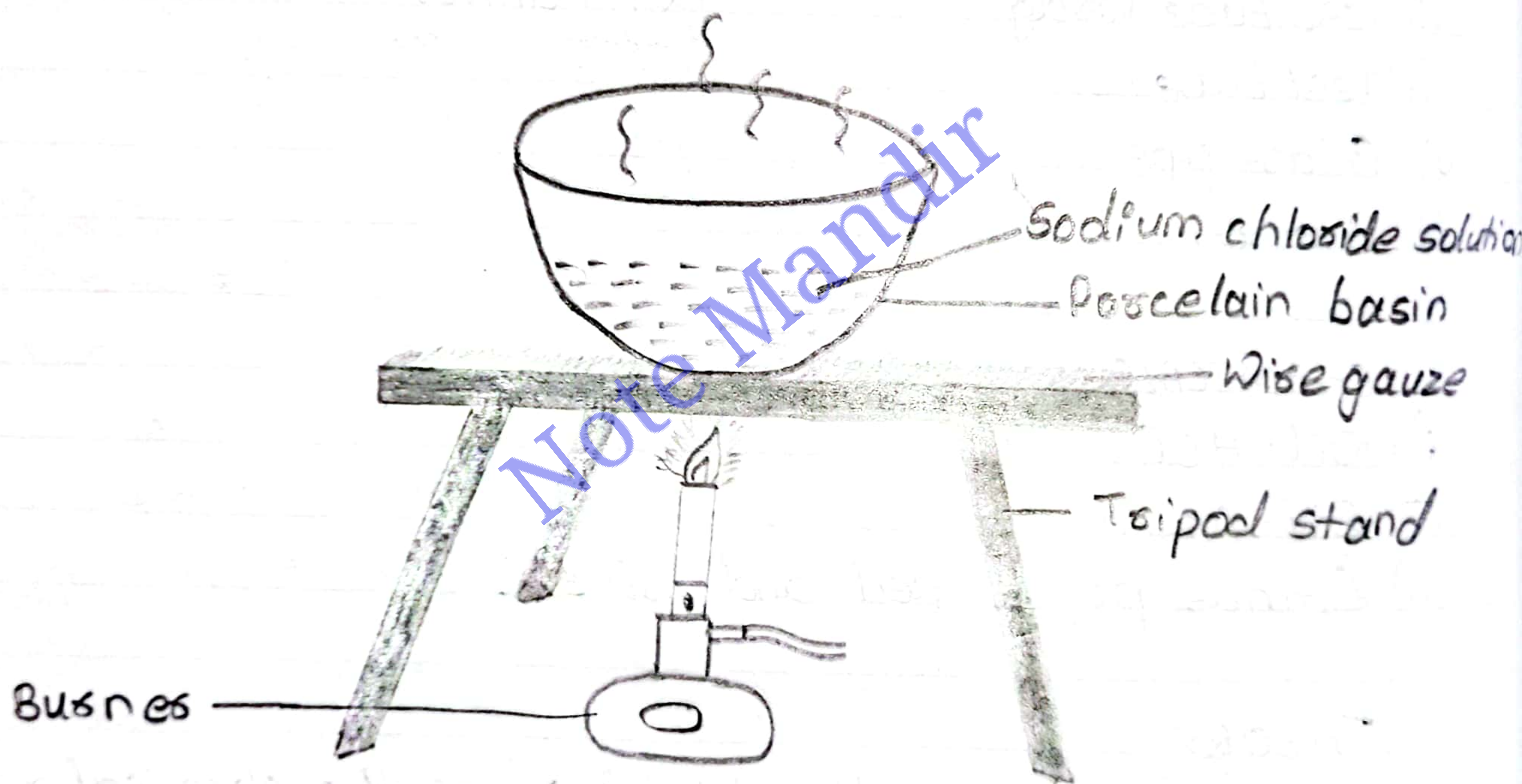
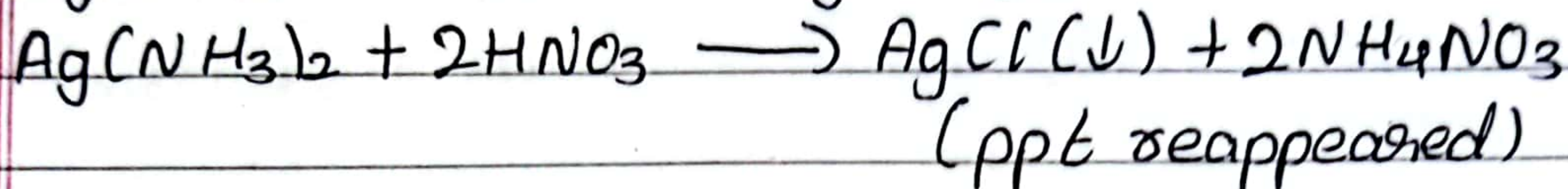
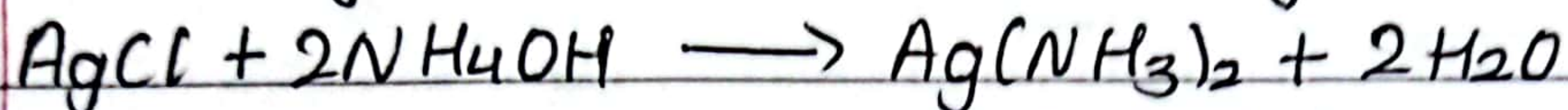
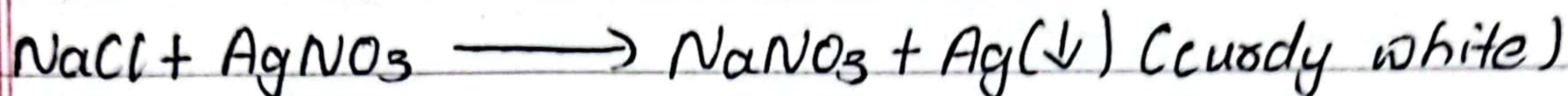


fig:- Evaporation of Common Salt Solution

OBSERVATION TABLE

Experiment	Observation	Inference
1. A few drops of the mixture solution were introduced on blue and red litmus paper.	1. Blue litmus paper turned into red.	1. The solution was acidic.
2. After adding few drops of NaOH the mixture was introduced on red and blue litmus paper.	2. Blue litmus was not affected but red litmus turned into blue.	2. The solution was basic.
3. After adding few drops of HCl, the mixture was introduced on blue and red litmus paper.	3. Both blue and red litmus paper were not affected.	3. The solution was neutral.
4. The salt solution was treated with a few drops of AgNO_3 solution.	4. Curdy white ppt. was formed.	4. Presence of ion chloride was observed.

REACTION INVOLVED



RESULT

NaCl salt is prepared by the neutralization of NaOH solution and HCl solution.

CONCLUSION

Any salt can be prepared by the neutralization of corresponding acid and base.

PRECAUTION

1. The mixture should be completely neutral.
2. Separate test tubes and glass pipes should be used for acid and base.
3. All the glass wares should be handled with care.

EXPERIMENT NO. 7

24

NAME OF EXPERIMENT: TO PREPARE CARBONDIOXIDE GAS
AND STUDY ITS PROPERTIES

APPARATUS REQUIRED

- | | |
|--------------------|---------------------------|
| a. Woulfe's bottle | e. Cocks with single base |
| b. Thistle funnel | f. Test tube |
| c. Gas jar | |
| d. Delivery tube | |

CHEMICALS REQUIRED

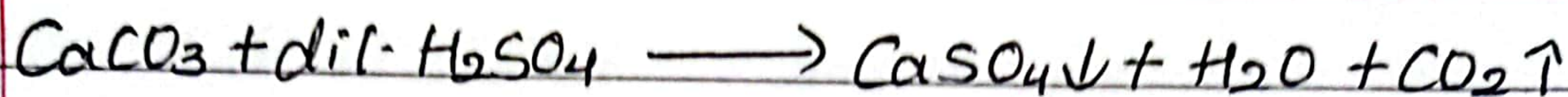
- | | |
|------------------|-----------------|
| a. Marble pieces | d. Litmus paper |
| b. Dil. HCl | |
| c. Mg ribbon | |

THEORY

Carbonates are decomposed by dilute acid liberating CO_2 gas. In a laboratory CO_2 gas is prepared by the action of dilute hydrochloric acid on marble (calcium carbonate).



Since carbondioxide is partially soluble in water & heavier than air, it is collected by upward displacement of air. Dilute sulphuric acid is not used because insoluble CaSO_4 formed, forms an impervious coat over the surface of marble & prevents further reaction.



PROCEDURE

- i) Some pieces of calcium carbonate was added into a clean woulfe's bottle.
- ii) Thistle funnel and delivery tube were fitted as shown in figure.
- iii) Airtightness of the apparatus was checked.
- iv) Dilute hydrochloric acid was added into the woulfe's bottle with the help of thistle funnel so that acid layer covered the piece of marble and end of the thistle funnel dipped into the acid.
- v) Reaction took place at ordinary temperature and CO_2 gas was formed with effervescence.
- vi) The gas was collected into a gas jar by the upward displacement of air.

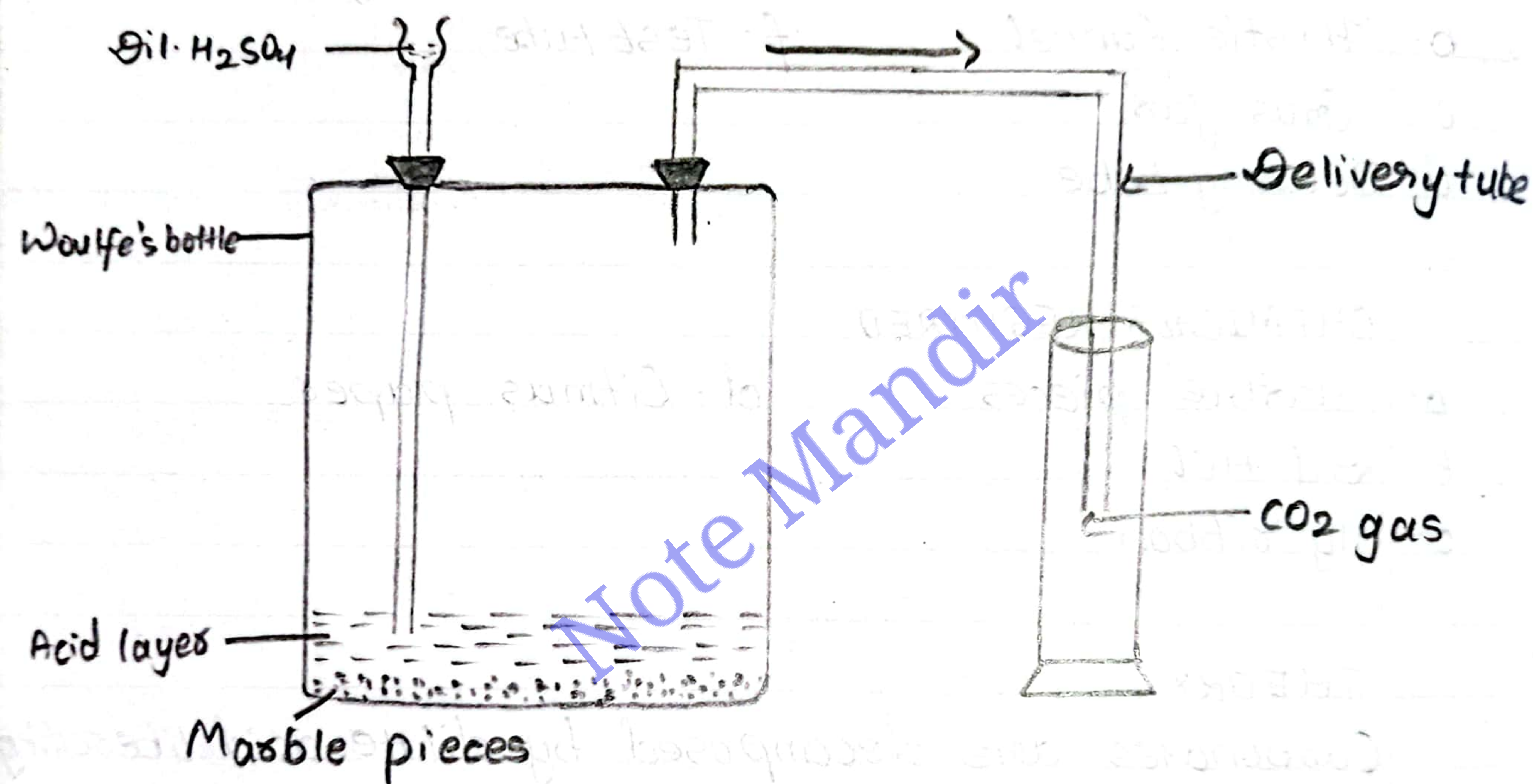


fig:- Preparation of carbon dioxide in the laboratory

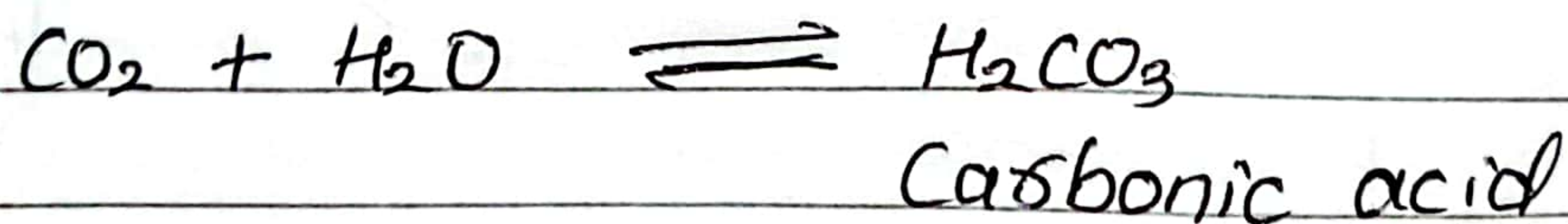
OBSERVATION TABLE:

Experiment	Observation	Inference
1. Colour & odour of gas was noted	The gas has no colour & odour	CO_2 gas is colourless & odourless
2. Moist blue & red litmus papers were introduced into the jar filled with CO_2 gas	Blue litmus paper turns to faint red but red litmus paper remains unchanged.	CO_2 gas is weakly acidic in nature
3. Burning match stick was introduced into the gas jar full of CO_2 gas.	The burning match stick extinguishes & gas does not burn.	CO_2 gas is neither combustible nor a supporter of combustion
4. A test tube filled with CO_2 gas inverted over water in a trough & shaken up & down.	The water level inside the tube slightly rises	CO_2 gas is slightly soluble in water.
5. A burning Mg ribbon was introduced into gas jar full of CO_2 .	Magnesium ribbon continues to burn forming white compound with black stain.	CO_2 gas supports the combustion of Mg forming magnesium oxide & carbon.

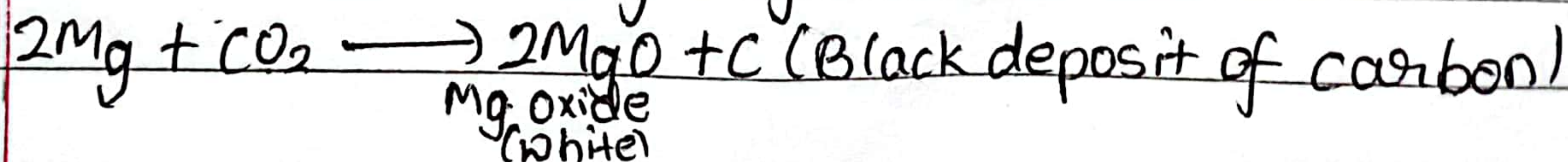
6. (a) CO_2 gas was passed into a test tube containing freshly prepared lime water till saturation. Lime water turns milky which on excess passing of CO_2 becomes colourless. Due to the formation of white ppt. of CaCO_3 & colourless solution of $\text{Ca(HCO}_3)_2$.
- (b) The colourless milky solution obtained in (a) was heated. Calcium bicarbonate decomposes into CaCO_3 on heating.
7. A test tube was filled with CO_2 gas. 2-3 drops of test tube rises up. CO_2 gas is an absorbent of gas. Strong alkali dil. NaOH was added into the test tube & shaken well.

REACTION INVOLVED

i) Action with water



ii) Action with burning Mg ribbon



EXPERIMENT NO-8

29

NAME OF EXPERIMENT: TO PREPARE HYDROGEN GAS
AND STUDY ITS PROPERTIES

APPARATUS REQUIRED

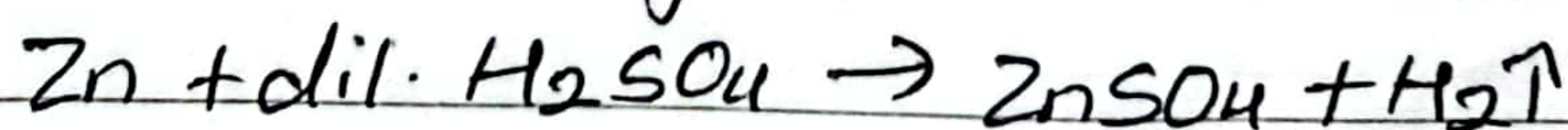
- | | |
|--------------------|---------------------------|
| a. Woulfe's bottle | e. Beehive shelf |
| b. Thistle funnel | f. Delivery tube |
| c. Gas jar | g. Cocks with single bore |
| d. Water trough | h. Test tube |

CHEMICALS REQUIRED

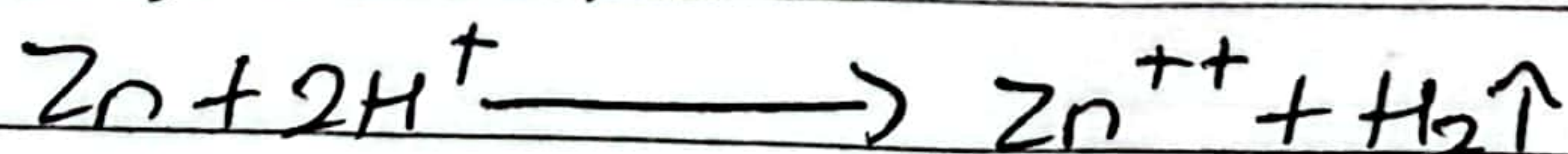
- Zinc pieces
- Dilute H_2SO_4
- Litmus papers
- Acidified $KMnO_4$, $K_2Cr_2O_7$ and $FeCl_3$

THEORY

Metals like Mg, Ca, Al, Zn etc which are above hydrogen in the electrochemical series react with dilute mineral acids like HCl and H_2SO_4 to evolve hydrogen gas. In the laboratory hydrogen gas is prepared by the action of dilute sulphuric acid on granulated zinc. Infact it is a redox reaction where zinc is oxidized by H_2SO_4 .



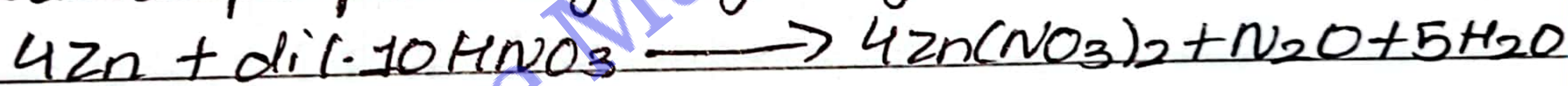
Ionic reaction,



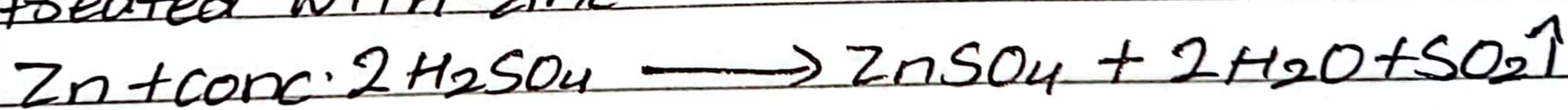
The newly produced hydrogen in situ is called nascent hydrogen. During this reaction, first nascent hydrogen is formed which is being very reactive can't exist in free state and it combines to form molecular hydrogen.

Hydrogen gas is lighter than air and very slightly soluble in water. Therefore it is collected by the downward displacement of water.

Nitric acid (both dilute and conc.) acts as powerful oxidant. It oxidises nascent hydrogen into water and gives oxide of nitrogen. So it is not used to prepare hydrogen gas.



Concentrated sulphuric acid evolves SO_2 gas when treated with zinc.



PROCEDURE

1. Pieces of granulated zinc ~~in a~~ was added in a clean Woulfe's bottle.
2. A thistle funnel was adjusted in one opening and a delivery tube in another opening of the Woulfe's bottle fitted with cork.
3. One end of the delivery tube was inserted into a bee-hive shelf of water trough as shown in the figure and the apparatus were made perfectly airtight.
4. Dil. H_2SO_4 was added into the thistle funnel to cover zinc pieces of the round bottomed flask and to immerse tip of the thistle funnel in acid solution.
5. The gas bubbles were allowed to escape for 2-3 minutes from the tip of the delivery tube dipped in water trough because it is impure hydrogen mixed with air of the Woulfe's bottle.
6. An inverted water filled gas jar was placed on the beehive shelf in the trough and the pure hydrogen gas was collected by the downward displacement of water.

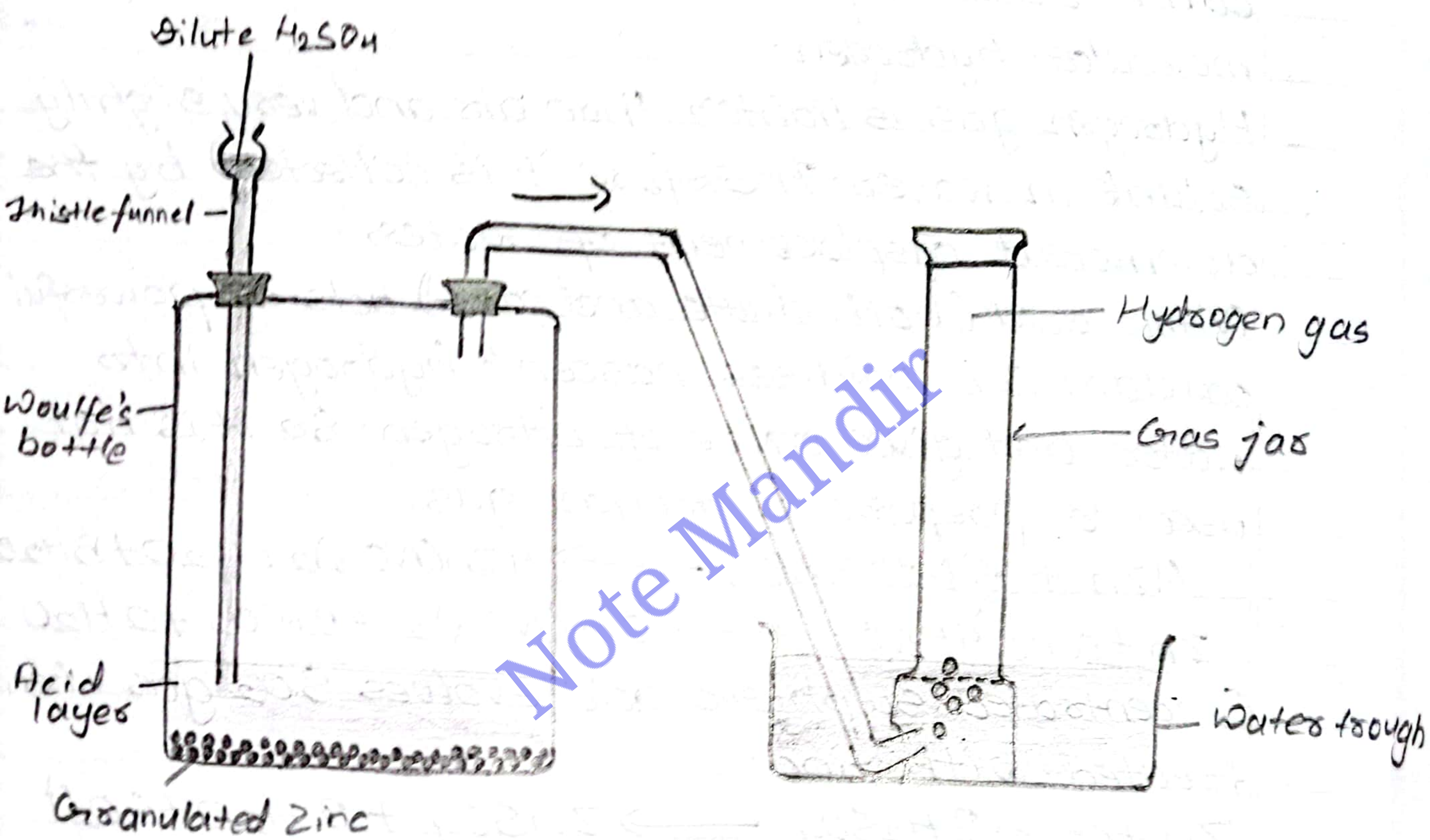


Fig: Preparation of hydrogen gas in the laboratory

OBSERVATION TABLE

Experiment	Observation	Inference
1. Colour and odour test	Colour and odour of the gas was observed	The gas had no colour and odour. Hydrogen gas is colourless & odourless.
2. Litmus paper test	The moist red and blue litmus papers were introduced into the jar of hydrogen.	No change was seen in the colour of litmus. Hydrogen gas is neutral towards litmus.
3. Combustibility test	A burning match stick was introduced into the jar filled with hydrogen gas	The burning match stick extinguished but the gas supported combustion with a blue flame.
4. Solubility test	A test tube filled with hydrogen gas was inverted over water in a trough.	There was no rise in water level inside the test tube. H_2 gas is almost insoluble in water.

5. Pop sound test

In a test tube filled with hydrogen, a test tube was inverted mouth to mouth and the upper tube was ignited. The gas in the upper tube burns with pop sound. H_2 gas is lighter than air. It is oxidised with O_2 of air and it is a reducing agent.

6. Comparative properties of molecular and nascent hydrogen

6. Reaction with acidified $KMnO_4$ solution

a) Pass Hydrogen gas was passed into acidified potassium permanganate solution. No change in colour. Molecular hydrogen can't reduce acidified $KMnO_4$ solution.

b) Small pieces of zinc was added into the above acidified solution of $KMnO_4$. Pink colour of acidified $KMnO_4$ was discharged in few minutes. Nascent hydrogen can reduce acidified $KMnO_4$ into colourless $MnSO_4$.

7. Reaction with acidified $K_2Cr_2O_7$ solution.

a) Hydrogen gas was passed into $K_2Cr_2O_7$ solution acidified with dil. H_2SO_4 . No change in colour. Ordinary molecular hydrogen can't reduce acidified $K_2Cr_2O_7$.

b) Some pieces of zinc was added into the above acidified $K_2Cr_2O_7$ solution. Orange red colour of acidified $K_2Cr_2O_7$ is reduced to green colour.

acidified solution of $K_2Cr_2O_7$.

changed into light green colouration in few minutes.

acidified $K_2Cr_2O_7$ into $Cr_2(SO_4)_3$

8. Reaction with acidified $FeCl_3$ solution

a) Hydrogen gas was passed into the $FeCl_3$ solution acidified with dil. HCl

No change in colour.

Molecular hydrogen can't reduce acidified $FeCl_3$ solution.

b) Small pieces of zinc Reddish yellow colour of acidified $FeCl_3$ was added into the above acidified solution changed into light greenish of $FeCl_3$.

greenish yellow coloured on immediately. $FeCl_2$.

REACTION INVOLVED

i) Action with acidified $KMnO_4$ solution

a. $KMnO_4 + \text{dil. } H_2SO_4 + H_2 \longrightarrow \text{No action}$

b. $Zn + \text{dil. } H_2SO_4 \longrightarrow ZnSO_4 + 2[H]$ 5

$KMnO_4 + \text{dil. } 3H_2SO_4 + 10[H] \longrightarrow K_2SO_4 + 2MnSO_4 + 8H_2O$

$5Zn^0 + 2KMn^{+7}O_4 + 8H_2SO_4 \longrightarrow 5Zn^{+2}SO_4 + K_2SO_4 + 2Mn^{+2}SO_4 + 8H_2O$
 pink colourless

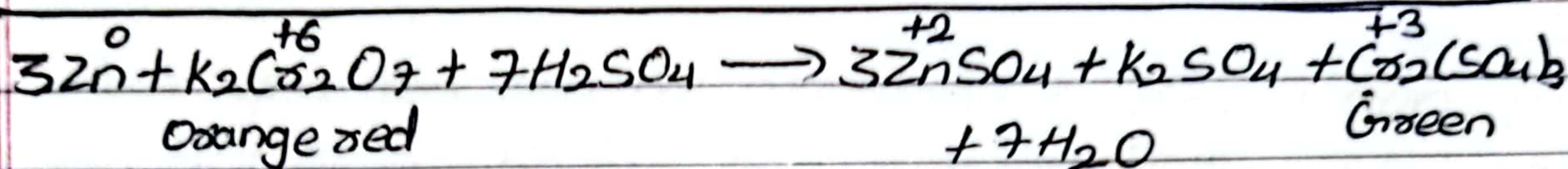
Ionic equation: $2MnO_4^- + 16H^+ + 5Zn \longrightarrow 2Mn^{++} + 8H_2O + 5Zn^{++}$

i) Action with acidified $K_2Cr_2O_7$ solution

a. $K_2Cr_2O_7 + \text{dil. } H_2SO_4 + H_2 \longrightarrow \text{No action}$

b. $Zn + \text{dil. } H_2SO_4 \longrightarrow ZnSO_4 + 2[H]$

$K_2Cr_2O_7 + \text{dil. } 4H_2SO_4 + 6[H] \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O$



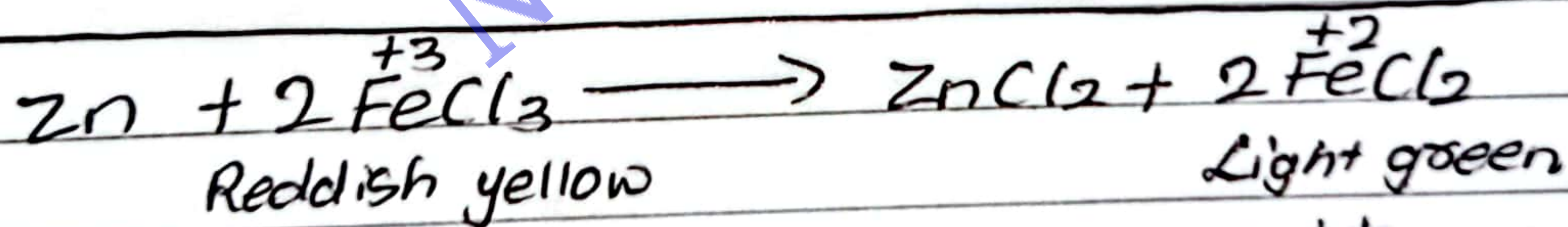
Ionic equation: $Cr_2O_7^{--} + 14H^+ + 3Zn \longrightarrow 2Cr^{+++} + 7H_2O + 3Zn^{++}$

iii) Action with acidified $FeCl_3$ solution

a. $FeCl_3 + \text{dil. } HCl + H_2 \longrightarrow \text{No action}$

b. $Zn + \text{dil. } 2HCl \longrightarrow ZnCl_2 + 2[H]$

$FeCl_3 + [H] \longrightarrow FeCl_2 + HCl$



Ionic equation: $2Fe^{+++} + Zn \longrightarrow 2Fe^{++} + Zn^{++}$

RESULT

Hydrogen gas is prepared in the lab and its properties are studied.

CONCLUSION

Hydrogen gas can be prepared by the action of dil. HCl or dil. H_2SO_4 on electropositive metals.

PRECAUTIONS

1. The apparatus should be completely airtight before the gas is prepared.
2. Air present inside the apparatus should be removed completely by displacing it with the gas and then only the gas is collected in the gas jar.

EXPERIMENT NO. 9

NAME OF EXPERIMENT: TO DETERMINE THE EQUIVALENT MASS OF THE GIVEN ACTIVE METAL BY HYDROGEN DISPLACEMENT METHOD.

APPARATUS REQUIRED

- | | |
|--------------------|-----------|
| a. Eudiometer tube | c. Funnel |
| b. Stand | d. Beaker |

CHEMICALS REQUIRED

- a. Dil. H_2SO_4
b. Mg piece (0.02 gm)

THEORY

The equivalent mass of metals is defined as the number of parts by mass of the metal that can displace 1.008 parts by mass of hydrogen or can combine with 8 parts by mass of oxygen or 35.5 parts by mass of chlorine.

In this method, a known mass of the given metal is reacted completely with 5% dil. HCl or dil. H_2SO_4 as



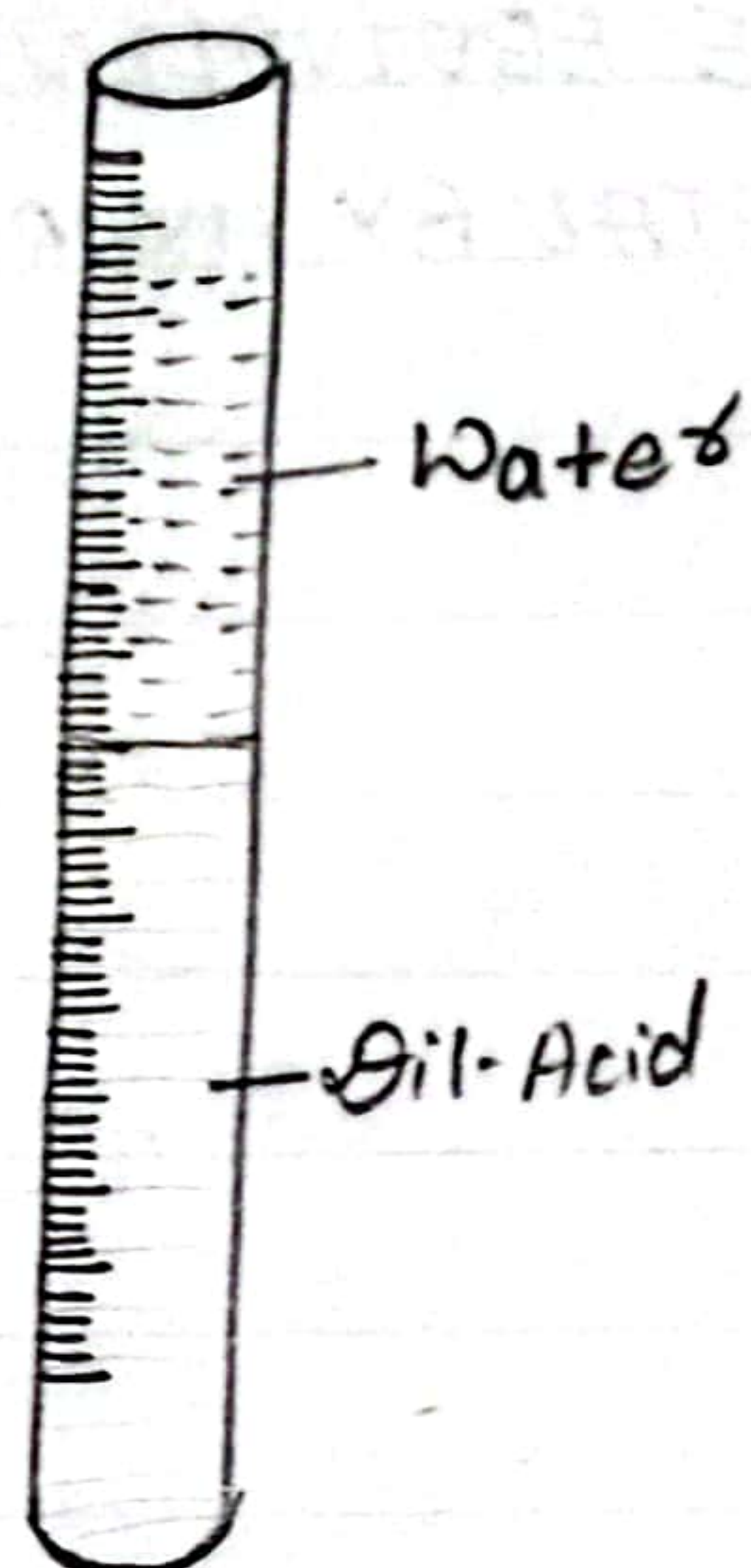
The law of chemical equivalence states that the ratio of masses of elements combines or displaces with each other is in the ratio of their equivalent masses.

i.e.
$$\frac{\text{Equivalent mass of a metal}}{\text{Equivalent mass of hydrogen}} = \frac{\text{Mass of metal}}{\text{Mass of hydrogen}}$$

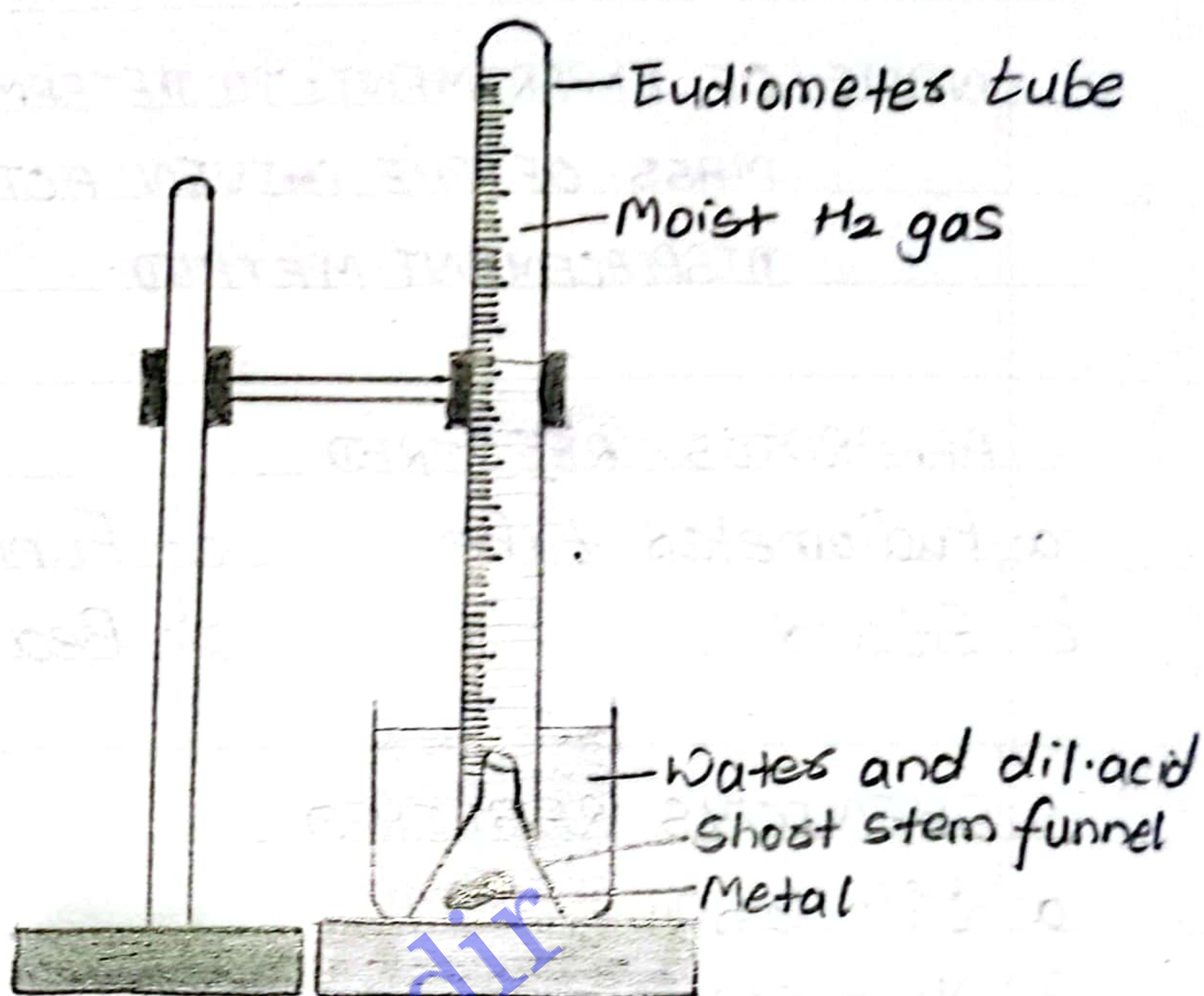
∴
$$\text{Equivalent mass of metal} = \frac{\text{Mass of metal}}{\text{Mass of hydrogen}} \times 1.008$$

PROCEDURE

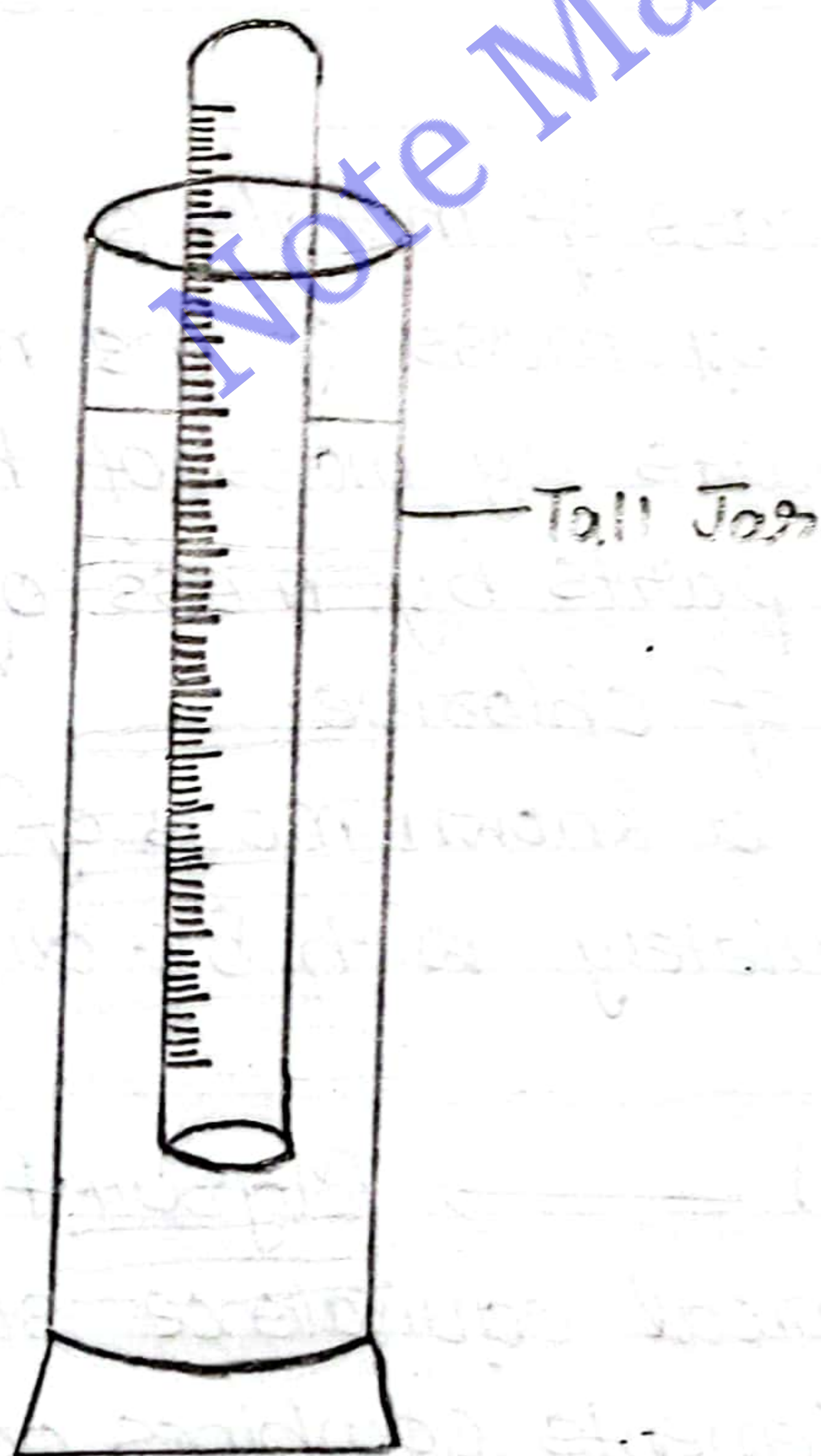
1. The surface of the piece of the given metal foil was cleaned by means of sand paper and weight it out accurately, the given strip of foil metal was made semicircular and then it was placed in a beaker covered with a funnel. The water poured in the beaker so as to dip the stem completely under water.
2. The eudiometer tube was filled with dil. H_2SO_4 and little amount of water in it and closed the mouth of it by finger or thumb and inverted it vertically over the stem of funnel inside water.
3. Hydrogen gas was collected in the eudiometer tube by the downward displacement of water.
4. After complete reaction, Eudiometer was taken out by closing the mouth tightly with thumb and the tube was inserted in the tall jar containing water in an inverted position.
5. The temperature of the tall jar was recorded.
6. The atmospheric pressure and aqueous tension was noted.



(a) Eudiometer tube



(b) Collection of hydrogen gas in Eudiometer tube



(c) Equalizing hydrogen gas of Eudiometer in tall jar

Fig.: Determination of equivalent weight of metal by hydrogen displacement method

7. The moist volume of H_2 was converted to dry volume at NTP and the mass of hydrogen was calculated.
8. Finally, the equivalent mass of the metal was calculated.

OBSERVATION

The mass of metal = 0.02g

For lab condition

$$\text{Temperature } (T_1) = 18^\circ\text{C} + 273\text{K} = 291\text{K}$$

$$\text{Pressure of moist hydrogen } (P) = 745 \text{ mm of } H_2$$

$$\text{Aqueous tension } (f) = 15.38$$

$$\begin{aligned} \text{Press of dry hydrogen } (H_2) (P_1) &= P - f \\ &= 745 - 15.38 = 729.62 \end{aligned}$$

$$\text{Volume of hydrogen } (V_1) = ?$$

At STP

$$\text{Volume of dry } H_2 (V_2) = ?$$

$$\text{The temperature } (T_2) = 273\text{K}$$

$$\text{The pressure } (P_2) = 760 \text{ mm of Hg}$$

From the combined gas law,

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$V_2 = \frac{P_1 V_1}{T_1} \times \frac{T_2}{P_2} = \frac{729.62 \times 28.7}{291} \times \frac{273}{760}$$

$$= 25.8484 \text{ ml}$$

Now,

$$\begin{aligned} \text{The mass of hydrogen gas displaced} &= 25.8484 \times 0.00009 \\ &= 2.3 \times 10^{-3} \text{ gm} \end{aligned}$$

Finally,

$$\text{Equivalent weight of metal} = \frac{0.02}{2.3 \times 10^{-3}} \times 1.008$$
$$= 8.763 \text{ gm}$$

Ex 806

$$\% \text{ error} = \left| \frac{8.763 - 12}{12} \times 100 \right|$$
$$= 26.975\%$$

RESULT

The equivalent mass of given piece of metal is found to be

CONCLUSION

Hence, the equivalent mass of the metal above hydrogen in the electrochemical series can be determined by hydrogen displacement method.

EXPERIMENT NO. 10

NAME OF EXPERIMENT: TO CARRY OUT THE ELECTROPLATING OF COPPER METAL ONTO IRON WIRE.

APPARATUS REQUIRED

- | | |
|--------------------------------|----------------|
| a. Beakers | c. Iron wire |
| b. Copper plate or copper wire | d. D.C battery |

CHEMICALS REQUIRED

- a. Copper sulphate solution
b. Dilute sulphuric acid

THEORY

Electrolysis is the process of decomposition of electrolyte in its molten or solution phase by passing electric current in a voltametric set up.

Electrodes are the metallic strips or wire connected to conduct electrochemical reaction.

Electrolytes are chemical substance which undergo ionization to give cations & anion.

Dissociation of electrolyte



In presence of electric field anions go to anode & cations go to cathode. Meanwhile oxidation takes place at anode and reduction takes place at cathode. At anode, copper gets oxidized forming copper ions.

At cathode, copper ions get reduced to metallic copper which gets deposited over iron. As the copper ions are generated at anode and migrate to cathode to get deposition by reduction, anode goes on decaying, cathode goes on thickening keeping the electrolyte concentration constant.

The reaction takes place as follows.

Reaction with anode: $\text{Cu} \rightarrow \text{Cu}^{++} + 2\text{e}^-$

Reaction with cathode: $\text{Cu}^{++} + 2\text{e}^- \rightarrow \text{Cu}$

PROCEDURE

1. A beaker with acidified copper sulphate solution was taken. (About 200ml of copper sulphate solution was put and about half test tube dil. H_2SO_4 was added).
2. Copper metallic plate at anode and iron strip at cathode was dipped.
3. Anode was connected to the positive terminal of circuit and cathode was connected to the negative terminal of the circuit.
4. 12V DC supply battery was allowed applied and the electric circuit was completed.
5. The process of electrolysis was allowed for 15 min to 30 min.
6. The setup was disassembled when reaction was thought to be over.

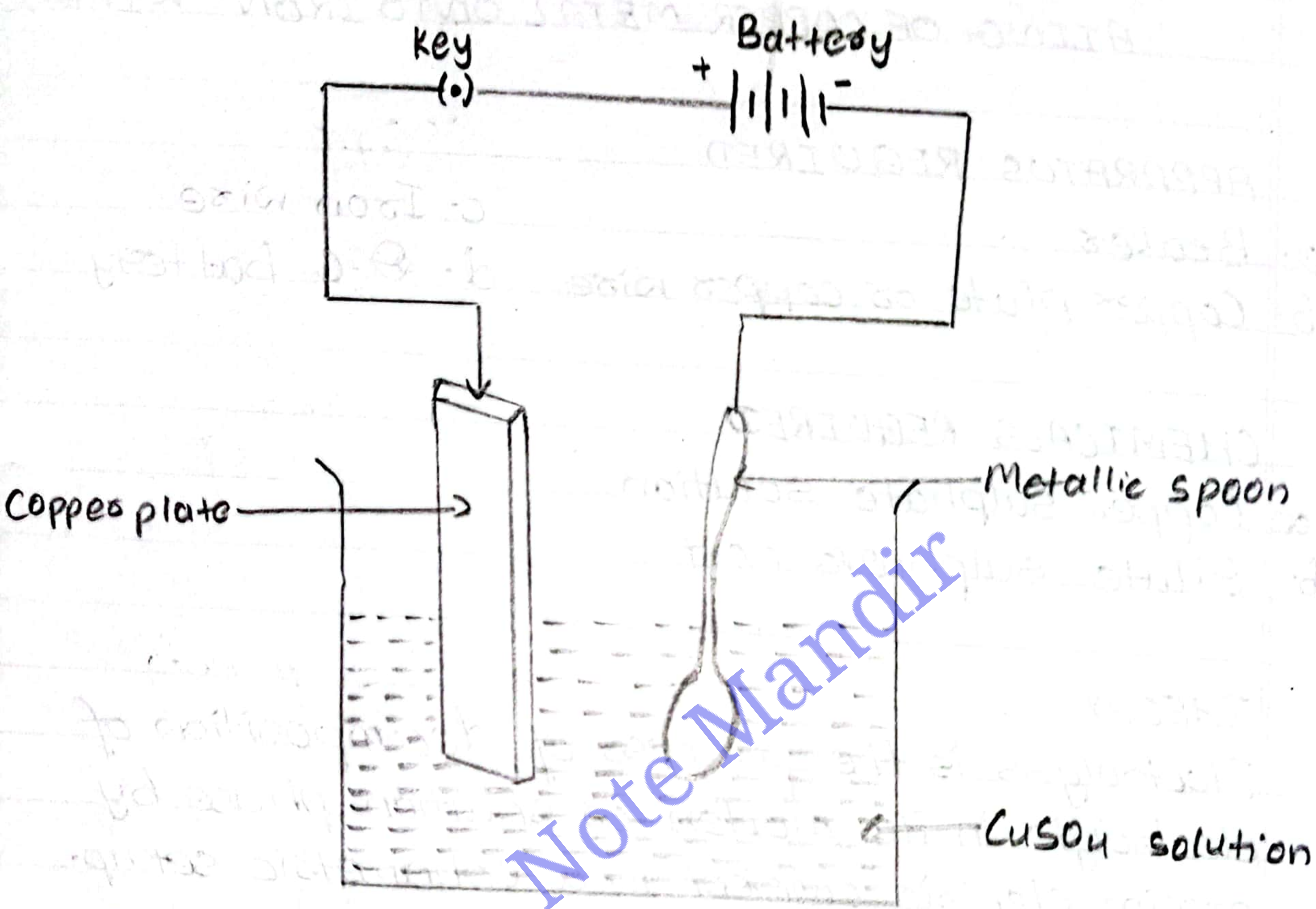


Fig:- Electroplating

OBSERVATION

Copper coating over iron strip can be observed. Take weight of anode and cathode before and after the electrolysis. Then calculate the difference to determine the amount of copper lost from anode and amount of copper deposited over the cathode.

RESULT

Copper is successfully coated over the iron by electrolysis process.

CONCLUSION

Metallic coating can be performed by electrolysis. Electroplating is very useful technique to coat one metal over another to show attractive impression or to protect from corrosion.

PRECAUTION

1. Only DC supply should be used for electrolysis.
2. Electric circuit should be connected properly.
3. Copper sulphate solution should be acidified.
4. Electrolyte should be the salt of anode material.

EXPERIMENT NO. 11

44

NAME OF EXPERIMENT: TO PREPARE AMMONIA GAS (NH_3) AND STUDY ITS PROPERTIES

APPARATUS REQUIRED

- | | |
|-------------------------|--------------------------|
| a. Round bottomed flask | e. Tripod stand |
| b. Delivery tube | f. Wire gauze |
| c. Gas jar | g. Cork with single bore |
| d. Burner | h. Stand with clamps |

CHEMICALS REQUIRED

- a. Slaked lime b. Ammonium chloride

THEORY

Ammonia gas can be obtained by heating any ammonium salt (sal ammoniac) with alkali. In laboratory it is prepared by heating mixture of ammonium chloride with slaked lime in 1:3 ratio.



Ionic reaction:



As ammonia gas is lighter than air and highly soluble in water it is collected by the downward displacement of air. If required in dry condition it is passed through a tower containing quick lime (CaO). Solid NH_4Cl may sublime on heating, so paste of NH_4Cl is used.

PROCEDURE

1. Mixture of ammonium chloride (1 part) and slaked lime (3 parts) in a sound bottle was taken in a round bottom flask.
2. Little amount of water was added to make paste.
3. The whole apparatus was fitted as shown in figure.
4. The flask was heated gently and ammonia gas was formed and it was collected by the downward displacement of air.

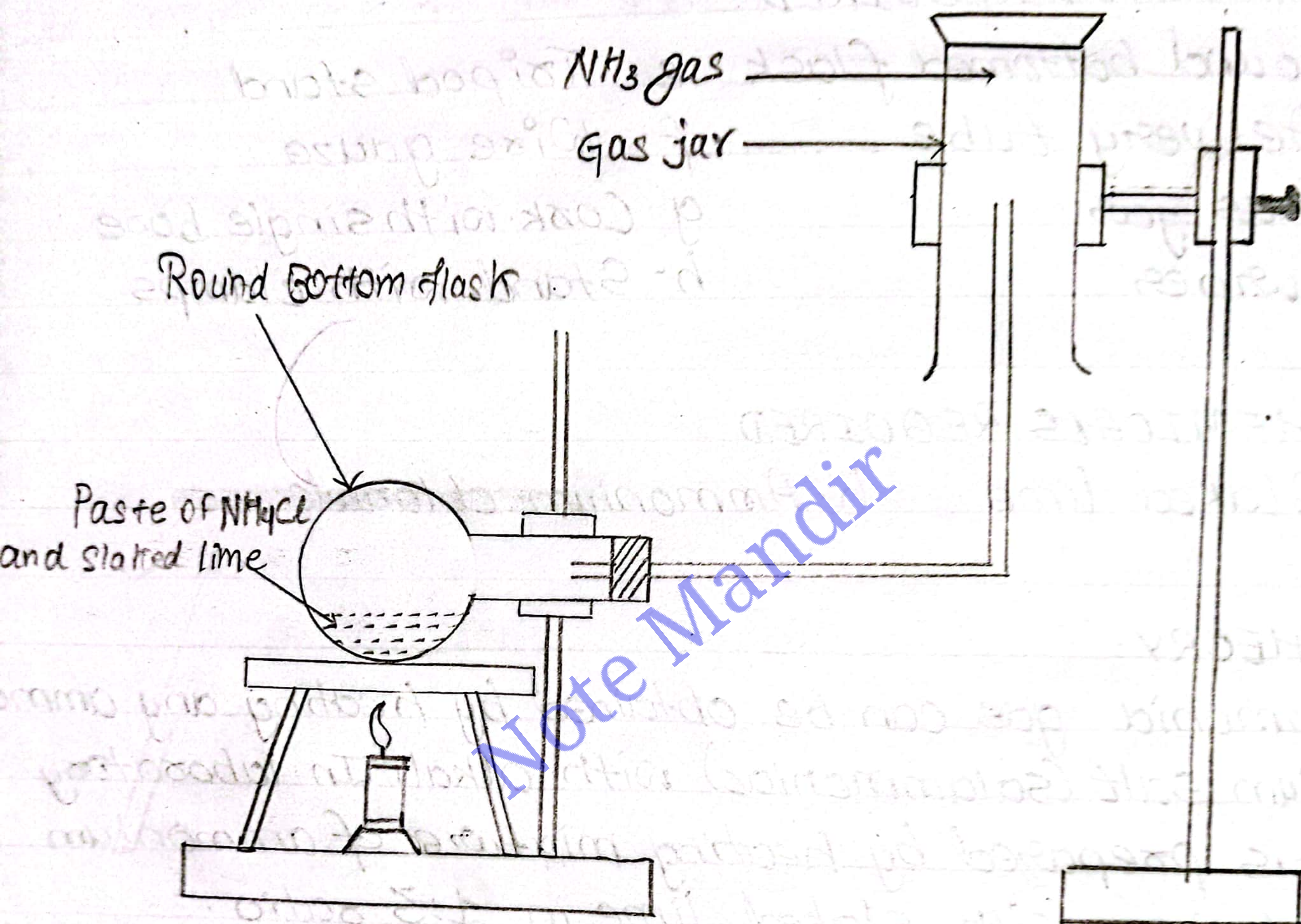


Fig:-Laboratory preparation of ammonia gas

OBSERVATION TABLE

Experiment	Observation	Inference
1. Colour and odour test Note Colour and odour of the gas was noted.	The gas had no colour but sharp pungent odour.	Ammonia is a colourless gas having sharp pungent odour.
2. Combustibility test A burning match stick was introduced into the gas jar filled with ammonia.	The burning match stick extinguished.	NH_3 gas is non combustible and non supporter of combustion.
3. Solubility test A test tube filled with ammonia was inverted in a trough filled with water.	Solution level rose in the test tube.	NH_3 gas is highly soluble in water.
4. Test with indicators		
a. Moist red and blue litmus paper was introduced into the gas jar and blue litmus paper remained unchanged.	The red litmus paper turned blue.	NH_3 gas is alkaline in nature.
b. Add 1-2 drops of phenolphthalein was added into a test tube filled with ammonia gas.	Phenolphthalein turned pink.	NH_3 gas is alkaline in nature.

5. Action with HCl

Conc. HCl was taken in a glass tube and brought near the tip of the delivery tube of ammonia gas generator.

Dense white fumes evolved.

Due to the formation of white colloidal particles of ammonium chloride in air.

6. Action with FeSO_4 solution

Few drops of ammonia solution was added into about 1cc FeSO_4 solution taken in a test tube.

Dirty green precipitate was formed.

Due to formation of ferrous hydroxide.

7. Action with CuSO_4 solution

About 1cc of CuSO_4 solution was treated with few drops of ammonia solution and then with excess of ammonia solution.

Bluish white precipitate was formed which dissolved into deep blue coloured solution.

Due to formation of cupric hydroxide of tetra amine cupric complex.

8. Action with FeCl_3 sol.

Few drops of ammonia solution was added into FeCl_3 solution taken in a test tube.

A brown precipitate was formed.

Due to formation of ferric hydroxide.

9. Action with $ZnSO_4$ solution

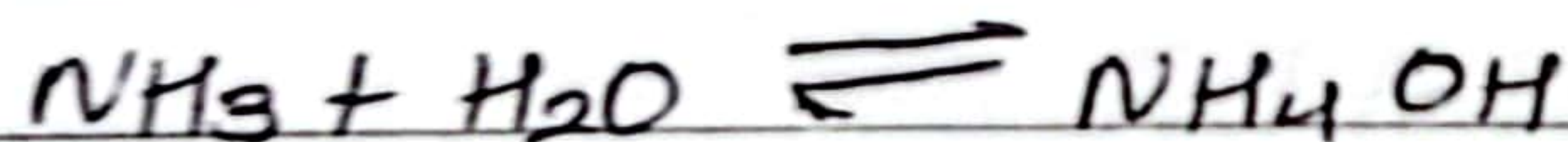
About 1cc of $ZnSO_4$ solution was treated with few drops of ammonia solution and then with excess amount.	Gelatinous white precipitate formed which dissolved in excess of ammonia solution.	Due to formation of zinc hydroxide. Due to formation of tetra amine zinc complex.
--	--	---

10. Action with Nessler's reagent.

1-2 drops of Nessler's reagent was added into the ammonia solution taken in a test tube.	Reddish brown precipitate was formed.	Due to formation of iodide of Million's base.
--	---------------------------------------	---

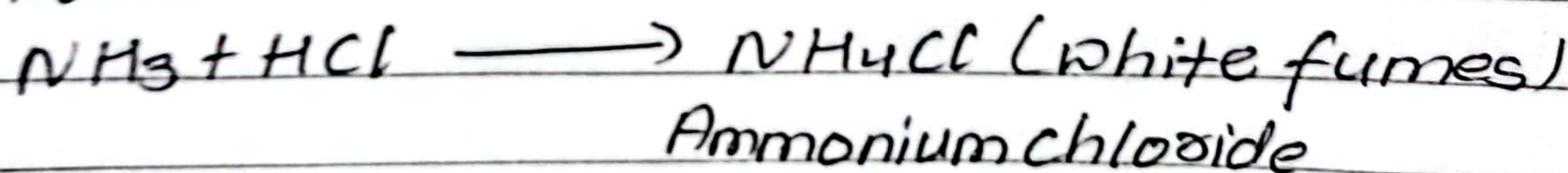
REACTION INVOLVED

i) Action with water (solubility)



Ammonium hydroxide

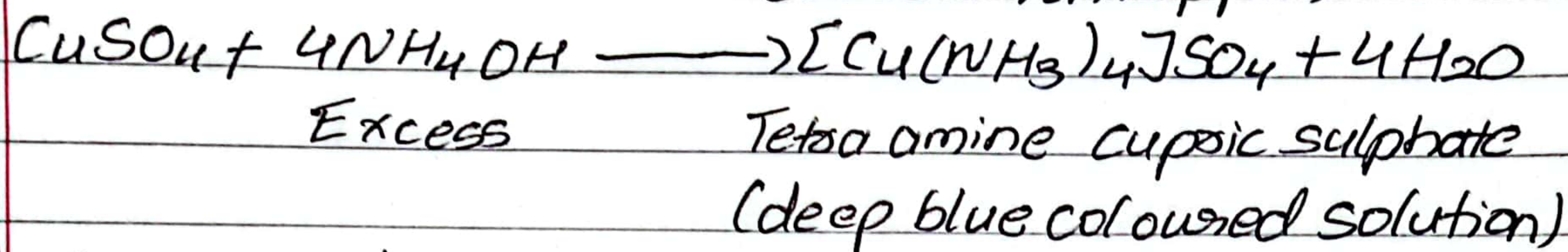
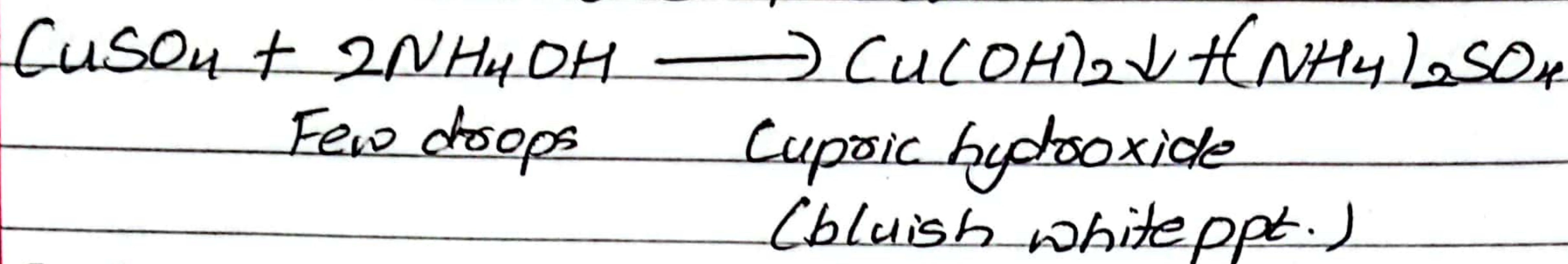
ii) Action with conc. HCl



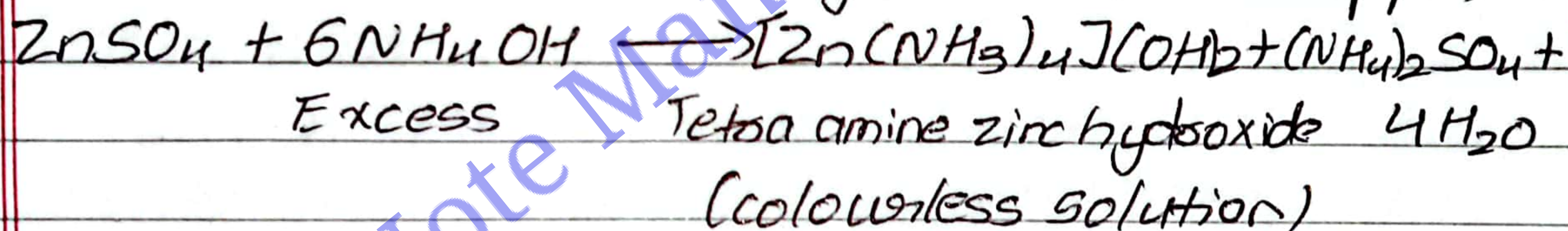
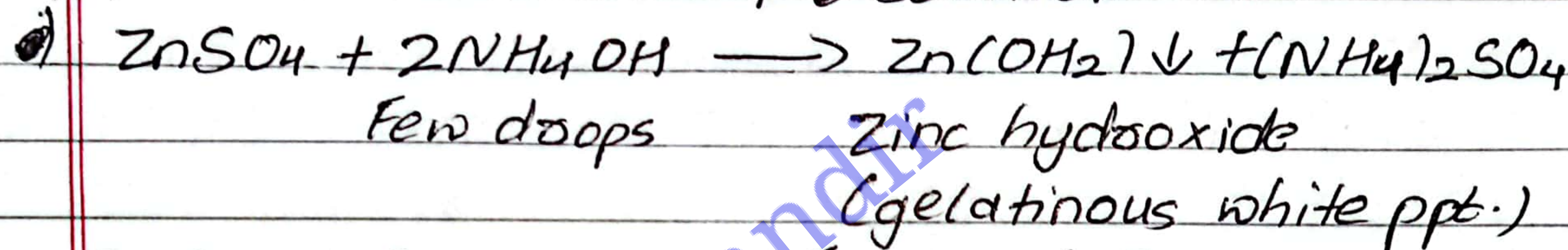
Ammonium chloride

iii) Action with $FeSO_4$ solutionFerrous hydroxide
(dirty green ppt.)

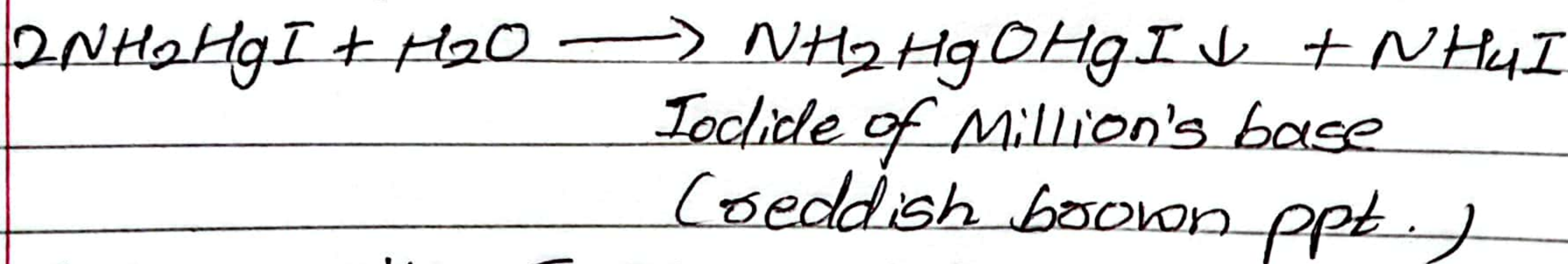
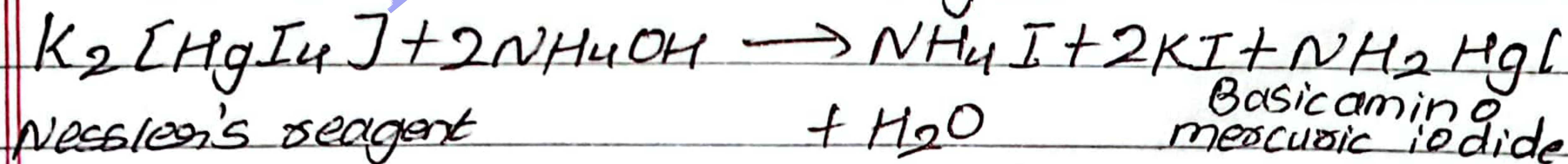
iv) Action with CuSO_4 solution



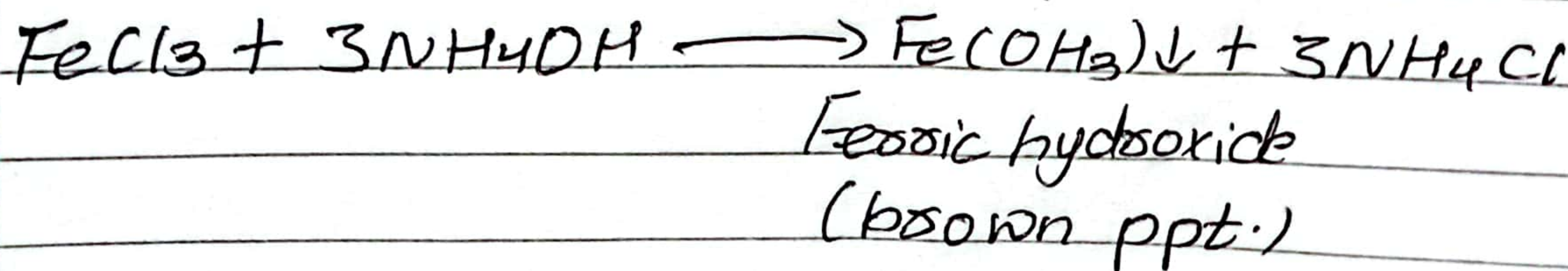
v) Action with $ZnSO_4$ solution



v) Action with Nessler's reagent



vi) Action with FeCl_3 solution



RESULT:

Ammonia gas was prepared by heating the mixture of ammonium chloride and slaked lime and its properties were studied.

PRECAUTIONS

1. While fitting the apparatus round bottom flask should be inclined slightly.
2. More water should not be used for making paste.
3. All the glasswares should be handled with care.
4. The cork should be fitted tightly to the round bottom flask.
5. The edge of the delivery tube should be cut smoothly it and it should not be dipped into the reaction mixture.