Date

Expt. No. 1 Page No. 1

# PREPARATION OF LYOPHILIC AND LYOPHOBIC SOLUTION

**Principle :-** The lyophilic Sols are directly formed by mixing and shaking the substance with a suitable liquid lyophobic Sols cannot be prepared by direct mixing and shaking, Special methods are employed to prepare lyophobic Sols.

**Chemicals required**

1] Egg albumin
2] Sodium chloride Solution (5g in 100ml water)
3] Ferric chloride Solution (2g in 100ml water)
4] Aluminium chloride Solution (2g in 100ml water)
5] Starch 1 gram - 500 mg
6] Arsenious oxide (0.2g in 100ml water)

**Procedure :-**

A. Preparation of lyophilic Sol.

I Egg Albumin Sol

1] Prepare 100ml of 5% (w/v) Solution of NaCl in water in a 250ml beaker.
2] Break one egg in a porcelain dish

Teacher's Signature : _____

and pipette out the albumin and pour it is sodium chloride solution Stir well to ensure that the Sol is well prepared.

II Strach / gum Sol

1] Take 100ml of distilled water in a 250 ml beaker and boil it
2] Make a paste of 500mg Starch or gum in hot water and transfer this paste in 100ml of boiling water with constant Stirring cup Continue boiling and stirring for 10 minutes cool. ensure that Sol is well prepared.

B Preparation of lyophobic Sol

Ferric hydroxide / Aluminium hydroxide

1] Take 100ml of distilled water in a 250ml beaker and boil it
2] Add 2g of ferric chloride / aluminium chloride powders to boiling water and Stir it well.
3] Take 100ml of distilled water in another 250ml beaker and boil it
4] Pour 10ml of ferric chloride / aluminium chloride Solution prepared in Step (ii)

Teacher's Signature : _____

and transfer it into the boiling water with constant stirring keep the water boiling till brown/white Sol is obtained

## II Arsenious Sulphide Sol.

1] Take 100ml of distilled water in 250ml beaker
2] Add 0.2g of arsenious oxide to it and boil the content of the beaker
3] cool and filter the Solution.
4] Pass hydrogen sulphide ($H_2S$) gas through the filtered Solution till it attains the smell of $H_2S$ (use kipps apparatus to pass hydrogen sulphide gas)
5] Expel $H_2S$ gas from the Sol by slow heating and filter it
6] Label the filtrate as arsenious Sulphide Sol.



Teacher's Signature : _____

Equation:

$$Na_2S_2O_{3(aq)} + 2HCl_{(aq)} \rightarrow S_{(s)} + 2NaCl_{(aq)} + H_2O + SO_{2(g)}$$

Date

Expt. No. 2

Page No. 4

# EFFECT OF CONCENTRATION ON RATE OF REACTION

**Aim:** To study the effect of concentration on the rate of reaction between Sodium thiosulphate and hydrochloric acid.

**Principle:** Sodium thiosulphate solution reacts with dilute hydrochloric acid and forms a yellow percipitate of Sulphur the time taken for a certain amount of Sulphur to form can be used to indicate the rate of reaction.

**Apparatus and chemical required.**

100ml conical flask. 50ml measuring cylinder thermometer and a Stopcratch 0.1m Sodium thiosulphate Solution 1m hydrochloric acid

**Procedure:**

1) Five 100ml clean conical flasks are taken and labeled as 1,2,3,4,5

Teacher's Signature :

Date .....

Expt. No. 2 Page No. 5

2] 10ml of 0.05m Sodium thiosulphate Solution is taken in the conical flask labeled 1

3] 10ml of dilute hydrochloric acid is added and immediately stop clock is started

4] The flask is swirled to mix the Solution and placed on paper marked with a cross.

5] Marked cross is observed from the top. when the cross is just invisible time is noted.

6] Experiment is repeated by adding 10ml of Hcl to the conical flask 2,3,4,5 containing 10ml of different concentration of Sodium thiosulphate Solution as tabulated below.

Different concentration of Sodium thiosulphate Solution are made by mixing different volume of the Sodium thiosulphate Solution with water as shown in the table]

A graph is plotted between the concentration of Sodium thiosulphate and the time taken for the marked cross to become just invisible.

It is clear from the graph that

Teacher's Signature : _____

Date .....

Expt. No. 2 Page No. 6

rate of reaction between $Na_2S_2O_3$ and HCl decreases with the decrease in concentration of Sodium thiosulphate

Result:- Rate of reaction between Sodium thiosulphate and hydrochloric acid decrease with the concentration of Sodium thiosulphate.



Teacher's Signature : _____

Equation

$$Na_2S_2O_{3(aq)} + 2HCl \rightarrow S_{(s)} + 2NaCl_{(aq)} + H_2O_{(l)} + SO_{2(g)}$$

Date

Expt. No. 3 Page No. 7

# EFFECT OF TEMPERATURE ON RATE OF REACTION

**Aim:-** To Study effect of temperature on rate of reaction between Sodium thiosulphate and hydrochloric acid.

**Principle:-** The rate of reaction depends upon the temperature of the reaction generally rate of reaction increase with increase in temperature rate of reaction between Sodium thiosulphate and hydrochloric acid is studied by measuring the time taken for precipitation of Sulphur

Apparatus and chemical required

100ml conical flask 25ml and 10ml measuring cylinder wire gauze tripod stand thermometer and a stop watch 0.1m Sodium thiosulphate Solution and 1m Hydrochloric acid

Procedure

1. 50ml of 0.1m Sodium thiosulphate Solution

Teacher's Signature :

| SL NO | Temperature in °C | Time taken for the printing to become invisible (sec) |
|---|---|---|
| 1 | 30° | 166 |
| 2 | 40° | 84 |
| 3 | 50° | 62 |

is taken in a clean 100-ml conical flask and kept in thermostart of 30°c

2] 10 ml of 1m hydrochloric acid is added and immediatly stop clock is started

3] The flask is swirled to mix the Solution and placed on paper marked with a cross.

4] Marked cross is observed from top. when the cross is just invisible time is noted

5] Again 50ml of 1m Sodium thiosulphate Solution is taken in another clean 100ml conical flask the flask is kept in a thermistat at a temperature of the Solution is noted after placing it on a piece of printed paper Immediately 10ml of 1m HCl is added and a stop watch is started the time taken for the precipitation of Sulphur enough for to make printing on the paper just invisible is noted.

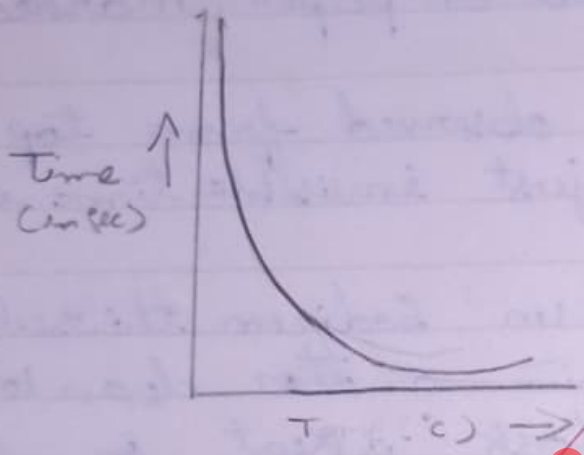
6] The same experiment is replated at 50°c and 60°c and using fresh Sodium thiosulphate Solution & HCl each time taken for paper mark to become just invisible is noted.

observation

Volume of 0.1m Sodium thiosulphate



Teacher's Signature : _____



Date .....

Expt. No. 3 Page No. 9

Solution taken each time = 50ml

Volume of 1M HCl added each time = 10ml

A graph between the time V/s temperature is plotted and from shape of the curve

Result:-

Rate of reaction between Sodium thiosulphate and hydrochloric acid increase with the increase in temperature.



Teacher's Signature : _____

Reaction.

$KNO_3 + aq \rightarrow KNO_3(aq)$

(or)

$CuSO_{4(s)} + aq \rightarrow CuSO_4(aq)$

Date

Expt. No. 11 Page No. 10

# DETERMNATION OF ENTHLPY OF SOLUTION

**Aim :-** To determine the enthalpy of Solution of potassium nitrate crystals of copper sulphate.

**Principle :-** A known amount of potassium nitrate dissolved in water the heat absorbed @ Evolved is experimentally determined Amount of heat absorbed @ evolved when one mole of potassium nitrate is dissolved in excess of the solvent at a given temperature is calculated. It gives the enthalpy of Solution.

**Apparatus and chemical required.**

Polythene bottle fited with thermometer potassium nitrate @. copper Sulphate crystals.

**Procedure.**

100 $cm^3$ of water is taken is a polythene bottle fitted with thermometer and stirrer about of

Teacher's Signature :

observation and calculation.

Initial temperature = $T_1 K$ = 301k
Final temperature = $T_2 K$ = 300k
change in temperature = $\{T_1 - T_2\} K$ = 1k
Mass of $KNO_3$ taken = W g = 2.834g
volume of the Solution = 100 $cm^3$
Molecular mass of $KNO_3$ = 101.1 g $mol^{-1}$
mass of the Solution = 100g = 0.1kg
Specific heat of Solution = 4200 J/kg 1k

Heat absorbed during the Process
Mass x Sp heat x change in temperature

= 0.1 X 4200 X $(T_1 - T_2)$
= 0.1 X 4200 X 1
= 420 J

Amount of heat absorbed when one mol of potassium nitrate is dissolved in water

$$= \frac{420 \times 101.1}{W}$$

= 14983 J
= 14.98 kJ
=

Date .....

Expt. No. 4 Page No. 11

2-3 g of $KNO_3$ (or) $CuSO_4$ crystals are powdered and weighed accurately. Initial temperature of water is noted. powered potassium nitrate is quickly added to polythene bottle containing water and the bottle is immediately stoppered and solution is stirred well. The minimum temperature attains is noted enthalpy of solution is then calculated.

Result: Enthalpy of solution of potassium nitrate = ____ $kJ\ mol^{-1}$

Note: To determine the enthalpy of solution of copper sulphate in the above experiment replace potassium nitrate by copper sulphate [molar mass of $CuSO_4 \cdot 5H_2O = 249$]



Teacher's Signature : _____

Reaction:-

$$HCl_{(aq)} + NaOH \Rightarrow NaCl_{(aq)} + H_2O$$

Date [redacted]

Expt. No. 5 Page No. 12

# DETERMINATION OF ENTHALPY OF NEUTRALIZATION

**Aim:** To determine the enthalpy of neutralisation of strong acid (HCl) with a strong base (NaOH)

**Principle:** A known amount of acid is neutralised by an equivalent determined amount of heat liberated per gram equivalent of an acid neutralized is calculated. It gives the enthalpy of neutralization.

Apparatus and chemical required.

Polythene bottle fitted with thermometer and stirrer 1N HCl, 1N NaOH.

Procedure:

100 $cm^3$ of 1N HCl is taken in a polythene bottle fitted with thermometer and stirrer beaker both the solution are kept in a

Teacher's Signature : _____

# Observation and calculation

Initial temperature = $T_1 K$ = 301K (28°C)

Final temperature = $T_2 K$ = 307.7K (34.3°C)

Rise in temperature = $(T_2 - T_1)K$ = 6.83K

Total Volume of the Solution - 200 $cm^3$

Mass of the Solution - 200g = 0.2kg

Specific of heat of Solution - 4200 J/Kg K

Heat liberated during the process
$Q$ = mass x S.P Heat x change in temperature

i.e when 0.1 gram eq. wt of HCl is neutralized ) $Q = 0.2 \times 4200 \times (T_2 - T_1)$

$Q = 0.2 \times 4200 \times 6.83$

$Q = 5737.2 J$

Amount of heat liberated when one gram equivalent mass of HCl is neutralized $q = \frac{Q_1}{0.1}$

$= 57372 J$

$= 57.3 kJ$

both for 15 minutes to attain the temperature of water both when both the solution attain steady temperature initial temperature is noted let it be T·K

Sodium hydroxide solution is quickly added to polythene bottle containing Hcl solution and the bottle is shaken well the maximum temperature attained is noted let it be $T_2F$

Result: Enthalpy of neutralization of Hcl with NaoH on

$H = \frac{5 \times 4.2 \times 5}{} kJ\,eq^{-1}$



Teacher's Signature : _____

For Daniel cell Nernst equation is as follows

$$E_{cell} = E^{\circ}_{cell} + \frac{2.303RT}{nF} \log \frac{[Cu^{2+}]}{[Zn^{2+}]}$$

$$E_{cell} = E^{\circ}_{cell} + \frac{0.59}{2} \log \frac{[Cu^{2+}]}{[Zn^{2+}]} \text{ at } 298K$$

$$E^{\circ}_{cell} = E^{\circ}_{C} - E^{\circ}_{A} = E^{\circ}_{Cu} - E^{\circ}_{Zn}$$

$$= 0.34 - (-0.76)$$

$$= +1.10V$$

Date

Expt. No. 6

Page No. 1H

# TO STUDY THE VARIATION IN CELL POTENTIAL OF THE CEL $Zn|Zn^{2+}//Cu^{2+}|Cu$ WITH CHANGE IN CONCENTRATION OF ELECTROLYTES ($CuSO_4/ZnSO_4$) AT ROOM TEMPERATURE

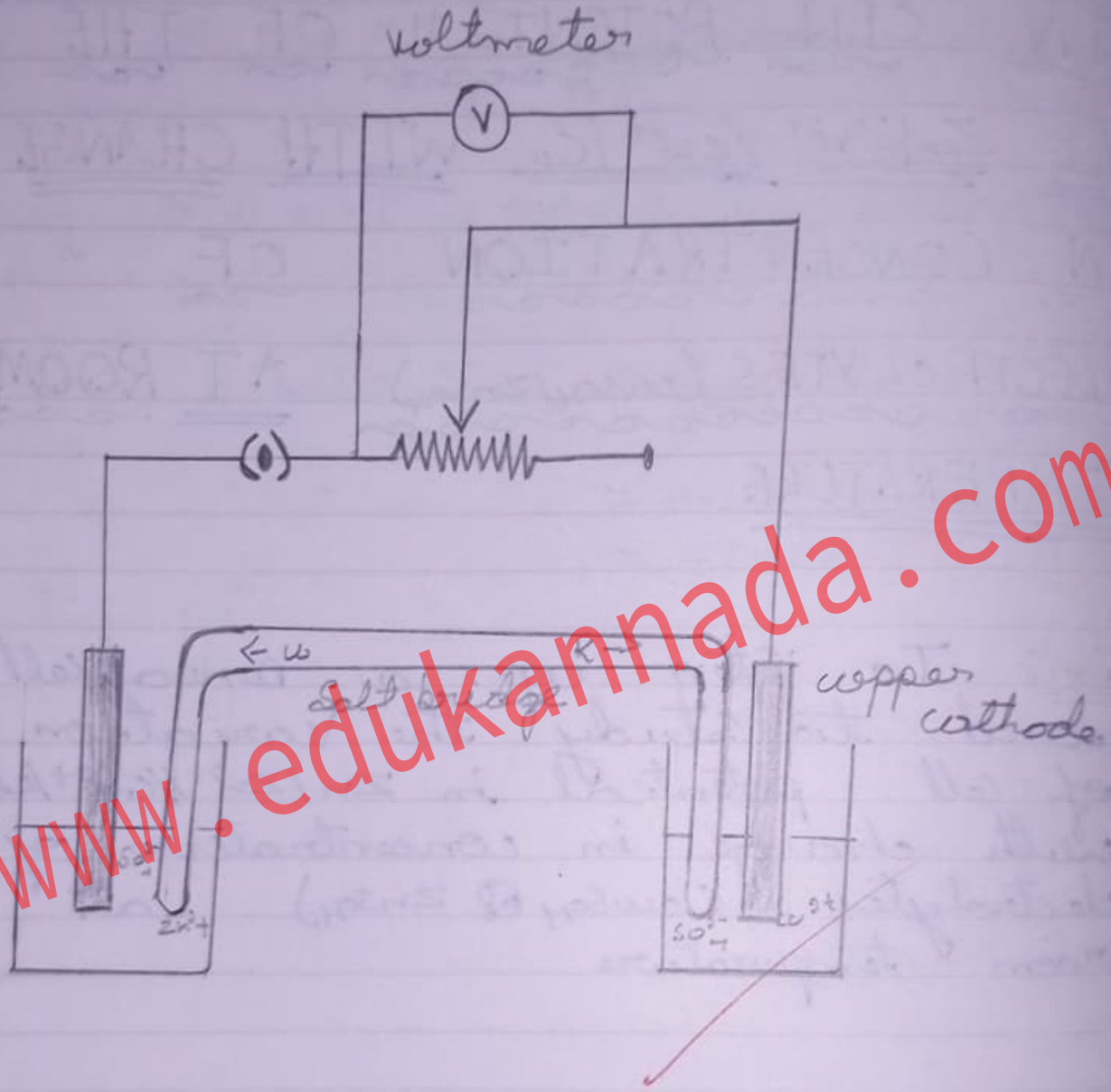


**Aim:** To setup a Daniel cell and to study the variation of cell potential in $Zn/Zn^{2+}//Cu^{2+}/Cu$ with change in concentration of electrolytes ($CuSO_4$ & $ZnSO_4$) at room temperature

**Theory:** Daniel cell is $Zn/ZnSO_4//CuSO_4/Cu$

The redox reaction of Daniel cell can be carried out in the laboratory either by using a Salt bridge (or) porous pot. Here we shall carry out the redox reaction

Teacher's Signature : _____



Date .....

Expt. No. 6 Page No. 15

using Kcl Salt bridge. which will Prevent the mixing of two Solution the complete redox reaction involves the two half cell reactions. In the Daniel cell is the concentration of $ZnSO_4$ Solution is 1m & that of $CuSO_4$ Solution is 1m the cell potential is 1.1 Volts However if the concentration of $ZnSO_4$ Solution and $CuSO_4$ Solution are different them the cell potential can be calculated using Nernst equation.

Materials: A strip of copper a strip of Zinc a large beaker board a porous pot a plastic tube cotton 100g of copper Sulphate ($CuSO_4$) 100g of Zinc Sulphate ($ZnSO_4$) Distilled water, a voltmeter (two cables alligator clips Kcl salt bridge

Procedure:

1. About 100$cm^3$ of 1m $ZnSO_4$ Solution is taken in a parcilain board. A Zinc rod is dipped in it.
2. About 100$cm^3$ of 1M $CuSO_4$ Solution is taken in a small beaker A copper rod is dipped in it A Salt bridge of

Teacher's Signature : _____

| | Trial No | concentration of $ZnSO_4$ Solution | concentration of $CuSO_4$ Solution | observed emf of the cell (volts) | calculated E.M.F of the cell from Nernst equation (volts) |
|---|---|---|---|---|---|
| A | 1 | 1M | 1M | | |
| | 2 | 0.4M | 1M | | |
| | 3 | 0.2M | 1M | | |
| | 4 | 0.1M | 1M | | |
| B | | 1M | 0.4M | | |
| | | 1M | 0.2M | | |
| | | 1M | 0.1M | | |

KCl is used to connect the two solutions thus Daniel cell is formed

3] The copper plate with +ve polarity and zinc plate with the -ve polarity are connected to the voltmeter as shown

4] As soon as the circuit is completed electric current will begin to flow and then the voltmeter reading is noted which indicates the e.m.f of the cell This is reading No.1

5] The above procedure is repeated while keeping the concentration of copper sulphate solution as 1m but changing the concentration of zinc sulphate solution by dilution to 0.05, 0.02 and 0.01m for reading 2.3 and 4 recorded.

6] Again the above procedure is repeated while keeping the concentration of $ZnSO_4$ solution as 1m but changing the concentration of $CuSO_4$ solution by dilution to 0.05, 0.02 and 0.01m This reading 5.6 and 7 are recorded

The reaction at the electrodes can be represented by the equation.



Teacher's Signature : _____

Date .....

Expt. No. 6

Page No. 17

At: anode

$Zn \rightarrow Zn^{2+} + 2\bar{e}$ (oxidation)

At: cathode

$Cu^{2+} + 2\bar{e} \rightarrow Cu$ (reduction)

$Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$ (overall reaction)

Conclusions

Increase in $[Cu^{2+}]$ increases the emf of the cell

Increase in $[Zn^{2+}]$ decreases the emf of the cell.



Teacher's Signature : _____

Reaction :-

$$FeSO_4 \cdot 7H_2O + (NH_4)_2SO_4 \rightarrow FeSO_4(NH_4)_2SO_4 \cdot 6H_2O + H_2O$$

Date

Expt. No. 7 Page No. 18

# PREPARATION OF FERROUS AMONIUM SULPHATE CRYSTALS

**Aim:** To prepare crystals of ferrous ammonium sulphate (or) mohrs salt.

**Theory:** Mohrs salt i.e ferrous ammonium sulphate [$FeSO_4(NH_4)_2SO_4 6H_2O$] is a double salt. It can be prepared by mixing equal volume of equimolar solutions of $FeSO_4 \cdot 7H_2O$ and $(NH_4)_2SO_4$, on concentration and cooling crystals of mohrs salt are formed.

**Reactions:**

$$FeSO_4 \cdot 7H_2O + (NH_4)_2SO_4 \rightarrow FeSO_4(NH_4)_2SO_4 6H_2O + H_2O$$

**Apparatus and chemicals required**

Two 25ml beakers, a glass rod, china dish, funnel stand, wire gauze, tripod stand and filter paper. Ferrous sulphate, ammonium sulphate, dilute sulphuric acid and ethanol.

Teacher's Signature : _____

Date .....

Expt. No. 7 Page No. 19

Procedure:-

1] 14g of ferrous sulphate and 6.5g of ammonium sulphate are taken in a clean beaker

2] About 50ml of distilled water is boiled in another beaker for about 5 minutes to expel dissolved air.

3] About 2ml of dilute Sulphuric acid is added to the above water and it is poured into the first beaker containing $FeSO_4$ and $(NH_4)_2SO_4$. The mixture is stirred with a glass rod to dissolve the salts.

4] The solution is filtered to remove any suspended impurities.

5] The filtrate is collected in a clean china dish and concentrated on a low flame until the crystallization point is reached.

6] The china dish is covered with a watch glass and kept in an undisturbed place for cooling well defined crystals will be obtained after some time.

7] The mother liquid is removed and the crystals in the china dish are washed with a small quantity of ethanol.

8] The crystals are dried by pressing between the folds of rough filter

Teacher's Signature : _____

paper and weighed. the colour and shapes of the crystals are observed

Result :-

colour of the crystals - light green
shape of the crystals - mondinic
yield (mass of the crystal obtained) - 11.265 g

Reactions

$$K_2SO_4 + Al_2(SO_4)_3\ 18H_2O + 6H_2O \rightarrow K_2SO_4\ Al_2(SO_4)_3 \cdot 24H_2O$$

Expt. No. 8 Date

Page No. 21

# PREPARATION OF POTASH ALUM

**Aim:** To prepare crystals of potash alum

**Theory:** Potash alum a double salt commonly known as filtration has the formula $K_2SO_4 Al_2(SO_4)_3 24H_2O$. It can be prepared by the crystallisation of a mixture of equal volume of equimolar solution of $Al_2(SO_4)_3 \cdot 18H_2O$ and $K_2SO_4$.



**Apparatus and chemical required**

Two 25ml beakers, a glass rod, china dish funnel stand, wire gauze, tripod stand and filter paper. Potassium sulphate, aluminium sulphate and concentrated sulphuric acid.

**Procedure:-**

1) 7g of potassium sulphate is taken in a clean beaker. It is dissolved in a minimum amount

Teacher's Signature : _____

Date .....

Expt. No. 8 Page No. 22

of distilled water with gentle heating.

2] 26.5g of aluminium sulphate is taken in another beaker about 3-4 drops of concentrated sulphuric acid are added about 20ml of distilled water is added to the beaker and heated on a wire gauze with occasional stirring. The solution is then filtered to remove the turbidity.

3] The two clear solution are mixed in a china dish. The dish heated gently on a wire gauze and the solution is concentrated to the crystallization point.

4] The dish is covered and cooled without any disturbance.

5] The crystals formed are separated by decanting the another liquor crystals are washed with very small quantity of ice cold water

6] The crystals are then dried between the folds of filter paper and weighed. The colours and shapes of the crystals are observed and noted.

Result :-

colour of the crystals = colourless

Teacher's Signature : _____

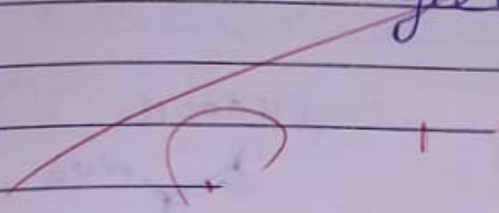
Date .....

Expt. No. 8 .....

Page No. 23 .....

Shape of crystals = octahedral

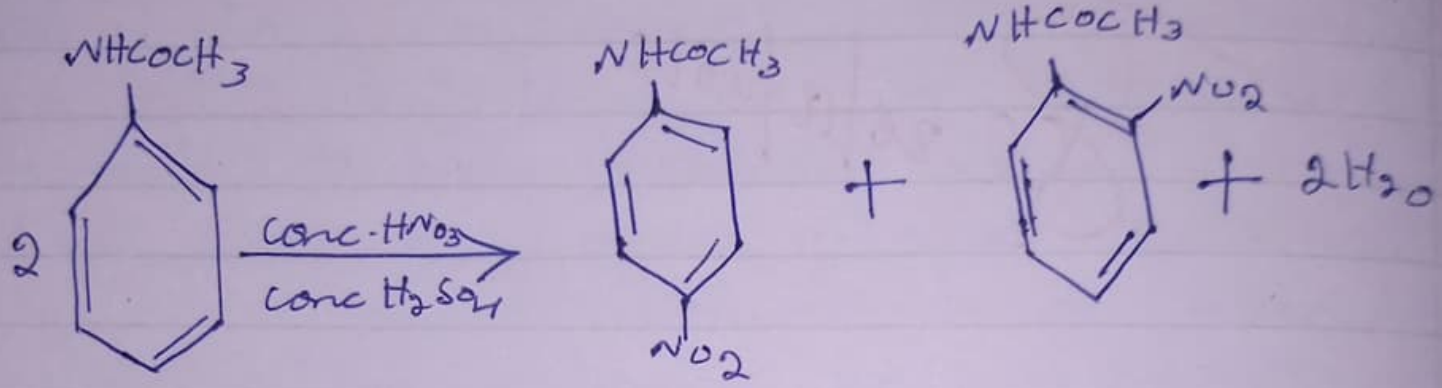
yield = 10.4814g





Teacher's Signature : _____

# chemical reaction




Acetanilide

p-nitro acetanilide (major) o-nitro acetanilide

Expt. No. 9 Date [redacted]

Page No. 24

# PREPARATION OF P-NITROACETANILIDE FROM ACETANILIDE

**Aim:-** To prepare a pure sample of p-nitroacetanilide.

**Apparatus and chemical required.**

25ml round bottom flask ice bath beaker measuring cylinder funnel and filter paper Acetanilide con Nitric acid Sulphuric acid glacial acetic acid and rectified spirit

**Procedure:-**

1] 10g of powdered acetanilide is placed in a 250ml of round bottomed flask and 10ml of glacial acetic acid is added.

2] The mixture is stirred well and 20ml of conc Sulphuric acid is added to it.

3] The flask is placed an ice bath and cooled.

4] 8ml of cold conc. Nitric acid is added drop by drop with constant

Teacher's Signature : _____

Date

Expt. No. 9 Page No. 25

stirring.

5] The flask is removed from the ice bath and allowed to stained for about 45 mins at room temperature.

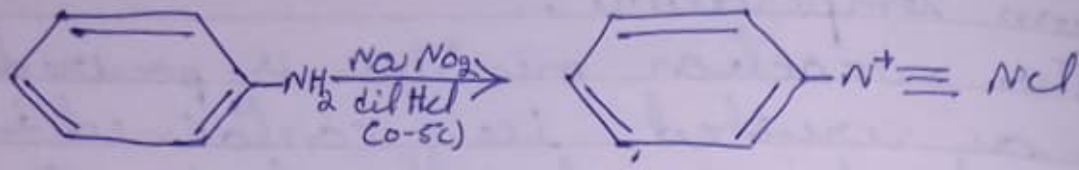
6] The reaction mixture is poured on a crushed ice contained in a beaker and allowed to stand for 15 mins

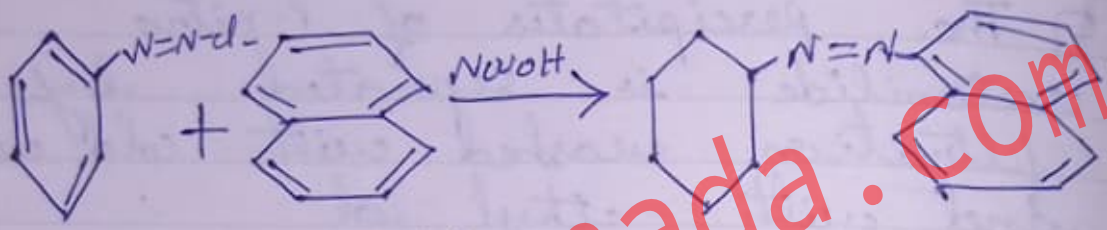
7] The percipitates of P-nitro acetanilide is seprated by filtration washed with cold water and with ethyl



Teacher's Signature :

# Chemical reaction




Benzene diazonium chloride

β-Naphthol

Phenyl-azo β-Naphthol (orange dye)

Date

Expt. No. 10 Page No. 26

# PREPARATION OF PHENYL-AZO-B-NAPTHOL (an azo dye)

**Aim:-** To prepare phenyl-azo-B-naphthol.

**Apparatus and chemical required.**

conical flask beaker funnel measuring cylinder ice bath. Aniline B-naphthol sodium nitrite conc.HCl Sodium hydroxide glacial acetic acid and Spirit.

**Procedure:**

1] 2.5 ml of pure aniline 8ml of conc.HCl and 8ml of water are mixed in a beaker

2] The Solution is cooled to 0-5°C in an ice bath.

3] To the cold Solution a Solution of Sodium nitrite is Slowly added Benzene diazonium chloride Solution is formed.

4] 22.5ml of 10% NaOH Solution is taken in a beaker & 4.0g of pure Bnapthol is added

5] The cold benzene diazonium

Teacher's Signature : _____

chloride Solution is added with constant Stirring to the β-naptthol
b] The mixture is allowed to stand for 10 min an orange red dye is filtered.

Result :- Yield = 5.4 g



Teacher's Signature : _____

Date :

Expt. No. 11 Page No. 28

# SYSTEMATIC QUALITATIVE ANALYSIS OF SIMPLE INORGANIC SALT

Preliminary test

State :- Amorphous solid

colour :- white

Solubility :- Soluble in cold dil HCl original solution + dil HCl

Detection of acid radicals.

Detection of I group acid radical

| Experiment | observation | Inference. |
|---|---|---|
| Salt + dil HCl | brisk effer. | I grop acid radical $CO_3^{-2}$ is present. |

conformatory test for $CO_3^{-2}$

| Experiment | observation | Inference |
|---|---|---|
| Salt + water, heat Strongly pass the. | Lime water does not turn milky. | $CO_3^{-2}$ is confirmed |

Teacher's Signature :

| | | |
|---|---|---|
| through lime water | | |

## Detection of basic radicals

### Detection of zero group basic radical ($NH_4^+$)

Test for $NH_4^+$

| Experiment | observation | Inference |
|---|---|---|
| Salt + NaOH Solution heat | No pungent Smelling gas | zero group basic radical $NH_4^+$ is absent. |

### Detection of first group basic radical

| Experiment | observation | Inference. |
|---|---|---|
| Original Solution + dil HCl + $H_2S$ | No precipitate | II group basic radical are absent. |

### Detection of Second group basic radical

| Experiment | observation | Inference. |
|---|---|---|
| original Solution + dil. HCl + | No Precipiate | II group basic radicals are absent |

### Detection of third group basic radical.

Teacher's Signature : _____

Date .....

Expt. No. ..... 11 .....

Page No. 32 .....

| Experiment | observation | Inference |
|---|---|---|
| orginal Solution + $NH_4Cl$ (Solid) + $NH_4OH$ (excess) | no precipitate | III group basic radical are absent |

## Detection of fourth group basic radical

| Experiment | observation | Inference |
|---|---|---|
| orginal Solution + $NH_4Cl$ (Solid) + $NH_4OH$ (excess) + $H_2S$ | No precipitate | IV group basic radicals are absent. |

## Detection of fifth group basic radical

| Experiment | observation | Inference |
|---|---|---|
| orginal Solution + $NH_4Cl$ (Solid) + $NH_4OH$ (excess) + $(NH_4)_2CO_3$ | A white PPt is formed | V group basic radical present $Ba^{2+}$, $Ca^{2+}$ or $Sr^{2+}$ may be present |

## Confirmatory test for $Ba^{2+}$ $Ca^{2+}$ or $Sr^{2+}$

| Experiment | observation | Inference |
|---|---|---|
| orginal Solution + dilute acetic acid | | |

Teacher's Signature : _____

Date .....

Expt No. ....11....  Page No. ...31...

| | | |
|---|---|---|
| $K_2CrO_4$ Solution | Yellow ppt is not obtained | $Ba^{2+}$ is not confirmed. |
| original Solution + $(NH_4)_2SO_4$ Solution | No white precipitate is obtained | $Sr^{2+}$ is not confirmed. |
| original Solution + $NH_4Cl$ + ammonium oxalate | white precipitate is obtained | $Ca^{2+}$ is confirmed |

Flame Test

| Experiment | Observation | Inference |
|---|---|---|
| Salt + conc. HCl, ignite in platinum wire in the non-luminous flame | Brick red colour is imparted | $Ca^{2+}$ is confirmed. |

Report: The given inorganic salt contains

Acid radical is $CO_3^{2-}$

Base radical is $Ca^{2+}$

Hence, given salt is $CaCO_3$

Teacher's Signature : _____

Expt. No. 11 Date

Page No. 32

# Salt No 2

## Preliminary tests

State :- crystaline
colour :- white
Solubility :- Soluble in cold water
original Solution :- Salt + water.

## Detection of acid radicals

### Detection of I group acid radicals

| Experiment | Observation | Inference |
|---|---|---|
| Salt + dil HCl | No gas is evolved | I group acid radical are absent. |

### Detection of II group acid radicals.

| Experiment | Observation | Inference |
|---|---|---|
| Salt + Conc. $H_2SO_4$ in dry test tube | Reaction take place in cold with evolution of gas | II group acid radical ($Cl^-$ or $Br^-$ may be present. |
| Add a few crystals | white fumes evolved | $Cl^-$ is present |

Teacher's Signature :

Date .....

Expt. No. 11 Page No. 33

## conformatory test for chloride

| Experiment | observation | Inference |
|---|---|---|
| Salt + potassium dichromate crystal + conc. $H_2SO_4$ heat | Reddish brown vapour of chromyl chloride are evolved | Cl is confirmed |
| Pass the vapour into the NaOH Solution | Yellow Solution is obtained | |
| Yellow Solution + dilute acetic acid + lead acetate Solution | Yellow precipitate is formed. | |

## Silver nitrate test for Cl, Br radical

| Experiment | observation | Inference |
|---|---|---|
| Salt Solution + dil $HNO_3$ + Silver nitrate Solution | A curdy white percipitate is formed which is Stable in $NH_4OH$ | Cl is confirmed. |

## Detection of basic radical

Teacher's Signature : _____

Date .....

Expt. No. ..11.....

Page No. 34

## Detection of zero group basic radical ($NH_4^+$)

Test for $NH_4^+$

| Experiment | observation | Inference |
|---|---|---|
| Salt + NaOH Solution heat | Gives a pungent smelling gas which gives dense white fumes | Zero group basic radical $NH_4^+$ is present |

Confirmatory test for $NH_4^+$ (Nessler's reagent test):

| Experiment | Observation | Inference. |
|---|---|---|
| original Solution + Nessler's reagent + Excess of NaOH | A brown precipitate is formed | $NH_4^+$ is conformed |

Report: The given inorganic salt contains

A) acid radical $Cl^-$

B) Basic radical $NH_4^+$

Hence the given salt is $NH_4Cl$

Teacher's Signature : _____

Expt. No. 11 Date

Page No. 35

Salt no :- 3

Preliminary test

State :- Amorphous Solid

colour :- white

Solubility :- Salt + dilute HCl

original Solution : Salt + dilute HCl

Detection of acid radical

Detection of I group acid radical

| Experiment | observation | Inference |
|---|---|---|
| Salt + dil HCl | No brisk effervescence | I group acid radical are absent |

Detection of II group acid radical

| Experiment | observation | Inference |
|---|---|---|
| Salt + conc. $H_2SO_4$ in dry test tube | Rxn take place in cold condition | II group acid radical Cl⁻ or Br⁻ may be present |
| | Dense white fumes are evolved | $Cl^-$ is present. |

Teacher's Signature :

Date .....

Expt. No. 11 Page No. 36

## Confirmatory test for chloride

| Experiment | observation | Inference |
|---|---|---|
| Salt + potassium dichromate crystal + conc. $H_2SO_4$, heat | Reddish brown vapour are formed | |
| Pass the vapour into the NaOH Solution | Yellow Solution is obtained | $Cl^-$ is confirmed. |
| Yellow Solution + dilute acetic acid + lead acetate Solution | Yellow precipitate is obtained | |

## Silver nitrate test for $Cl^-$

| Experiment | Observation | Inference |
|---|---|---|
| Salt solution + dil $HNO_3$ + Silver nitrate Solution | A curdy white precipitate is formed which is Soluble in $NH_4OH$ | $Cl^-$ is confirmed |

## Detection of basic radical

## Detection of zero group basic radical

Teacher's Signature : _____

Date .....

Expt. No. 11 Page No. 37

| Experiment | observation | Inference |
|---|---|---|
| Salt + NaOH Solution heat | No pungent Smelling gas | Zero group basic radical $NH_4^+$ is absent |

Detection of first group basic radical

| Experiment | observation | Inference |
|---|---|---|
| original Solution + dil HCl | No white precipitate | I group basic radicals are absent |

Detection of II group basic radical

| Experiment | observation | Inference |
|---|---|---|
| original Solution + dil HCl + $H_2S$ | No precipitate | II group basic radicals are absent. |

Detection of III group basic radical

| Experiment | observation | Inference |
|---|---|---|
| original Solution + $NH_4Cl$ (Solid) + $NH_4OH$ (excess | no precipitate | III group basic radical are absent. |

Teacher's Signature : _____

Expt. No. 11 Date .....

Page No. 38

## Detection of fourth group basic radical

| Experiment | observation | Inference |
|---|---|---|
| original Solution + $NH_4Cl$ (Solid) + $NH_4OH$ (excess) + $H_2S$ | No precipitate | IV group basic radicals are absent. |

## Detection of fifth group basic radical

| Experiment | observation | Inference |
|---|---|---|
| original Solution + $NH_4Cl$ (Solid) + $NH_4OH$ (excess) + $(NH_4)_2CO_3$ | A white ppt is obtained | V group basic radical $Ba^{2+}$ $Ca^{2+}$ or $Sr^{2+}$ may be present |

## Confirmatory test for $Ba^{2+}$ $Ca^{2+}$ or $Sr^{2+}$

| Experiment | observation | Inference |
|---|---|---|
| original Solution + dil acetic acid + $K_2CrO_4$ Solution | Yellow ppt is obtained | $Ba^{2+}$ is confirmed. |
| Flame test<br>Salt + con. HCl make paste, ignite on platinum wire to the non-luminous flame | Apple green colour is imparted | $Ba^{2+}$ is confirmed. |

Teacher's Signature : _____

Date .....

Expt. No. 11

Page No. 39

Report :- The given inorganic salt contains

A] Acid radical is $Cl^-$

B] Basic radical is $Ba^{2+}$

Hence the given salt is $BaCl_2$



Teacher's Signature : _____

Date

Expt. No. 11

Page No. 40

Salt no:- H

Preliminary test

State :- crystaline Solid

colour :- white

Solubility :- Soluble in cold water

orginal Solution - salt + cold water

Detection of acid radical

| Experiment | observation | Inference |
|---|---|---|
| Salt + dil Hcl | No brisk apperance | I group acid radical are absent. |

Detection of II group acid radicals.

| Experiment | observation | Inference |
|---|---|---|
| Salt + conc. $H_2SO_4$ in a dry test tube | Rxn take place in cold condition | II group acid radical $Cl^-$ or $Br^-$ may be present. |
| | dense white fumes are evolved | $Cl^-$ is present |

confirmatory test for chloride

| Experiment | observation | Inference |
|---|---|---|

Teacher's Signature :

Expt. No. 11 Date

Page No. 41

| | | |
|---|---|---|
| Salt + potassium dichromate crystal + conc. $H_2SO_4$ heat | reddish brown vapour are formed | |
| Pass the vapour into the NaOH Solution | Yellow Solution is obtained | $Cl^-$ is conformed |
| Yellow Solution + dilute acetic acid + lead acetate Solution | Yellow precipitate is obtained | |

Silver nitrate test for $Cl^-$ or $Br^-$ radicals

| Experiment | observation | Inference |
|---|---|---|
| Salt Solution + dil $HNO_3$ + Silver nitrate Solution | A curdy white precipitate is formed | $Cl^-$ is conformed. |

Detection of Basic radical

Detection of zero group basic radical ($NH_4^+$)

| Experiment | observation | Inference |
|---|---|---|
| Salt + NaOH Solution heat | No pungent Smelling gas | zero group basic radical $NH_4^+$ is absent. |

Teacher's Signature :

Date .....

Expt. No. 11

Page No. 42

## Detection of first group basic radical

| Experiment | observation | Inference |
|---|---|---|
| original Solution + dil HCl | No white precipitate | I group basic radicals are absent. |

## Detection of Seond group basic radical

| Experiment | observation | Inference |
|---|---|---|
| original Solution + dil HCl + $H_2S$ | No precipitate | II group basic radicals are absent. |

## Detection of third group basic radical.

| Experiment | observation | Inference |
|---|---|---|
| original Solution + $NH_4Cl$ (Solid) + $NH_4OH$ (excess) | no precipitate | III group basic radical are absent. |

## Detection of fourth group basic radical.

| Experiment | observation | Inference. |
|---|---|---|
| original Solution | | |

Teacher's Signature : _____

Date .....

Expt. No. 11 Page No. 43

| | | |
|---|---|---|
| $NH_4Cl$ (Solid) + $NH_4OH$ (conc) + $(NH_4)_2CO_3$ | No precipitate | V group basic radical are absent. |

## Detection of Sixt group basic Radical

Since the given radical is not present in the previous groups it is present in VI group. It may be $Mg^{2+}$

## Confirmatory test for $Mg^{2+}$

| Experiment | observation | Inference. |
|---|---|---|
| original Solution + $NH_4Cl$ (Solid) + $NH_4OH$ + Sodium dihydrogen ortho phosphate | A white ppt is formed | VI th G.B.R is Present $Mg^{2+}$ is conformed |

Report :- The given inorganic Salt.

A] Acid radical is Cl⁻

B] Basic radical is $Mg^{2+}$

Hence the given Salt is $MgCl_2$



Teacher's Signature : _____

Expt. No. 11 Date

Page No. 44

## Salt No :- 5

### Preliminary test

State :- crystaline
colour :- white
Solubility :- Soluble in cold water
orginal Solution = salt + cold water

### Detection of acid radical

### Detection of I group acid radical

| Experiment | observation | Inference |
|---|---|---|
| Salt + dil HCl | No gas is evolved | I group acid radicals are absent. |

### Detection of II group acid radical.

| Experiment | observation | Inference |
|---|---|---|
| Salt + conc. $H_2SO_4$ in a dry test Tube | Reddish Vapour is evolved | $Br^-$ is present. |

### confirmatory test for $Br^-$

| Experiment | observation | Inference |
|---|---|---|

Teacher's Signature :

Date .....

Expt. No. 11 Page No. 45

| | | |
|---|---|---|
| Salt Solution + equal volume of $H_2O$ water + cold Dilute Sulphuric acid & Stir | Orange Red globule is formed | $Br^-$ is confirmed. |

## Detection of basic radical

### Detection of zero group basic radical ($NH_4^+$)

| Experiment | observation | Inference |
|---|---|---|
| Salt + NaOH Solution heat | give a dense white fumes with a pungent smell which turns red litmus blue | Zero group basic radical $NH_4^+$ is present |

### Confirmatory test for $NH_4^+$

| Experiment | Observation | Inference |
|---|---|---|
| orginal Solution + Nessler's Reagent + excess of NaOH | A brown precipitate is formed | $NH_4^+$ is confirmed. |

Report :- The given inorganic Salt contains
a) Acid radical is $Br^-$
b) Basic radical is $NH_4^+$
Hence the given Salt is $NH_4Br$

Teacher's Signature : _____

Expt. No. 11 Date

Page No. 46

Salt no 6

Priliminary test

State :- Amorphous Solid
colour :- white
Solubility :- Soluble in cold water
original Solution = Salt + cold water

Detection of acid radical

Detection of I group acid radical

| Experiment | observation | Inference |
|---|---|---|
| Salt + dil HCl | No brisk effervescence | I group acid is absent. |

Detection of II group acid radical

| Experiment | observation | Inference |
|---|---|---|
| Salt + Con $H_2SO_4$ in a dry test tube | no rxn take place | II group acid radical $Cl^-$ or $Br^-$ is absent |
| Add copper turnings heat strongly | no rxn take place | II group acid radical is absent |

Detection of III group acid radical

Teacher's Signature :

Expt. No. 11 Date .....

Page No. 47

| Experiment | observation | Inference |
|---|---|---|
| Salt Solution + $BaCl_2$ Solution add excess of dil. HCl | A white is formed | II group acid radical ($CO_3^{2-}$) is present & confirmed. |

## Detection of basic radical

### Detection of zero group basic radical ($NH_4^+$)

| Experiment | observation | Inference |
|---|---|---|
| Salt + NaOH Solution heat | no pungent smelling gas | Zero group basic radical $NH_4^+$ is absent |

### Detection of first group basic radical

| Experiment | observation | Inference |
|---|---|---|
| original Solution + dil HCl | No white precipitate | I group basic radical are absent. |

### Detection of Second group basic radical

| Experiment | observation | Inference |
|---|---|---|
| original Solution + dil HCl + $H_2S$ | No precipitate | II group basic radical are absent. |

Teacher's Signature : _____

Expt. No. 11 Date .....

Page No. 48

## Detection of third group basic radical

| Experiment | observation | Inference |
|---|---|---|
| original Solution + $NH_4Cl$ (Solid) + $NH_4OH$ (excess) | A gelatinous white ppt is formed | III group basic radical $Al^{3+}$ is present |

## Confirmatory test for $Al^{3+}$

| Experiment | observation | Inference |
|---|---|---|
| original Solution + NaOH Solution | white ppt is formed which is soluble in excess of NaOH | $Al^{3+}$ is confirmed. |
| clear Solution + Solid $NH_4Cl$ + heat | Gelatinous white ppt disappears | |

Report :- The given inorganic salt contains

A) Acid radical is $SO_4^{2-}$

B) Basic radical is $Al^{3+}$

Hence the given salt is $Al_2(SO_4)_3$



Teacher's Signature : _____

Expt. No. 11 Date

Page No. 49

Salt no 8

Preliminary test

State :- Amorphous solid
colour :- white.
Solubility :- Soluble in cold water
orginal Solution = Salt + cold water

Detection of acid radicals

Detection of I group acid radical

| Experiment | observation | Inference |
|---|---|---|
| Salt + dil Hcl | No brisk effervescence | I group acid radical is absent. |

Detection of II group acid radical

| Experiment | observation | Inference |
|---|---|---|
| Salt + Conc $H_2SO_4$ in a dry test tube | no rxn takeplace | II grap acid radical is absent. |
| Add cu turnings & heat strongly | no rxn takeplace | II grap acid radical is absent. |

Teacher's Signature :

Date .....

Expt. No. 11 Page No. 50

## Detection of III group acid radical

Test for $SO_4^{2-}$

| Experiment | observation | Inference |
|---|---|---|
| Salt Solution + $BaCl_2$ Solution add excess of dil HCl | white ppt is insoluble in excess of dilute hydrochloric acid | III G A R is present $SO_4^{2-}$ is present & confirmed |

## Detection of basic radicals

### Detection of zero group basic radical ($NH_4^+$)

| Experiment | observation | Inference |
|---|---|---|
| Salt + NaOH Solution heat | No pungent Smelling gas | Zero group basic radical $NH_4^+$ is absent. |

### Detection of first group basic radical

| Experiment | observation | Inference |
|---|---|---|
| orginal Solution + dil HCl | No white precipitate | I group basic radical are absent |

### Detection of Second group basic radical

Teacher's Signature : _____

Expt. No. 11 Date

Page No. 51

| Experiment | observation | Inference |
|---|---|---|
| original Solution + $NH_4Cl$ (Solid) + $NH_4OH$ (excess) | no precipitate | III group basic radicals are absent |

Detection of fourth group basic radical

| Experiment | observation | Inference |
|---|---|---|
| original Solution + $NH_4Cl$ (Solid) + $NH_4OH$ (excess) + $H_2S$ | no precipitate | IV group basic radical are absent |

Detection of fifth group basic radical

| Experiment | observation | Inference |
|---|---|---|
| original Solution + $NH_4Cl$ (Solid) + $NH_4OH$ (excess) + $(NH_4)_2CO_3$ | no precipitate | V group basic radical |

Detection of Sixth group Radical

Since the given (Salt) radical is not present in the previous groups, it is present in VI group. It may be $Mg^{2+}$

Teacher's Signature :

Date .....

Expt. No. 11 Page No. 52

## Confirmatory Test for $Mg^{2+}$

| Experiment | observation | Inference |
|---|---|---|
| original Solution + $NH_4Cl$(solid) + $NH_4OH$ + Sodium dihydrogen ortho phosphate | A white PPt is formed | VI Gr BR is Present $Mg^{2+}$ is confirmed |

Report:- The given inorganic Salt contains

A] Acid radical is $SO_4^{2-}$

B] Base radical is $Mg^{2+}$

Hence, the given Salt is $MgSO_4$



Teacher's Signature : _____

## Observation

Burette :- $KMnO_4$ Solution

conical flask :- $10cm^3$ FAS Solution + $1cm^3$ Dil $H_2SO_4$ + Tube full

Indicator :- $KMnO_4$ Itself (Self Indicator)

End point :- colourless to permanent pale pink

## Tabular column:

| Trial Number | I | II | III |
|---|---|---|---|
| Final Burette Reading | 9.5 | 9.5 | |
| Initial Burette Reading | 0.0 | 0.0 | |
| Volume of $KMnO_4$ Solution added In $cm^3$ | 9.5 | 9.5 | |

Expt. No. 12 Date

Page No. 53

To determine the concentration of $KMnO_4$ Solution by titrating it against 0.1M Standard Solution of ferrous Ammonium Sulphate [FAS]

Aim:- To determine the concentration or molarity of $KMnO_4$ Solution by titrating it against 0.1M Standard Solution of ferrous Ammonium Sulphate [FAS]

Principle:- A known volume of Standard FAS Solution (mohr's Salt Solution) is titrated against potassium permanganate Solution in acid medium in the reaction ferrous Sulphate gets oxidized to ferric Sulphate & $KMnO_4$ gets reduced to colourless manganous Sulphate

$$2KMnO_4 + 8H_2SO_4 + 10FeSO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 5Fe_2(SO_4)_3$$

By knowing the volume of $KMnO_4$ Solution required to oxidized ferrous Sulphate from the titration the molarity of $KMnO_4$ Solution is calculated.

Procedure:- A 10 $cm^3$ pipette is washed with water, & then Rinsed with given FAS Solution A Burette is washed with water & then Rinsed with $KMnO_4$ Solution it is

Teacher's Signature :

calculation:-

$$\frac{M_1V_1}{a_1} = \frac{M_2V_2}{a_2}$$

$KMnO_4$ FAS

where $a_1$ & $a_2$ are the Stoichiometric coefficients of $KMnO_4$ & Fe in the balanced chemical equation

$a_1 = 1$ & $a_2 = 5$

$$\therefore M_{KMnO_4} = \frac{a_{KMnO_4} \times M_{FAS} \times V_{FAS}}{a_{FAS} \times V_{KMnO_4}}$$

$$= \frac{1 \times 0.1 \times 10}{5 \times 9.5} = 0.02\ M$$

$$= 0.02$$

filled with $KMnO_4$ Solution & fixed to a Stand. Initial Burette reading is noted to the upper meniscus. Coloured Solution. 10 $cm^3$ of FAS Solution is pipetted out into a clean conical flask and test tube free of dilute Sulphuric acid is added. The Solution is titrated against the $KMnO_4$ Solution taken the Burette till the Solution turns permanent pale pink colour. Burette Reading is noted. Titrations are repeated for concordant values, In this titration $KMnO_4$ acts as self Indicator.

Result: Molarity of $KMnO_4$ = 0.02 M.



Teacher's Signature : _____

Expt. No. 13 Date

Page No. 54

Aim: Test for the functional group present in organic compound

1] Test for unsaturation

| Experiment | observation | Inference |
|---|---|---|
| a] Baeyer's test organic compound is dissolved in water or acetone + a few drop of 1% alkaine $KMnO_4$ Solution | Pink colour of $KMnO_4$ | The given organic compound is unsaturated |
| b] Bromine water test organic compound is dissolved in $CCl_4$ + 2% Solution of bromine in $CCl_4$ dropwise | orange red colour of bromine discharge | The given organic compound is unsaturated |

2] Test for Alcoholic (R-OH) group:

| | | |
|---|---|---|
| a] Ceric ammonium nitrate test organic compound + few drops of ceric ammonium nitrate Solution Shaken well | A pink or red colour of $KMnO_4$ | Alcholic (-OH) group |

Teacher's Signature : _____

Expt. No. 13 Date .....

Page No. 55

| | | |
|---|---|---|
| b] Esterification organic compound + acetic acid + 2 drops of conc. $H_2SO_4$ keep it in boiling water bath for 5 minutes pour the mixture in $Na_2CO_3$ Solution | A fruity smell | Alcoholic (-OH) group present |

3] Test for Phenolic (Ar-OH) group

| | | |
|---|---|---|
| a] Neutral $FeCl_3$ test organic compound in a test tube + a few drops of neutral $FeCl_3$ Solution | A violet colour | The given organic compound contains a phenolic group |
| b] Phthalein test organic compound + phthalic anhydride + conc. $H_2SO_4$, heated and added to NaOH | A pink colour | The given organic compound contains a phenolic group |

4] Test for Aldehydic (-CHO) group

| | | |
|---|---|---|
| a] 2,4-DNP test organic compound in a test tube + 2,4-Dinitrophenyl hydrazine | Orange Yellow crystalline precipitate is formed | The give organic compound contains aldehydic or ketonic group |

Teacher's Signature : _____

Expt. No. 13 Date

Page No. 56

| | | |
|---|---|---|
| b) Schiff's test<br>organic compound in a test tube + Schiff's reagent | A pink colour is obtained | The given organic compound contains aldehydic group |
| a] Tollen's test<br>organic compound in a test tube + Tollen's reagent Keep in a boiling water bath | A blackish red precipitate or Silver mirror is formed | The given organic compound confirms the presence of an aldehydic group |
| d] Benedict's / Fehling's test :<br>organic compound + Benedicts / Fehling's Solution & heated | A brick red precipitate is obtained | The given organic compound contains aldehydic group |
| 5] Test for Ketonic (-CO-) group | | |
| a) m-dinitrobenzene test<br>organic compound in a test tube + m-dinitrobenzene(s) + dil. NaOH Solution & Shake well | A Violet colour which slowly fades | The given organic compound contains Ketonic group |
| b] Sodium nitroprusside test | | |

Teacher's Signature : _____

Expt. No. 13 Date

Page No. 57

| | | |
|---|---|---|
| organic compound in a test tube + Sodium nitroprusside Solution + NaOH Solution | Acuine red colour is obtained | The given organic compound confirms the presence of a Ketonic group |

b) Test for carboxylic (-COOH) group

| | | |
|---|---|---|
| a) Litmus test<br>organic compound in a test tube + blue litmus paper | Blue litmus paper turns red | The given organic compound contains a carboxylic group |
| b) Sodium Bicarbonate test<br>organic compound in a test tube + aq $NaHCO_3$ Solution | Brisk effervescence of $CO_2$ | The given organic compound contains carboxylic group |
| c) Esterification<br>organic compound in a test tube + ethyl alcohol + 2 drops of conc. $H_2SO_4$ Keep it in a boiling water bath of 5 minutes & cool pour into aq $Na_2CO_3$ | A fruity smell | The given organic compound contains carboxylic group. |

d) Test for Amino group ($-NH_2$) group.



Teacher's Signature : _____

Expt. No. 13 Date

Page No. 58

| Experiment | observation | Inference |
| --- | --- | --- |
| a) carbylamine test: organic compound in a test tube + a few drops of chloroform + alcoholic potash. warm | An intolerable smell of isocyanide | The given organic compound is a primary amine & confirms the presence of amino group |
| b) Diazotisation test for aromatic primary amine: organic compound dissolved in dil HCl & cooled in ice + ice cooled NaNO2 solution + ice cooled solution of β naphthol in NaOH | A red or orange dye is obtained | Primary aromatic amine group is present. |



Teacher's Signature :