

# CHEMISTRY RECORD

## ALLIED CHEMISTRY



NAME : \_\_\_\_\_

REG. No. : \_\_\_\_\_

CLASS : \_\_\_\_\_

**Post Graduate and Research Department of Chemistry**  
**Seethalakshmi Ramaswami College (Autonomous)**  
**Affiliated to Bharathidasan University**  
**Accredited with "A" Grade by NAAC**  
**Tiruchirappalli – 620 002**



# **PG and Research Department of Chemistry**

**Certified Bonafide Record of work done by**

---

**at Seethalakshmi Ramaswami College, Tiruchirappalli – 620 002.**

**Course Teacher**

**Submitted for the practical examination held in \_\_\_\_\_**

**at Seethalakshmi Ramaswami College, Tiruchirappalli – 620 002.**

**Examiners**



## INDEX

<b>Volumetric Analysis</b>				
<b>No.</b>	<b>Date</b>	<b>Experiment</b>	<b>Page No.</b>	<b>Remarks</b>
1		Estimation of sodium carbonate		
2		Estimation of sulphuric acid		
3		Estimation of ferrousammonium sulphate		
4		Estimation of oxalic acid		
5		Estimation of potassium permanganate		
6		Estimation of copper		

## INDEX

<b>Physical Experiments</b>				
<b>No.</b>	<b>Date</b>	<b>Experiment</b>	<b>Page No.</b>	<b>Remarks</b>
<b>1</b>		<b>Preparation of standard solution</b>		
<b>2</b>		<b>Determination of cell constant</b>		
<b>3</b>		<b>Determination of equivalent conductance</b>		
<b>4</b>		<b>Determination of pH using pH meter</b>		
<b>5</b>		<b>Estimation of hardness of water</b>		
<b>6</b>		<b>Colorimetric estimation of Potassium Permanganate</b>		
<b>7</b>		<b>Determination of standard electrode potential</b>		
<b>8</b>		<b>Determination of pH using universal indicator</b>		
<b>9</b>		<b>Paper chromatographic technique</b>		



### Estimation of sodium carbonate

$$\begin{aligned}\text{Weight of sodium hydroxide in one litre} &= 2\text{g.} \\ \text{Equivalent weight of sodium hydroxide} &= 40 \\ \text{Normality of sodium hydroxide} &= \frac{\text{Weight / litre}}{\text{Equivalent weight}} \\ &= \frac{2}{40} = 0.0500\text{N}\end{aligned}$$

### Standard sodium hydroxide Vs sulphuric acid

Sl. No.	Volume of sodium hydroxide in ml	Burette Readings in ml		Volume of H <sub>2</sub> SO <sub>4</sub> in ml	Indicator
		Initial	Final		

$$\begin{aligned}\text{Volume of sodium hydroxide (V}_1\text{)} &= 20 \text{ ml} \\ \text{Normality of sodium hydroxide (N}_1\text{)} &= 0.0500 \text{ N} \\ \text{Volume of sulphuric acid (V}_2\text{)} &= \quad \quad \text{ml} \\ \text{Normality of sulphuric acid (N}_2\text{)} &= \frac{V_1 N_1}{V_2} \\ &= \frac{20 \times 0.0500}{\quad} = \quad \quad \text{N}\end{aligned}$$

### Made up sodium carbonate Vs standardised sulphuric acid

Sl. No.	Volume of Na <sub>2</sub> CO <sub>3</sub> in ml	Burette Readings in ml		Volume of H <sub>2</sub> SO <sub>4</sub> in ml	Indicator
		Initial	Final		



**Ex. No. :** **Estimation of Sodium Carbonate**

**Date :**

### **AIM**

To estimate the weight of sodium carbonate present in the whole of the given solution. A decinormal solution of sodium hydroxide containing 2g per litre and sulphuric acid as the link solution have been provided.

### **PROCEDURE**

The burette is washed with tap water, rinsed with distilled water first and then with sulphuric acid. It is filled with sulphuric acid. The pipette is washed with tap water and then rinsed with distilled water. The pipette is then rinsed with standard sodium hydroxide solution. 20ml of the same sodium hydroxide solution is pipetted out into a clean conical flask. A drop of methyl orange is added as indicator and titrated the contents of the conical flask against the sulphuric acid taken in the burette. The end point is the change of golden yellow to pink colour. The titration is repeated to get concordant values.

The given sodium carbonate solution is made up to 100 ml in a standard flask with distilled water. The pipette is washed and then rinsed with the made up sodium carbonate solution. 20 ml of this solution is pipetted out into a clean conical flask. A drop of methyl orange is added and the titration is done as before. The end point is the change of golden yellow to pink colour. The titration is repeated to get concordant values.

### **RESULT**

Weight of sodium carbonate present in the whole of the given solution is \_\_\_\_\_ g

Volume of sulphuric acid ( $V_2$ )	=	ml.	
Normality of sulphuric acid ( $N_2$ )	=	N.	
Volume of sodium carbonate ( $V_3$ )	=	20ml.	
Normality of sodium carbonate ( $N_3$ )	=	$\frac{V_2 N_2}{V_3} N$	
	=	$\frac{x}{20}$	= N
Equivalent weight of sodium carbonate	=	53	
Weight / litre of sodium carbonate	=	Normality x Equivalent weight	
	=	x 53	
	=	g	
Weight of sodium carbonate present in 100 ml	=	$\frac{g}{10}$	
	=	g	
Weight of sodium carbonate present in the Whole of the given solution	=	g	



### Estimation of sulphuric acid

Weight of hydrochloric acid in one litre = 1.8 g

Equivalent weight of hydrochloric acid = 36.5

Normality of hydrochloric acid =  $\frac{\text{Weight / litre}}{\text{Equivalent weight}}$

=  $\frac{1.8 \times 1}{36.5} = 0.0493 \text{ N}$

### Sodium hydroxide Vs Standard hydrochloric acid

Sl. No.	Volume of NaOH in ml	Burette Readings in ml		Volume of HCl in ml	Indicator
		Initial	Final		

Volume of hydrochloric acid ( $V_1$ ) = ml.

Normality of hydrochloric acid ( $N_1$ ) = N

Volume of sodium hydroxide ( $V_2$ ) = ml

Normality of sodium hydroxide ( $N_2$ ) =  $\frac{V_1 N_1}{V_2} \text{ N}$

=  $\frac{\quad \times \quad}{\quad} = \quad \text{N}$

### Standardised sodium hydroxide Vs Made up sulphuric acid

Sl. No.	Volume of NaOH in ml	Burette Readings in ml		Volume of $\text{H}_2\text{SO}_4$ in ml	Indicator
		Initial	Final		

**Ex. No.** : **Estimation of Sulphuric Acid**

**Date** :

### **AIM**

To estimate the weight of sulphuric acid present in the whole of the given solution. A standard solution of hydrochloric acid containing 1.8g per litre and approximately decinormal sodium hydroxide solution have been provided.

### **PROCEDURE**

After preliminary washings, the burette is rinsed with the given standard hydrochloric acid solution and filled with the same. The pipette is washed and rinsed with the given sodium hydroxide solution. Pipetted out 20ml of sodium hydroxide into a clean conical flask. A drop of phenolphthalein is added as indicator and titrated this solution against the hydrochloric acid taken in the burette. The end point is the disappearance of pink colour. The titrations are repeated for concordant values.

The given sulphuric acid is made up to 100ml in a standard flask with distilled water. The burette is washed with water, rinsed with the made up sulphuric acid and then filled with the same. Pipetted out 20ml of sodium hydroxide solution into a clean conical flask, added a drop of phenolphthalein and titrated against sulphuric acid taken in the burette. The end point is the disappearance of pink colour. The titrations are repeated for concordant values.

### **RESULT**

Weight of sulphuric acid present in the whole of the given solution is \_\_\_\_\_ g

Volume of sodium hydroxide ( $V_2$ )	=	ml.	
Normality of sodium hydroxide ( $N_2$ )	=	N.	
Volume of sulphuric acid ( $V_3$ )	=	ml.	
Normality of sulphuric acid ( $N_3$ )	=	$\frac{V_2 N_2}{V_3} N$	
	=	$\frac{20 \times}{\quad}$	= N
Equivalent weight of sulphuric acid	=	49	
Weight / litre of sulphuric acid	=	Normality x Equivalent weight	
	=	x 49	
	=	_____g.	
Weight of sulphuric acid in 100 ml	=	$\frac{\quad}{10} \text{g}$	
	=	g	
Weight of sulphuric acid present in the whole of the given solution	=	g	



### Estimation of Ferrous Ammonium Sulphate

Weight of oxalic acid in 500 ml = 0.7875g

Equivalent weight of oxalic acid = 63

Normality of oxalic acid =  $\frac{\text{Weight / litre}}{\text{Equivalent weight}}$

=  $\frac{0.7875 \times 2}{63} = 0.0250 \text{ N}$

### Standard oxalic acid Vs KMnO<sub>4</sub>

Sl. No.	Volume of oxalic acid in ml	Burette Readings in ml		Volume of KMnO <sub>4</sub> in ml	Indicator
		Initial	Final		

Volume of oxalic acid (V<sub>1</sub>) = ml.

Normality of oxalic acid (N<sub>1</sub>) = N

Volume of potassium permanganate (V<sub>2</sub>) = ml

Normality of potassium permanganate (N<sub>2</sub>) =  $\frac{V_1 N_1}{V_2} \text{ N}$

=  $\frac{\quad \times \quad}{\quad} = \quad \text{ N}$

### Made up ferrous ammonium sulphate Vs standardised KMnO<sub>4</sub>

Sl. No.	Volume of ferrous ammonium sulphate in ml	Burette Readings in ml		Volume of KMnO <sub>4</sub> in ml	Indicator
		Initial	Final		



**Ex. No. : Estimation of Ferrous Ammonium Sulphate**

**Date :**

### **AIM**

To estimate the weight of ferrous ammonium sulphate present in the whole of the given solution. A standard solution of oxalic acid containing 0.7875g per 500ml and an approximately decinormal solution of potassium permanganate have been provided.

### **PROCEDURE**

After preliminary washings, the burette is rinsed with potassium permanganate solution and filled with the same. The pipette is washed and rinsed with oxalic acid and pipetted out 20ml of it into a clean conical flask. An equal volume of dilute sulphuric acid is added to it and heated to bearable warmth and titrated against potassium permanganate solution taken in the burette. The end point is the appearance of pale permanent pink colour. The titration is repeated to get concordant values.

The given ferrous ammonium sulphate solution is made up to 100ml in a standard flask with distilled water. The pipette is washed and rinsed with made up ferrous ammonium sulphate and pipetted out 20 ml of it into a clean conical flask. An equal volume of dilute sulphuric acid is added to it and titrated against potassium permanganate taken in the burette. The end point is the appearance of pale permanent pink colour. The titration is repeated to get concordant values.

### **RESULT**

The weight of the ferrous ammonium sulphate present in the whole of the given solution is \_\_\_\_\_ g.

$$\begin{aligned}
\text{Volume of potassium permanganate (V}_2\text{)} &= \quad \text{ml.} \\
\text{Normality of potassium permanganate (N}_2\text{)} &= \quad \text{N.} \\
\text{Volume of ferrous ammonium sulphate(V}_3\text{)} &= \quad \text{ml.} \\
\text{Normality of ferrous ammonium sulphate (N}_3\text{)} &= \frac{V_2 N_2}{V_3} \text{N} \\
&= \frac{\quad \times \quad}{\quad} = \quad \text{N} \\
\text{Equivalent weight of ferrous ammonium sulphate} &= 392 \\
\text{Weight / litre of ferrous ammonium sulphate} &= \text{Normality x Equivalent weight} \\
&= \quad \times 392 = \quad \text{g} \\
\text{Weight of ferrous ammonium sulphate present in 100 ml} &= \frac{\quad \text{g}}{10} \\
&= \quad \text{g.} \\
\text{Weight of ferrous ammonium sulphate present in the} & \\
\text{whole of the given solution} &= \quad \text{g.}
\end{aligned}$$



### Estimation of Oxalic acid

Weight of ferrous ammonium sulphate in one litre = 9.8 g

Equivalent weight of ferrous ammonium sulphate = 392

Normality of ferrous ammonium sulphate =  $\frac{\text{Weight / litre}}{\text{Equivalent weight}}$

=  $\frac{9.8 \times 1}{392} = 0.0250\text{N}$

### Standard ferrous ammonium sulphate Vs KMnO<sub>4</sub>

Sl. No.	Volume of Ferrous Ammonium Sulphate in ml	Burette Readings in ml		Volume of KMnO <sub>4</sub> in ml	Indicator
		Initial	Final		

Volume of ferrous ammonium sulphate (V<sub>1</sub>) = ml.

Normality of ferrous ammonium sulphate (N<sub>1</sub>) = N

Volume of potassium permanganate (V<sub>2</sub>) = ml

Normality of potassium permanganate (N<sub>2</sub>) =  $\frac{V_1 N_1}{V_2}$  N

=  $\frac{\quad \times \quad}{\quad} = \quad$  N

### Made up oxalic acid Vs standardised KMnO<sub>4</sub>

Sl. No.	Volume of Oxalic acid in ml	Burette Readings in ml		Volume of KMnO <sub>4</sub> in ml	Indicator
		Initial	Final		

**Ex. No.** : **Estimation of Oxalic Acid**

**Date** :

### **AIM**

To estimate the weight of oxalic acid present in the whole of the given solution. A standard solution of ferrous ammonium sulphate containing 9.8 g per litre and an approximately decinormal solution of potassium permanganate have been provided.

### **PROCEDURE**

After preliminary washings, the burette is rinsed with potassium permanganate solution and filled with the same. The pipette is washed and rinsed with ferrous ammonium sulphate and pipetted out 20ml of it into a clean conical flask. An equal volume of dilute sulphuric acid is added and titrated against potassium permanganate solution taken in the burette. The end point is the appearance of pale permanent pink colour. The titration is repeated to get concordant values.

The given oxalic acid solution is made up to 100ml in a standard flask with distilled water. The pipette is washed and rinsed with made up oxalic acid and pipetted out 20 ml of it into a clean conical flask. An equal volume of dilute sulphuric acid is added to it and heated to bearable warmth and titrated against potassium permanganate taken in the burette. The end point is the appearance of pale permanent pink colour. The titration is repeated to get concordant values.

### **RESULT**

The weight of oxalic acid present in the whole of the given solution is \_\_\_\_\_ g.

Volume of potassium permanganate ( $V_2$ )	=	ml.
Normality of potassium permanganate ( $N_2$ )	=	N.
Volume of oxalic acid ( $V_3$ )	=	ml.
Normality of oxalic acid ( $N_3$ )	=	$\frac{V_2 N_2}{V_3} N$
	=	$\frac{\quad \times \quad}{\quad} = \quad N$
Equivalent weight of oxalic acid	=	63
Weight / litre of oxalic acid	=	Normality x Equivalent weight
	=	$\quad \times 63 = \quad g$
Weight of oxalic acid present in 100 ml	=	$\frac{\quad g}{10}$
	=	g
Weight of oxalic acid present in the whole of the given solution	=	g



### Estimation of Potassium Permanganate

$$\begin{aligned}\text{Weight of sodium hydroxide in 500 ml} &= 0.5\text{g} \\ \text{Equivalent weight of sodium hydroxide} &= 40 \\ \text{Normality of sodium hydroxide} &= \frac{\text{Weight / litre}}{\text{Equivalent weight}} \\ &= \frac{0.5 \times 2}{40} = 0.0250 \text{ N}\end{aligned}$$

### Standard sodium hydroxide Vs oxalic acid

Sl. No.	Volume of NaOH in ml	Burette Readings in ml		Volume of oxalic acid in ml	Indicator
		Initial	Final		

$$\begin{aligned}\text{Volume of sodium hydroxide (V}_1\text{)} &= \text{ml.} \\ \text{Normality of sodium hydroxide (N}_1\text{)} &= \text{N} \\ \text{Volume of oxalic acid (V}_2\text{)} &= \text{ml} \\ \text{Normality of oxalic acid (N}_2\text{)} &= \frac{V_1 N_1}{V_2} \text{ N} \\ &= \frac{\quad \times \quad}{\quad} = \text{N}\end{aligned}$$

### Standardised oxalic acid Vs made up KMnO<sub>4</sub>

Sl. No	Volume of Oxalic acid in ml	Burette Readings in ml		Volume of KMnO <sub>4</sub> in ml	Indicator
		Initial	Final		



**Ex. No.** : **Estimation of Potassium Permanganate**

**Date** :

### **AIM**

To estimate the weight of potassium permanganate present in the whole of the given solution. A standard solution of sodium hydroxide solution containing 0.5g of it in 500ml and approximately decinormal oxalic acid solution have been provided.

### **PROCEDURE**

The burette is washed and rinsed with oxalic acid and finally filled up with the same. The pipette is washed, rinsed with sodium hydroxide solution and pipetted out 20ml of it into a clean conical flask, a drop of phenolphthalein is added as indicator and titrated against oxalic acid solution taken in the burette. The end point is the disappearance of pink colour. The titration is repeated to get concordant values.

The given potassium permanganate is made up to 100ml in a standard flask with distilled water. The burette is washed, rinsed with potassium permanganate and filled with the same. The pipette is washed, rinsed with oxalic acid and 20 ml of it is pipetted out into a clean conical flask. Added an equal volume of dilute sulphuric acid, heated to bearable warmth and titrated against potassium permanganate taken in the burette. The end point is the appearance of pale permanent pink colour. The titration is repeated to get concordant values.

### **RESULT**

The weight of potassium permanganate present in the whole of the given solution is \_\_\_\_\_ g.

Volume of oxalic acid ( $V_2$ )	=	ml.
Normality of oxalic acid ( $N_2$ )	=	N.
Volume of potassium permanganate ( $V_3$ )	=	ml.
Normality of potassium permanganate ( $N_3$ )	=	$\frac{V_2 N_2}{V_3} N$
	=	$\frac{x}{10} = N$
Equivalent weight of potassium permanganate	=	31.6
Weight / litre of potassium permanganate	=	Normality x Equivalent weight
	=	$x \times 31.6$
Weight of potassium permanganate present in 100 ml	=	$\frac{x \times 31.6}{10} \text{ g}$
	=	$x \text{ g}$
Weight of potassium permanganate present in the whole of the given solution	=	$x \text{ g}$



### Estimation of Copper

Weight of potassium dichromate in 250ml = 0.3063 g

Equivalent weight of potassium dichromate = 49

Normality of potassium dichromate =  $\frac{\text{Weight / litre}}{\text{Equivalent weight}}$

=  $\frac{0.3063 \times 4}{49} = 0.0250 \text{ N}$

### Standard potassium dichromate Vs sodium thiosulphate

Sl. No.	Volume of K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> in ml	Burette Readings in ml		Volume of sodium thio sulphate in ml	Indicator
		Initial	Final		

Volume of potassium dichromate (V<sub>1</sub>) = ml.

Normality of potassium dichromate (N<sub>1</sub>) = N

Volume of sodium thiosulphate (V<sub>2</sub>) = ml

Normality of sodium thiosulphate (N<sub>2</sub>) =  $\frac{V_1 N_1}{V_2} \text{ N}$

=  $\frac{\quad \times \quad}{\quad} = \quad \text{N}$

### Made up copper sulphate Vs standardised sodium thiosulphate

Sl. No.	Volume of copper sulphate in ml	Burette Readings in ml		Volume of Sodium thio sulphate in ml	Indicator
		Initial	Final		

**Ex. No.** : **Estimation of Copper**

**Date** :

### **AIM**

To estimate the weight of copper present in the whole of the given solution. A standard solution of potassium dichromate containing 0.3063 g in 250ml and approximately decinormal solution of sodium thiosulphate have been provided.

### **PROCEDURE**

After preliminary washing and rinsing, the burette is filled up with sodium thiosulphate solution. After washing and rinsing, the pipette is rinsed with standard potassium dichromate solution. Pipetted out 20ml of the same into a clean conical flask, added 5ml of concentrated hydrochloric acid and 5ml of 10% potassium iodide solution. The liberated iodine is titrated against thiosulphate solution taken in the burette. When the solution becomes straw yellow in colour added 1 ml of starch as indicator and the titration is continued. The end point is the disappearance of blue colour and appearance of green colour. The titration is repeated to get concordant values.

Made up the given copper sulphate solution to 100ml in a standard flask. After washing and rinsing, the pipette is rinsed with the made up copper sulphate solution and pipetted out 20ml of the same into a clean conical flask, added ammonium hydroxide in drops till a pale blue precipitate is formed. It is dissolved in acetic acid added two drops of acetic acid in excess and then added 5 ml of 10% potassium iodide solution. The contents are titrated against sodium thiosulphate solution taken in the burette. When the solution becomes straw yellow in colour added 1 ml of starch as indicator. The end point is the disappearance of blue colour. The titration is repeated to get concordant values.

### **RESULT**

The weight of copper present in the whole of the given solution \_\_\_\_\_ g.

Volume of sodium thiosulphate ( $V_2$ )	=	ml.
Normality of sodium thiosulphate ( $N_2$ )	=	N.
Volume of copper solution ( $V_3$ )	=	ml.
Normality of copper solution ( $N_3$ )	=	$\frac{V_2 N_2}{V_3} N$
	=	$\frac{\quad \times \quad}{\quad} = \quad N$
Equivalent weight of copper	=	63.5
Weight / litre of copper	=	Normality x Equivalent weight
	=	$\quad \times 63.5 = \quad g$
Weight of copper present in 100 ml	=	$\frac{\quad g}{10}$
	=	g
Weight of copper present in the whole of the given solution	=	g



## Calculation

Article to be weighed	Weight		Correct weight in g
	g	mg	
Weighing bottle+substance			
Weighing bottle after transferring the substance			
Weight of substance (w)			

Weight of the substance in 100ml = g

Weight /litre of the substance =  $W \times 10 = \text{_____} \text{ g} \times 10 = \text{_____} \text{ g}$

Molecular weight of the substance =

Molarity of the solution =  $\frac{\text{weight / litre}}{\text{Molecular weight}}$

= \_\_\_\_\_

= M



**Ex. No.** : **Preparation of Standard Solution**

**Date** :

**AIM**

To prepare a standard solution of copper sulphate by accurately weighing about 2.5g and making up the solution to 100 ml.

**REQUIREMENTS**

Chemical balance, copper sulphate, weighing bottle, weight box, standard flask and funnel.

**PROCEDURE**

Dry weighing bottle with substance is placed in the left pan of a chemical balance. Weight is added to the right pan. After getting equal oscillation weighing bottle is taken out. The substance is transferred carefully to standard flask through funnel. A little amount of water is added to the flask and dissolved the substance. Then the weighing bottle is placed in the left pan and accurate weight of weighing bottle is taken. The weight is noted. The solution is made up to the mark and shaken well. Finally the solution is labeled.

**RESULT**

The molarity of the solution is \_\_\_\_\_ M.

$$\begin{aligned}
&\text{Conductance of 0.1N potassium chloride solution} = \\
&\text{Specific Conductance of 0.1N potassium chloride} \\
&\quad \text{at } 30^{\circ}\text{C} = 14.12 \times 10^{-3} \text{ ohm}^{-1} \text{ cm}^{-1} \\
&\text{Cell constant } (\ell/a) \text{ of the given conductivity cell} = \frac{\text{specific conductance}}{\text{conductance}} \\
&= \frac{14.12 \times 10^{-3} \text{ ohm}^{-1} \text{ cm}^{-1}}{\quad} \\
&= \\
&\text{Cell constant } (\ell/a) \text{ of the given conductivity cell} =
\end{aligned}$$

**Ex. No.** : **Determination of cell constant**

**Date** :

**AIM:**

To determine the cell constant of the given conductivity cell.

**REQUIREMENTS:**

Conductivity bridge, conductivity cell, 150ml beaker and 0.1N potassium chloride solution.

**PROCEDURE:**

The conductivity cell is washed with distilled water first and then rinsed with 0.1N potassium chloride. About half of the beaker is filled with 0.1N potassium chloride solution after rinsing. The conductivity cell is immersed in this solution, connected to the conductivity bridge and conductance (C) of the solution is measured. Specific conductance (k) of 0.1N potassium chloride at 30°C is  $0.01412 \text{ ohm}^{-1} \text{ cm}^{-1}$ . Cell constant ( $\ell/a$ ) is calculated using the equation  $\ell/a = K / C$ .

**RESULT:**

The cell constant of the given conductivity cell = \_\_\_\_\_

## Calculation

### Determination of equivalent conductance of electrolyte solution A1 (0.01M)

Conductance (s) of electrolyte solution A = \_\_\_\_\_ ohm<sup>-1</sup> cm<sup>-1</sup>.

Cell constant ( $\frac{l}{a}$ ) of the given cell = \_\_\_\_\_

Specific conductance (K) of electrolyte  
solution A =  $s \times \frac{l}{a}$  ohm<sup>-1</sup> cm<sup>-1</sup>.

Concentration (C) of electrolyte  
solution A = \_\_\_\_\_ N.

Equivalent conductance ( $\lambda_c$ ) of  
electrolyte solution A =  $\frac{1000K}{C}$  ohm<sup>-1</sup> cm<sup>2</sup> g equi<sup>-1</sup>.

### Determination of equivalent conductance of electrolyte solution A2 (0.005M)

Conductance (s) of electrolyte solution B = \_\_\_\_\_ ohm<sup>-1</sup> cm<sup>-1</sup>.

Cell constant ( $\frac{l}{a}$ ) of the given cell = \_\_\_\_\_

Specific conductance (K) of electrolyte  
solution B =  $s \times \frac{l}{a}$  ohm<sup>-1</sup> cm<sup>-1</sup>.

Concentration (C) of electrolyte  
solution B = \_\_\_\_\_ N.

Equivalent conductance ( $\lambda$ ) of  
electrolyte solution B =  $\frac{1000K}{C}$  ohm<sup>-1</sup> cm<sup>2</sup> g equi<sup>-1</sup>.

**Ex. No. :** **Determination of Equivalent Conductance**

**Date :**

### **AIM**

To determine the equivalent conductance of the given electrolyte solution.

### **REQUIREMENTS**

Conductivity bridge, conductivity cell, 150ml beaker and electrolyte solutions (A and B).

### **PROCEDURE**

The conductivity cell of known cell constant ( $l/a$ ) is washed with distilled water first and then rinsed with the given electrolyte solution A. About half of the beaker is filled with this electrolyte solution. The conductivity cell is immersed in this solution. Connected to the conductivity bridge and the conductance ( $s$ ) of this solution is measured. Specific conductance ( $K$ ) is determined using the equation  $K = s \times l/a$ . Knowing the concentration ( $C$ ) of the electrolyte solution A, equivalent conductance ( $\lambda_c$ ) is calculated using the formula

$$\lambda_c = \frac{1000K}{C}.$$

The above experiment is repeated with the solution B.

### **RESULT**

The equivalent conductance of

1. Electrolyte solution A 1 (0.01M) = \_\_\_\_\_  $\text{ohm}^{-1} \text{cm}^2 \text{g equi}^{-1}$ .
2. Electrolyte solution A 2 (0.005M) = \_\_\_\_\_  $\text{ohm}^{-1} \text{cm}^2 \text{g equi}^{-1}$ .

It is concluded that as dilution increases equivalent conductance also increases.

pH for tap water =

pH for cauvery water =

pH for distilled water =

**Ex. No. :** **Determination of pH using pH meter**

**Date :**

**AIM**

To determine the pH of water samples using pH meter.

**REQUIREMENTS**

Buffer tablets, pH meter, 100ml standard flask, 250ml beakers, funnel and glass rod.

**PROCEDURE**

The pH meter is switched on for 3 minutes. Buffer tablet (pH=4) is dissolved in a beaker using distilled water and made up to 100ml in a standard flask. This buffer solution is taken in a dry beaker. Glass and calomel electrodes are introduced into it. This set up is connected to pH meter. The instrument is calibrated. The electrodes are then removed and rinsed with water sample 1. Now the electrodes are immersed in the water sample 1 taken in the beaker. The meter reading shows the pH of the water sample. The experiment is repeated with other water samples.

**RESULT**

The pH of water sample (1) = tap water is

(2) = cauvery water is

(3) = distilled water is

**Calculation:**

**Hard Water Vs EDTA**

Sl. No	Volume of hard water in ml	Burette Reading		Volume of EDTA in ml	Indicator
		Initial	Final		

**Calculation:**

Strength of EDTA = 0.01 M.

1000 ml of 1M EDTA = 40.08g of Ca<sup>2+</sup> ion.

\_\_\_\_\_ ml of 0.01M EDTA =  $\frac{40.08 \times \quad \times 0.01}{1000 \times 1}$  = \_\_\_\_\_ g of Ca<sup>2+</sup>

40 ml of water contains \_\_\_\_\_ g of Ca<sup>2+</sup>

40.08 g of Ca<sup>2+</sup> ion is present in 100 g of CaCO<sub>3</sub>.

\_\_\_\_\_ g of Ca<sup>2+</sup> ion is present in  $\frac{\quad \times 100.08}{40.08}$  g of CaCO<sub>3</sub>

40 ml of water contains \_\_\_\_\_ g of CaCO<sub>3</sub>

∴ 10<sup>6</sup> ml of water contains  $\frac{\quad \times 10^6}{40}$  g of CaCO<sub>3</sub>

=

Hardness of water = \_\_\_\_\_ ppm



**Ex. No.** : **Estimation of Hardness of water**

**Date** :

**AIM**

To determine the total hardness of water, being supplied with standard EDTA solution.

**REQUIREMENTS**

Burette, pipette, conical flask, EDTA solution, Eriochrome Black – T.

**PROCEDURE**

Exactly 40 ml of the given sample of water is pipetted out into a clean conical flask. To this one ml of buffer solution and a pinch of eriochrome black–T are added and titrated against standard EDTA solution taken in the burette. The end point is the colour change from wine red to blue. The titration is repeated to get concordant value.

**RESULT**

The total hardness of water = \_\_\_\_\_ ppm.

<b>Concentration of <math>\text{KMnO}_4</math> <math>\times 10^{-4} \text{ M}</math></b>	<b>OD</b>

**Ex. No. : Colorimetric Estimation of Potassium Permanganate**

**Date :**

**AIM**

To determine the concentration of the given potassium permanganate solution colorimetrically.

**REQUIREMENTS**

Standard potassium permanganate solution, 100 ml standard flask (6), photoelectric colorimeter.

**PROCEDURE**

Standard potassium permanganate solutions of concentrations 0.6, 0.9, 1.2, 1.8 and  $2.4 \times 10^{-4}$  M are prepared. Optical densities of the above solutions are measured using 520 nm filter in a photoelectric colorimeter. A graph is drawn taking optical densities on y-axis and concentration on x-axis. Optical density is measured for the unknown solution. From the graph the unknown concentration is found out.

**RESULT**

The concentration of the unknown potassium permanganate are

i) unknown (A) = \_\_\_\_\_ M.

ii) unknown (B) = \_\_\_\_\_ M.

## Calculation:

### Standard electrode potential of Copper:

$$E_{\text{cell (obs)}} = E_{\text{Cu}} - E_{\text{calomel}}$$

$$E_{\text{cell (obs)}} = \quad \text{v.} \quad E_{\text{cal}} = 0.2422 \text{ v.}$$

$$E_{\text{Cu}} = E_{\text{cell (obs)}} + E_{\text{calomel}}$$

$$= \quad + 0.2422$$

$$E_{\text{Cu}} = \quad \text{v.}$$

$$E_{\text{Cu}} = E_{\text{Cu}}^{\circ} - \frac{2.303}{nF} RT \log \frac{1}{[\text{Cu}^{2+}]}$$

$$E_{\text{Cu}}^{\circ} = E_{\text{Cu}} - \frac{2.303}{nF} RT \log [\text{Cu}^{2+}]$$

$$E_{\text{Cu}} = \quad \text{v.} \quad [\text{Cu}^{2+}] = \quad \text{N.}$$

$$E_{\text{Cu}}^{\circ} = \quad - \frac{0.06}{2} \log [ \quad ]$$

$$E_{\text{Cu}}^{\circ} = \quad - 0.03 \times ( \quad )$$

$$E_{\text{Cu}}^{\circ} = \quad + \quad$$

$$= \quad \text{v}$$

**Ex. No. :** **Determination of Standard Electrode Potential**

**Date :**

**AIM**

To determine the standard electrode potential of copper.

**REQUIREMENTS:**

Potentiometer, calomel electrode, copper electrode, standard solution of copper.

**Procedure:**

The cell calomel ||Cu<sup>2+</sup>|Cu is set up. It is connected to a potentiometer and the emf of the cell is measured. Knowing the emf of the standard electrode potential E<sup>o</sup> is calculated

using the equation  $E = E^o - \frac{2.303 RT}{nF} \log [M^{n+}]$ .

**RESULT**

The standard electrode potential of copper is \_\_\_\_\_ volt.



**Ex. No.** : **Determination of pH using Universal Indicator**

**Date** :

**Aim:**

To determine the pH of the given buffer solutions A and B.

**Requirements:**

Universal indicator, beaker, buffer solution.

**Procedure:**

Buffer solutions of known pH are prepared. Few drops of universal indicator are added to each of the buffer solution and noted the colour. Added indicator to the unknown buffer solutions A and B and compared with the colours already noted. The corresponding pH values are recorded.

**Result:**

The pH of the buffer solution A =

buffer solution B =

buffer solution C =

buffer solution D =

**For Copper**

Distance travelled by the solute from the origin =

Distance travelled by the solvent from the origin =

$$R_f \text{ value} = \frac{\text{Distance travelled by the solute}}{\text{Distance travelled by the solvent}}$$

= \_\_\_\_\_

=



**Ex. No.** : **Paper chromatographic technique**

**Date** :

### **AIM**

To determine the  $R_f$  value of copper using paper chromatographic technique.

### **REQUIREMENTS**

A sheet of whatmann no:1 filter paper, copper sulphate solution, developing solvent, (acetone : HCl : water in the ratio 17 : 12 : 1), chromatographic chamber, capillary tubes and hydrogen sulphide solution.

### **PROCEDURE**

A pencil line is drawn 3 to 4 cm above the end of the sheet of a filter paper. A pencil mark is made on this line. A small drop of the given solution is placed on the pencil mark with the help of a hot air blower. The paper is suspended in a chromatographic chamber with the glass rod and dipped into the solvent. The jar is covered and allowed to stand for the developing solvent to rise almost up to the end of the capillary tube. The spot is dried using a hot air blower paper. The paper is removed from the jar carefully and the solvent front is marked. The paper is dried and exposed to hydrogen sulphide. A black coloured spot is observed. The distance is measured from the origin to the centre of the coloured spot and also between the origin and the solvent front. The  $R_f$  value has been determined.

$$R_f = \frac{\text{Distance travelled by the solute from the origin}}{\text{Distance travelled by the solvent from the origin}}$$

### **RESULT**

The  $R_f$  value of copper is \_\_\_\_\_.

