

ENGINEERING SCIENCE LAB

CHEMISTRY

LAB MANUAL



Govt. Polytechnic College, Perumbavoor

General Department

COURSE CODE : C207 [2007]

COURSE NAME : ENGINEERING SCIENCE LAB

www.gptcperumbavoor.ac.in

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VISION AND MISSION

Government Polytechnic College, Perumbavoor
Vision Excel as a centre of skill education moulding professionals who sincerely strive for the betterment of society.
Mission <ul style="list-style-type: none">• To impart state of the art knowledge and skill to the graduate and moulding them to be competent, committed and responsible for the well being of society.• To apply technology in the traditional skills, thereby enhancing the living standard of the community

Department of Electronics & Communication Engineering
Vision Excel as a centre of skill education in Electronics and Communication Engineering, moulding professionals who sincerely strive for the betterment of themselves and society.
Mission <ul style="list-style-type: none">• To impart state of the art knowledge, skill and attitude to the students and contributing to their sustainable development.• To merge technologies in the field of Electronics and Communication Engineering with occupational skills, thereby improving quality of living.

Exp No. Date:

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PEO, PO and PSOs of the Program

Program Educational Outcome (PEOs)

PEO1: Secure successful careers in manufacturing, testing, maintenance, development and marketing in Electronics and Communication Engineering.

PEO2: Acquire knowledge and competency in the domain to develop innovative, cost effective and socially acceptable solutions to engineering problems in a multi disciplinary work environment.

PEO3: Develop strong fundamental knowledge that prepares them for professional careers/higher studies with attitude for lifelong learning.

PEO4: Instill the attitude to be sensitive to ethical, societal and environmental issues while pursuing their professional duties.

PEO5: Possess leadership qualities and be effective communicator to work efficiently with diverse teams, promote and practice appropriate ethical practices.

Program Outcomes (POs)

PO1: Basic Knowledge: Apply knowledge of basic mathematics, science and engineering to the solution of engineering problems.

PO2: Discipline knowledge: Apply knowledge in Electronics and Communication Engineering to solve applied engineering problems.

PO3: Experiments and practice: Able to plan and perform experiments and practices and to solve engineering problems.

PO4: Engineering Tools: Apply appropriate technologies and tools with proper understanding of their limitations.

PO5: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO6: Environment and sustainability: Understand the impact of the engineering solutions in societal and environmental contexts and demonstrate the knowledge and need for sustainable development.

PO7: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO8: Individual and team work: Function effectively as an individual and as a member or leader in diverse multidisciplinary teams.

PO9: Communication: Able to communicate effectively.

PO10: Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the context of technological changes.

Program Specific Outcome (PSO):

PSO1: Specialization knowledge: Apply concepts and knowledge in the field of semiconductor devices, communication and networking technologies, embedded systems.

PSO2: Professional growth: Generate ideas from the knowledge of engineering specialization leading to professional growth.

PSO3: Entrepreneurship: Apply knowledge and understanding of engineering principles to initiate entrepreneurship ventures.

Exp No. Date:

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SAFETY PROCEDURES

Problem Statement:

The safety instructions are presented to the attention of the students as a mean of preventing accidents while performing experiments and activities in the engineering science lab .The purpose is to draw attention to the risks involved in lab activities to prevent human suffering and damage to equipment.

Safety in the laboratory:

Laboratory in charge is responsible for the arrangements of lab activities; Listen carefully to his/her instructions and follow them.

Come to lab prepared to perform the experiment. Follow all written and verbal instructions. When in doubt, ask.

Be alert and attentive at all times.

Report all accidents, injuries or breakage to the instructor immediately. Also, report any equipment that you suspect is malfunctioning.

Use equipment with care for the purpose for which it is intended.

Do not perform unauthorized experiments. Get the instructor's permission before you try something original.

Return all equipment, clean and in good condition, to the designated location at the end of the lab period.

No individual work is allowed in the lab.

To do and not to do:

Inform the lab in charge about dangerous conditions and faults in the lab or nearby environment.

Do not do any action that may harm people or equipments in the lab.

Do not misuse any of the tools or instruments belong to the lab.

Strict discipline should be maintained in the laboratory.

Turn off cell phones before entering the lab.

At the end leave the work table clean and tidy.

Result

Familiarization of safety precautions performed.

	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Exp No.

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 Date:

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COMMON LABORATORY APPARATUS

Problem Statement:

Familiarize common laboratory apparatus

THEORY

Basic laboratory techniques have to be thoroughly mastered to become a good experimenter . Carelessness in handling the apparatus and inaccurate observations can only lead to incorrect and misleading results.

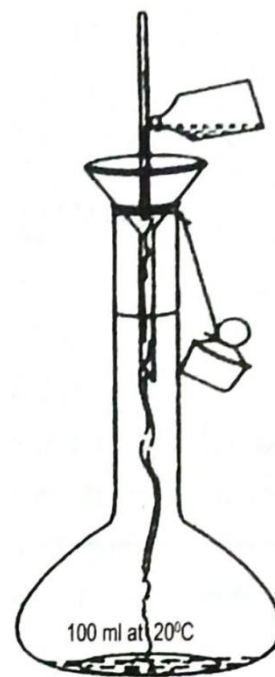
The chemical apparatus is simple but must be used with care .

The various types of commonly used apparatus in the laboratory for volumetric analysis are the following .

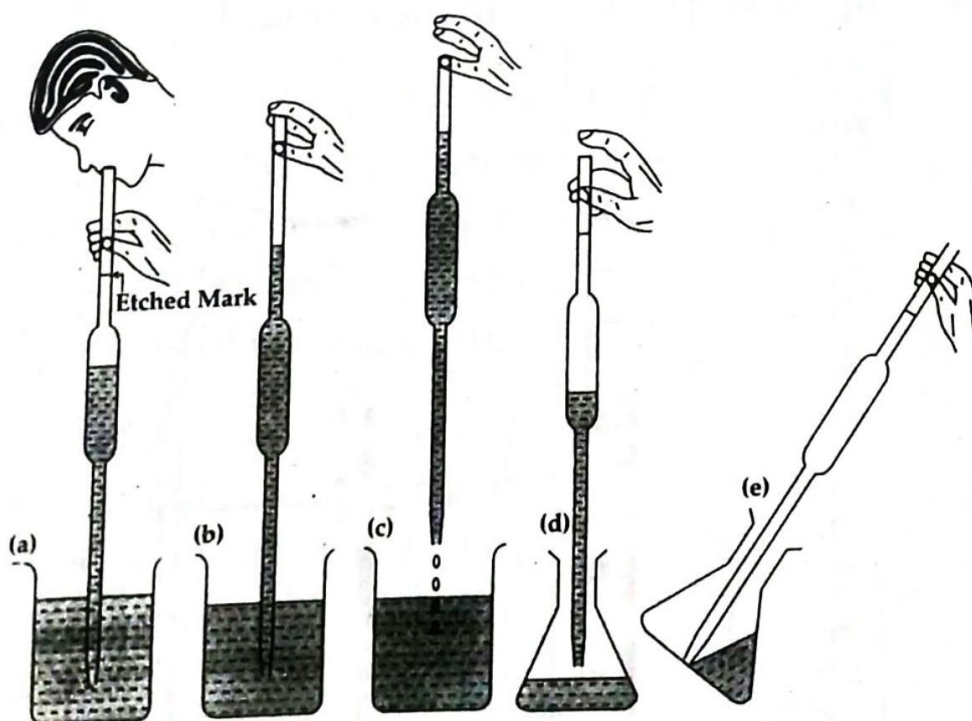
1. **GLASS TUBE** : It is a hollow , cylindrical tube of glass used for transporting liquids.
2. **BEAKER** : A beaker is a flat bottom cylindrical vessel with a pouring beak. It is available in various sizes and is mainly used for storing solutions .
3. **FUNNEL** : A funnel is a cone shaped vessel having a tube at the lower end . Funnels made of glass or plastic are used in the laboratory . It is used for transferring liquid.

4. **STANDARD MEASURING FLASK** : It is long narrow necked flat – bottom flask fitted with tight fitting glass stopper and constructed to contain a given volume of liquid when filled to a mark etched on the neck of the flask.

5. **PIPETTE** : The pipette is an apparatus which is used to measure out and deliver a definite volume of liquid. It consists of a long narrow glass tube with a cylindrical bulb in the middle. The lower end of the pipette , called **delivery end** is drawn out to a fine tip . The upper narrow part of the pipette has a mark etched around it . The upper end of the pipette is the **suction end**. The capacity of the pipette at a certain temperature , usually 20°C , will be marked on the bulb



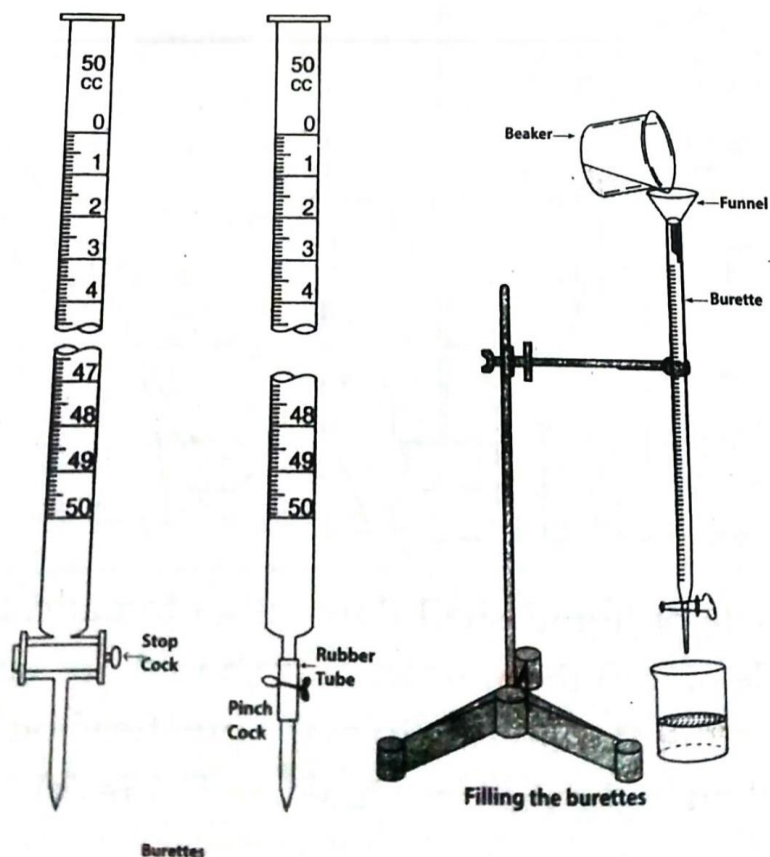
Quantitative transfer of a solution into a standard flask



6. BURETTE

Burette is an accurate device usually having a capacity of 50 ml and graduated to 0.1 ml. The graduation begins from zero at the top and proceeds downwards. Burette is used for adding measured volumes of solutions during a titration

It is a long graduated cylindrical glass tube and is provided with a glass tap or stop- cock at the end.



7. CONICAL FLASK (TITRATION FLASK)

Titration flask is a special type of flask having a wide neck, belly and a flat bottom. The wide neck, allows the direct fall of the liquid from the burette even when the flask is being whirled. The big belly avoids the risk of liquid going up along the sides while the flask is in whirling motion during titration.

The titration flask can be heated if desired. It should not be rinsed with any solution. It is always washed with distilled water.

8. MEASURING CYLINDER

The measuring cylinder is used for measuring approximate volumes of liquids. It is a graduated cylindrical glass vessel of uniform cross section with a flat bottom and a beak at the top. Measuring cylinders of various capacities are commonly used. It cannot be used for measurement of accurate volumes of liquids.

Result

Familiarization of common laboratory apparatus achieved.

	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Exp No.

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 Date:

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VOLUMETRIC ANALYSIS

Problem Statement:

Familiarize Volumetric Analysis

Principle :

When two solutions completely react with each other the product of volume and normality of one solution will be equal to the product of of volume and normality of the other solution.

THEORY

Volumetric analysis involves estimation of a substance in solution by neutralization , reduction , oxidation or by using another solution of accurately known strength . It depends on measurements of the volumes of solutions of interacting substances . A measured volume of the solution of a substance A is allowed to react completely with the solution of definite strength of another substance B . The volume of B is noted . Thus, by knowing the volumes of the two solutions used in the reaction and the strength of solution B , the strength of solution A , can be found out .

Titration

The process of finding out the volumes of reagents required to bring out a definite reaction just to completion is termed as *titration*

End point

The end point of a titration is the stage at which complete reaction takes place between two solutions . The end point is determined by an indicator which shows a marked colour change at the completion of the reaction .

Standard solution

A Standard solution is the one for which the concentration is known accurately.

Result

Familiarization of Volumetric analysis achieved .

	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Exp No. 6

Date:

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COMPLEXOMETRY

Problem Statement:

Familiarize Complexometry

THEORY

Ethylene diamine tetra acetic acid (EDTA) is considered as the best complexing agent in quantitative analytical reactions . EDTA forms very stable complexes with many metal and hydrogen ions are liberated during the formation of complexes .

Thev commonly used indicators in complexometry are certain dye stuffs which respond to certain cations like Mg ,Zn,Ni etc..known as metal indicators . The molecules of these dye stuffs are able to form complexes with specific metal atoms. The metal complexes has a colour different from that of the dye stuff.

The most commonly used metal indicator is Eriochrome black T which has a blue colour in the P^H range of 7 to 11.

Result

Familiarization of complexometric analysis achieved .

	Signature of Lab in charge	Remarks
Readiness to do experiment		
Completion of Experiment		

Standardisation of Hydrochloric Acid

OBSERVATION

NaOH × HCl (Indicator : Phenolphthalein)

Sl.No.	Volume of NaOH solution(ml)	Burette reading		Volume of HCl used(ml)
		Initial	Final	

Volume of HCl used , V_1 = ml

CALCULATION

Volume of NaOH , V_2 = 20 ml

Normality of NaOH , N_2 = .1N

Volume of HCl , V_1 = ml

At the end point , $V_1 N_1 = V_2 N_2$

$$N_1 = V_2 N_2 / V_1$$

Normality of HCl , N_1 =N

Equivalent weight of HCl = 36.5

Weight / litre of HCl = Normality × Equivalent weight

$$= \dots\dots\dots \times 36.5$$

$$= \dots\dots\dots \text{g}$$

Amount of HCl present inml of the given solution =g

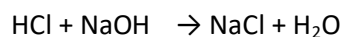
7. STANDARDISATION OF HYDROCHLORIC ACID

AIM

- i. Standardise and estimate the amount of hydrochloric acid in one litre of the given solution .
You are provided with decinormal solution of sodium hydroxide
- ii. Calculate the amount of HCl present inml of the given solution

PRINCIPLE

Standardisation is based on the neutralisation reaction between hydrochloric acid and sodium hydroxide solution



PROCEDURE

20 ml of sodium hydroxide solution is pipetted out into a clean conical flask. A drop of phenolphthalein indicator is added. It gives pink colour to the solution. This is titrated against hydrochloric acid taken in the burette. The end point is just disappearance of pink colour. The titration is repeated to get concordant values.

RESULT

1. Normality of hydrochloric acid =N
2. Amount of HCl present inml of the given solution =.....g

Standardisation of sodium hydroxide

OBSERVATION

NaOH × H₂SO₄ (Indicator : Phenolphthalein)

Sl.No.	Volume of NaOH solution (ml)	Burette reading		Volume of H ₂ SO ₄ used(ml)
		Initial	Final	

Volume of H₂SO₄ used , V₁ = ml

CALCULATION

Volume of H₂SO₄ , V₁ = ml

Normality of H₂SO₄ , N₁ = .1N

Volume of NaOH , V₂ = 20 ml

At the end point , V₁ N₁ = V₂ N₂

$$N_2 = V_1 N_1 / V_2$$

Normality of NaOH , N₂ =N

Equivalent weight of NaOH = 40

Weight / litre of NaOH = Normality × Equivalent weight

$$= \times 40$$

$$=g$$

Amount of NaOH present inml of the given solution =g

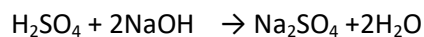
8. STANDARDISATION OF SODIUM HYDROXIDE

AIM

- i. Standardise and estimate the amount of sodium hydroxide in one litre of the given solution . You are provided with decinormal solution of sulphuric acid.
- ii. Calculate the amount of NaOH present inml of the given solution

PRINCIPLE

Standardisation is based on the neutralisation reaction between sodium hydroxide and sulphuric acid.



PROCEDURE

20 ml of sodium hydroxide solution is pipetted out into a clean conical flask. A drop of phenolphthalein indicator is added. It gives pink colour to the solution. This is titrated against sulphuric acid taken in the burette. The end point is just disappearance of pink colour. The titration is repeated to get concordant values.

RESULT

- i. Normality of sodium hydroxide =N
- ii. Amount of NaOH present inml of the given solution =.....g

A. Standardisation of sulphuric acid

OBSERVATION

$\text{Na}_2\text{CO}_3 \times \text{H}_2\text{SO}_4$ (Indicator : Methyl Orange)

Sl.No.	Volume of Na_2CO_3 solution (ml)	Burette reading		Volume of H_2SO_4 used(ml)
		Initial	Final	

Volume of H_2SO_4 used , $V_1 = \dots\dots\dots$ ml

CALCULATION

Volume of H_2SO_4 , $V_1 = \dots\dots\dots$ ml

Volume of Na_2CO_3 , $V_2 = 20$ ml

Normality of Na_2CO_3 , $N_2 = .1\text{N}$

At the end point , $V_1 N_1 = V_2 N_2$

$$N_1 = V_2 N_2 / V_1$$

Normality of H_2SO_4 , $N_1 = \dots\dots\dots\text{N}$

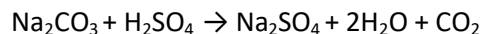
9 . ESTIMATION OF SODIUM HYDROXIDE

AIM

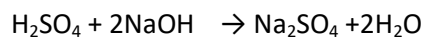
- i. Estimate the normality of sodium hydroxide solution using a standard solution of .1 N sodium carbonate and approximately decinormal sulphuric acid.
- ii. Calculate the amount of NaOH present inml of the given solution

PRINCIPLE

This experiment involves double titration . First titration is standardization of sulphuric acid using a standard solution of sodium carbonate



The second titration involves estimation of NaOH using standardised sulphuric acid



PROCEDURE

(i) STANDARDISATION OF SULPHURIC ACID

20 ml of sodium carbonate solution is pipetted out into a clean conical flask. A drop of methyl orange indicator is added. It gives yellow colour to the solution. This is titrated against sulphuric acid taken in the burette till the yellow colour changes to orange red. Noted the final reading of the burette . The titration is repeated to get concordant values.

Estimation of sodium hydroxide

OBSERVATION

NaOH × H₂SO₄ (Indicator : Phenolphthalein)

Sl.No.	Volume of NaOH solution (ml)	Burette reading		Volume of H ₂ SO ₄ used(ml)
		Initial	Final	

Volume of H₂SO₄ used , V₁ = ml

CALCULATION

Volume of H₂SO₄ , V₁ = ml

Normality of H₂SO₄ , N₁ =N

Volume of NaOH , V₂ = 20 ml

At the end point , V₁ N₁ = V₂ N₂

$$N_2 = V_1 N_1 / V_2$$

Normality of NaOH , N₂ =N

Equivalent weight of NaOH = 40

Weight / litre of NaOH = Normality × Equivalent weight

$$= \times 40$$

$$=g$$

Amount of NaOH present inml of the given solution =g

(ii) ESTIMATION OF NaOH

20 ml of sodium hydroxide solution is pipetted out into a clean conical flask. A drop of phenolphthalein indicator is added. It gives pink colour to the solution. This is titrated against sulphuric acid taken in the burette. The end point is just disappearance of pink colour. The titration is repeated to get concordant values.

RESULT

- i. Normality of sodium hydroxide =N
- li . Amount of NaOH present inml of the given solution =.....g

Standardisation of NaOH

OBSERVATION

NaOH × H₂SO₄ (Indicator : Phenolphthalein)

Sl.No.	Volume of NaOH solution (ml)	Burette reading		Volume of H ₂ SO ₄ used(ml)
		Initial	Final	

Volume of H₂SO₄ used , V₁ = ml

CALCULATION

(H₂SO₄) X (NaOH)

$$V_1 N_1 = V_2 N_2$$

$$N_2 = V_1 N_1 / V_2$$

Normality of NaOH , N₂ =N

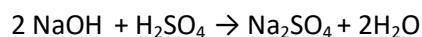
10. ESTIMATION OF NITRIC ACID

AIM

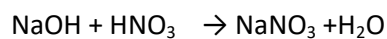
- i. To determine strength of the given nitric acid solution using a standard solution of sulphuric acid of .1N and an approximately decinormal solution of NaOH
- ii. Calculate the amount of HNO₃ present inml of the given solution

PRINCIPLE

This experiment involves double titration . First titration is standardization of NaOH using a standard solution of H₂SO₄



The second titration involves estimation of HNO₃



PROCEDURE

- i. STANDARDISATION OF NaOH

20 ml of sodium hydroxide solution is pipetted out into a clean conical flask. A drop of phenolphthalein indicator is added. It gives pink colour to the solution. This is titrated against sulphuric acid taken in the burette. The end point is just disappearance of pink colour. The titration is repeated to get concordant values.

OBSERVATION

NaOH × HNO₃ (Indicator : Phenolphthalein)

Sl.No.	Volume of NaOH solution(ml)	Burette reading		Volume of HNO ₃ used(ml)
		Initial	Final	

Volume of HNO₃ used , V₁ = ml

CALCULATION

(HNO₃) X (NaOH)

$$V_1 N_1 = V_2 N_2$$

$$N_1 = V_2 N_2 / V_1$$

Normality of HNO₃ , N₁ =N

Equivalent weight of HNO₃ = 63

Weight / litre of HNO₃ = Normality × Equivalent weight

$$= \times 63$$

$$=g$$

Amount of HNO₃ present inml of the given solution =g

i. ESTIMATION OF NITRIC ACID

20 ml of sodium hydroxide solution is pipetted out into a clean conical flask. A drop of phenolphthalein indicator is added. It gives pink colour to the solution. This is titrated against nitric acid taken in the burette. The end point is just disappearance of pink colour. The titration is repeated to get concordant values.

RESULT

1. Normality of nitric acid =N

2. Amount of HNO_3 present inml of the given solution =.....g

11. MEASUREMENT OF pH

AIM

- (i) To determine the pH values of the given solutions using universal indicator

PRINCIPLE

This experiment is based on the use of universal indicator which is a mixture of several indicators. The universal indicator will impart different colours to solutions depending on their pH values.

PROCEDURE

Take 10 ml of the solution whose pH value is to be determined in a clean test tube. Add two drops of universal indicator to the solution. The colour obtained was then matched with the most suitable colour in the standard pH chart. This is the pH value of the unknown solution. Repeat the procedure with other solutions.

- (ii) To determine pH of a solution using pH test paper

Dip the pH test paper in the given solutions. The colour developed is compared with the standard chart provided. The pH value corresponding to the matched colour in the chart is the pH of the unknown solution. Repeat with other solutions

Unknown solution	pH value		Nature of solution
	Universal indicator	pH test paper	
A			
B			
C			

Titration of standard ferrous ammonium sulphate vs potassium permanganate solution

Sl.No.	Volume of ferrous ammonium sulphate solution(ml)	Burette reading		Volume of KMnO ₄ used(ml)
		Initial	Final	

Titre Value =

CALCULATION

Equivalent weight of FeSO₄ (NH₄)₂SO₄ .6H₂O = M.Wt. = 392

Strength of ferrous ammonium sulphate solution =

$$N_1 = \frac{\text{Wt/litre}}{\text{Equivalent weight}}$$

(ferrous ammonium sulphate) x (KMnO₄)

$$V_1 N_1 = V_2 N_2$$

$$N_2 = V_1 N_1 / V_2$$

Normality of KMnO₄ solution , N₂ =N

Equivalent weight of KMnO₄ = M.Wt/5=31.6

Weight / litre = Normality × Equivalent weight

$$= \dots\dots\dots\text{g}$$

Amount of KMnO₄ inml. of the given solution =g.

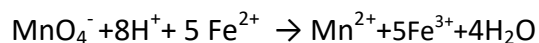
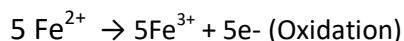
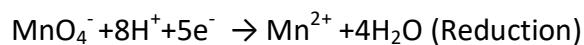
12. ESTIMATION OF KMnO_4

AIM

- (i) To determine strength of the given potassium permanganate solution using a standard solution of Ferrous Ammonium sulphate containinggm salt/litre
- (ii) To calculate the amount of potassium permanganate present inml. of given solution

PRINCIPLE

Potassium permanganate is an oxidising agent. It oxidises ferrous salts to ferric salts in acid medium



PROCEDURE

Rinsed a clean burette with given KMnO_4 solution . Filled the burette with KMnO_4 solution. Rinsed a clean 20 ml. pipette with standard solution of ferrous ammonium sulphate. Pipetted out 20 ml. of ferrous ammonium sulphate solution in to a clean conical flask. Added about 20 ml. of dilute sulphuric acid to the ferrous ammonium sulphate solution in the conical flask. Noted initial reading of the burette. Titrated contents of the conical flask against KMnO_4 from the burette till a pale permanent pink colour appeared. Noted final reading of the burette. Repeated the titration to concordant titre values.

RESULT

Strength of KMnO_4 =N

Amount of KMnO_4 inml. of the given solution =g.

A. Standardisation of Potassium Permanganate

OBSERVATION

Mohr's Salt x KMnO_4 (KMnO_4 as self indicator)

Sl.No.	Volume of Mohr's Salt solution(ml)	Burette reading		Volume of KMnO_4 used(ml)
		Initial	Final	

Titre Value =

CALCULATION

Mass of Mohr's Salt in 500 ml. = 19.6 g

Equivalent weight of Mohr's Salt = 392

$$\text{Normality of Mohr's Salt solution, } N_2 = \frac{\text{Mass} \times 1000}{\text{Equivalent mass} \times \text{Volume (ml)}}$$

=

Volume of Mohr's Salt solution, $V_2 = 20\text{ml.}$

Volume of KMnO_4 solution, $V_1 = \dots\dots\dots\text{ml}$

Normality of KMnO_4 solution = N_1

At the end point

$$V_1 N_1 = V_2 N_2$$

$$N_1 = V_2 N_2 / V_1$$

$$= \dots\dots\dots N$$

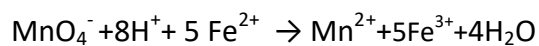
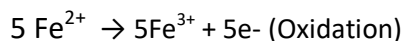
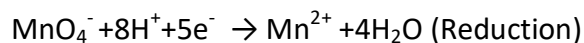
13. ESTIMATION OF FERROUS IRON

AIM

Estimate the amount of ferrous iron in 100 ml. of the given ferrous sulphate solution . You are provided with a solution of Mohr's salt containing 19.6 g. of Mohr's salt in 500 ml. of solution and approximately decinormal potassium permanganate solution.

PRINCIPLE

Potassium permanganate is an oxidising agent. It oxidises ferrous salts to ferric salts in acid medium



PROCEDURE

A. Standardisation of KMnO_4

Rinsed a clean burette with given KMnO_4 solution . Filled the burette with KMnO_4 solution. Rinsed a clean 20 ml. pipette with standard mohr's salt solution . Pipetted out 20 ml. of mohr's salt solution in to a clean conical flask. Added about 20 ml. of dilute sulphuric acid to the mohr's salt solution in the conical flask. Noted initial reading of the burette. Titrated contents of the conical flask against KMnO_4 from the burette till a pale permanent pink colour appeared. Noted final reading of the burette. Repeated the titration to concordant titre values.

B. Estimation Ferrous iron

OBSERVATION

FeSO₄ x KMnO₄ (KMnO₄ as self indicator)

Sl.No.	Volume of FeSO ₄ solution(ml)	Burette reading		Volume of KMnO ₄ used(ml)
		Initial	Final	

Titre Value =

CALCULATION

Normality of KMnO₄ solution(N₃ = N₁) =N

Volume of KMnO₄ solution , V₃ =ml

Volume of FeSO₄ solution , V₄ = 20ml.

Normality of FeSO₄ solution = N₄

At the end point

$$V_3 N_3 = V_4 N_4$$

$$N_4 = V_3 N_3 / V_4$$

$$= \dots\dots\dots N$$

Equivalent weight of Ferrous iron = 55.84

Mass of ferrous iron in 1 litre of the solution = N₄ x 55.84

Mass of ferrous iron in 100 ml of the given solution =g.

B. Estimation ferrous iron

Pipetted out 20 ml. of ferrous sulphate solution in to a clean conical flask. Added about 20 ml. of dilute sulphuric acid to it. Titrated contents of the conical flask against KMnO_4 from the burette till a pale permanent pink colour appeared. Noted final reading of the burette. Repeated the titration to concordant titre values.

RESULT

Strength of FeSO_4 =N

Amount of ferrous iron in 100 ml. of the given solution =g.

A . Standardisation of EDTA solution

OBSERVATION

ZnSO₄ × EDTA (Eriochrome black T indicator)

Sl.No.	Volume of ZnSO ₄ solution pipetted (ml)	Burette reading		Volume of EDTA solution used (ml)
		Initial	Final	

Volume of EDTA solution used , V₁ = ml

CALCULATION

Mass of ZnSO₄ 7H₂O in 100 ml solution = 0.72 g

Molecular mass of ZnSO₄ 7H₂O = 287.36

Molarity of Zinc Sulphate solution , M₂

$$\begin{aligned} &= \frac{\text{Mass} \times 1000}{\text{Molar mass} \times \text{Volume (ml)}} \\ &= \frac{0.72 \times 1000}{287.36 \times 100} \\ &= 0.02506 \text{ M} \end{aligned}$$

Volume of Zinc Sulphate solution V₂ = 20 ml

Volume EDTA solution , V₁ =ml

Molarity of EDTA solution = M₁

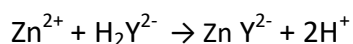
At the end point , M₁ V₁ = M₂ V₂

$$M_1 = \frac{M_2 V_2}{V_1} = \frac{0.02506 \times 20}{V_1} = \dots\dots\dots\text{M}$$

14. ESTIMATION OF ZINC

AIM : Estimate the mass of Zinc in the whole of the given solution of Zinc Sulphate. You are provided with 0.025 molar EDTA and a solution of $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ containing 0.72 g of $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ in 100 ml.

PRINCIPLE : Zinc ions form complexes with EDTA (H_2Y^{2-}) which can be represented by the equation.



The given EDTA solution is standardised using standard ZnSO_4 solution. The end point is detected by using Eriochrome black T indicator which has a blue colour in the P^{H} range between 7 to 11. The indicator react with Zn^{2+} ion to produce Zn- eriochrome black T indicator complex which has a wine red colour.

PROCEDURE

A . Standardisation of EDTA solution

20 ml of the standard zinc sulphate solution is pipetted in to a clean conical flask and diluted to 100 ml by adding distilled water. 2 ml of buffer solution ($\text{NH}_4\text{CL-NH}_4\text{OH}$) of P^{H} 10 and 3 to 4 drops of Eriochrome black T indicator are added to it. The solutions are mixed and then titrated against EDTA solution taken in the burette until the colour changes from wine red to blue which is the end point. The titration is repeated till concordant values are obtained.

B. Estimation of Zinc :

The given zinc sulphate solution is made up to 100 ml in a standard measuring flask.

20 ml of made up solution is pipetted in to a clean conical flask and diluted to 100 ml with distilled water. 2 ml of buffer solution ($\text{NH}_4\text{CL-NH}_4\text{OH}$) of P^{H} 10 and 3 to 4 drops of Eriochrome black T indicator are added to it. The solutions are mixed and then titrated against EDTA solution taken in the burette until the colour changes from wine red to blue. The titration is repeated till concordant values are obtained.

B. Estimation of Zinc

OBSERVATION

ZnSO₄ × EDTA (Eriochrome black T indicator)

Sl.No.	Volume of ZnSO ₄ solution pipetted (ml)	Burette reading		Volume of EDTA solution used (ml)
		Initial	Final	

Volume of EDTA solution used , V₃ = ml

CALCULATION

Molarity of EDTA solution (M₃ = M₁) =M

Volume of Zinc Sulphate solution V₄ = 20 ml

Molarity of ZnSO₄ solution = M₄

At the end point , M₃ V₃ = M₄ V₄

$$M_4 = \frac{M_3 V_3}{V_4} = \dots\dots\dots M$$

Molar mass of Zinc = 65.34

Mass of Zinc in one litre of the solution = M₄ × 65.34

Mass of Zinc in whole of given solution (100ml) = $\frac{M_4 \times 65.34}{10} =$

Result

Mass of Zinc in the whole of the given solution =.....g