Bharath

INSTITUTE OF HIGHER EDUCATION AND RESEARCH

(Declared As Deemed-to-be University u / s 3 Of UGC Act, 1956.)
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COURSE FILE - 2018 – 2019 (SEM II)

COURSE NAME: CHEMISTRY LABORATORY

COURSE CODE: U18BSCH2L4

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COURSE FILE

NAME OF THE FACULTY	**Dr. V.L. CHANDRABOSS**	**FACULTY DEPT**	**CHEMISTRY**
COURSE	**CHEMISTRY LAB**	**COURSECODE**	**U18BSCH2L4**
YEAR	**2018 - 2019**	**SEMESTER**	**I /II**
DEG &BRANCH	**B.TECH. (All branches)**	**DURATION**	**45**

SL.NO	**DETAILS IN COURSE FILE**	**REMARKS**
1.	LIST OF EXPERIMENTS	
2.	SYLLABUS WITH COURSE OUTCOMES	
3.	MODEL EXAM - QUESTION PAPER	
4.	MODEL EXAM – SAMPLE ANSWER SHEET	
5.	LAB MANUAL	
6.	LAB OBSERVATION NOTE	
7.	RECORD NOTE	
8.	CO ATTAINMENT	

STAFF

HOD

BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH
BHARATH INSTITUTE OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF CHEMISTRY

CHEMISTRY LABORATORY - U18BSCH2L4

LIST OF EXPERIMENTS

1. Determination of Total Hardness, Temporary Hardness and Permanent hardness of Water by EDTA method
2. Estimation of Alkalinity - Titrimetry
3. Estimation of Dissolved Oxygen
4. Estimation of Chlorides in Water by Argentometric Method (MOHR'S Method)
5. Estimation of Copper by EDTA method
6. Estimation of Iron in Water by Spectrophotometry
7. Conductometric Titration of Strong Acid with Strong Base
8. Determination of Molecular weight of a Polymer by Viscosity Average Method
9. pH measurements for Acid - alkali Titrations
10. Determination of rate of corrosion by weight loss method.
11. Conductometric Precipitation titration
12. Determination of Water Crystallization

REFERENCES

1. R. Jeyalakshmi, "Practical Chemistry", Devi Publications 2014.
2. S.S. Dara, A text book on experiments and calculation Engg.

U18BSCH2L4	**CHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	2
	Prerequisite – Engineering Chemistry				
	Course Designed by – Department of Chemistry				
OBJECTIVES: To enhance the practical knowledge on Chemistry through Volumetric and circuit experiments					

COURSE OUTCOMES (COs)	
CO1	Estimate certain properties of water, Standardize solutions using titration, Conductivity meter, pH-meter (Manipulate)
CO2	Recognize basic principle of spectrophotometric method (Manipulate)
CO3	Analyze some important physical properties like viscosity and rate of Corrosion of the samples (Manipulate)

Mapping of Course Outcomes (COs) with Progrmme Outcomes (POs)
(H/M/L indicates strength of correlation) : H – High, M – Medium, L – Low

COs/POs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M		H									
CO2	M			M	H							
CO3	H	H	H			H	H	M				
Category	Basic Sciences (BS)											
Approval	47th Meeting of Academic Council held in Aug, 2018											

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DEPARTMENT OF CHEMISTRY

CHEMISTRY LABORATORY - U18BSCH2L4

MODEL EXAMINATION

1. How will you estimate the amount of total hardness present in the given water sample by EDTA titration method.

REGNO: U18AE58
NAME: Sai Venkata Reddy
AERO-A

10/10

1. Determination of Total Hardness of water by EDTA method.

Aim :-

To estimate the amount of total hardness with a standard hard water sample and standard EDTA solution.

Principle :-

Hardness is largely due to the presence of bicarbonates of Calcium and Magnesium. When the sample of water is boiled, bicarbonates of calcium and magnesium are converted to insoluble carbonates and hydroxides, which can be removed by filtration.

Content	Titration - I	Titration - II
Burette Solution	EDTA	EDTA
Pipette Solution	20 ml of std. hard water.	20 ml of sample hard water.
Reagent added	5 ml of buffer solution	5 ml of buffer Solution
Indicator	Eriochrome black-T	Eriochrome black-T
End Point	Appearance of Steel blue Colour	Appearance of steel blue Colour.

Stardisation of EDTA :-

Standard hard water VS EDTA

S. No.	Volume of std. hard water (ml)	Burette Reading		Volume of EDTA Consumed (ml)	Concordant Value (ml) V_1	Indicator
		Initial (ml)	Final (ml)			
1.	20	0	20.1	20.1	20.1	EBT
2.	20	0	20.1	20.1		

Volume of EDTA consumed for std. hard water = V_2 ml

The permanent hardness which is due to the presence of chlorides and sulphates of Ca and Mg, cannot be removed by boiling.

$$Ca(HCO_3)_2 \xrightarrow{\Delta} CaCO_3 + H_2O + CO_2$$

$$Mg(HCO_3)_2 \xrightarrow{\Delta} Mg(OH)_2 + 2CO_2.$$

The total hardness is the sum of permanent and temporary hardness, which is determined by complexing with EDTA.

$$M^{2+} + Ind \longrightarrow M\text{-}Ind \text{ (wine red)}$$

$$M\text{-}Ind + EDTA \longrightarrow M\text{-}EDTA + Ind \text{ (steel blue)}$$

S. No.	Volume of Std. hard water (ml)	Burette reading		Volume of EDTA Consumed (ml)	Concordant value (ml) V_2	Indicato
		Initial (ml)	Final (ml)			
1.	20	0	15.8	15.8	15.8	EBT
2.	20	0	15.8	15.8		

Volume of EDTA consumed for unknown hard water } = V_2 ml = 15.8 ml

~~Temporary hardness = Total hardness~~

Calculation:-

Total hard of water = $\frac{V_2}{V_1} \times 1000$

10/10

$= \frac{15.8}{20.1} \times 1000$

= 786.069 ppm.

Result:-

Total hardness of water } = 786.09 ppm.

PRACTICAL CHEMISTRY

For the I year B.E. / B.Tech.
Degree Course

Department of Chemistry
Bharath University
Chennai - 600 073.

Preface

This Book "Practical Chemistry" has been prepared , by keeping in mind , the bright future of the First Year B.Tech. Students .The experimental details and the way of approach to proceed the experiment and calculations are really not only good but also simple , very clear and easily understandable even by the beginners. It has been so prepared that the moment the book reaches the hands of a student, success is confirmed by way of giving him unshakable confident .

We are very Grateful to our beloved Chancellor, Dr. SANDEEP ANAND, Honorable Vice- Chancellor Dr.K.P.THOOYAMANI for having permitted us to publish this valuable manual. We are very thankful to Dr. R.Venkatesh Babu, Dean (Academics) and Dr. S.R.Suresh, Dean (Science & Humanities) for having encouraged us to do something good for the welfare of the students by way of writing valuable and useful books. We really express our heartful thanks to the Staff members of the Chemistry Dept., for their involvement and dedication to bring out this manual in a very short period.

Authors

CONTENTS

FOR THE STUDENTS

The chemistry laboratory is an experimentation workshop and an experimentation classroom for the students. This section presents

i) Suggestions that will maximize efficiency in performing experiments and recording data.

ii) Rules that must be followed to ensure the safety of students and

iii) Rules that enhance the maintenance of the laboratory.

Suggestions for laboratory studies.

Record the results of your experiments as you observe them and do not relay on your memory. Unless otherwise instructed, work independently and draw your own conclusions before consulting with the instructor or fellow students.

The results of the experiments are truly meaningful only if you understand the purpose of each experiment. You must be able to answer the questions in general exercise, placed at the end of every experiment, which are designed largely to help you to extract the significance of the results.

Safety rules

1) Safety glasses must be worn in the laboratory unless otherwise indicated by the instructor.
2) It is strongly suggested that you must wear a laboratory apron or other protective clothing in the laboratory.
3) Do not perform unauthorized experiments. If you want extra experiments, consult your instructor.
4) Never smell or taste chemicals, when smelling of chemicals is required, do so by sweeping the vapors towards your nose.
5) If any chemical touch your skin, flood the area with water and notify your instructor. Make a habit of washing your hands before leaving the laboratory.

Laboratory rules.

The following rules will help you to maintain a neat and orderly working area and will eliminate difficulties arising from contamination.

1) Always use clean apparatus for each experiment.
2) Clean the bench top at the end of that period
3) Before leaving the lab. be certain that water outlets are turned off.

INTRODUCTION

Chemical Analysis

The determination of the elements present in a chemical sample is called chemical analy The analysis of an unknown sample to ascertain substances that are present in it is cal qualitative analysis. The identification of exact amount of the ascertained substances i chemical sample is called quantitative analysis.

Volumetric (Titrimetric) Analysis

In this analysis, the substance to be determined is allowed to react with a standard solution and the volume of standard solution needed for complete reaction is determined. The weight of the substance to be determined is calculated from the volume of the standard solution used and the known laws of stoichiometry. The above analysis can be done by electrical methods which involve the measurement of voltage, electrical conductivity or resistance in relation to the concentration of a certain species solution

Classification of Reactions

The common types of reactions are:

- Neutralization (acid - base) reactions
- Complex formation reactions
- Precipitation reactions
- Oxidation - Reduction reactions

GENERAL PHRASES IN QUANTITATIVE ANALYSIS

Standard Solution: Solution of known concentration.

Titration: The process of adding standard solution to the unknown solution until the reaction is just completed.

End Point : The point at which the reaction completes.

Indicator : An auxiliary reagent added during the titration to indicate the end point.

Titrant : The standard solution or solution of known concentration.

Titration Error : The small difference existing between the practical end point and theoretical or stochiometric end point.

Normal Solution : A solution containing one gram

Molar Solution : Any solution which contains one mole of a definite species per litre is called as molar solution.

Mole :

$$\frac{\text{weight of the substance}}{\text{Molecular weight of the same substance}}$$

Primary Standard : The substance which is unaltered in air during weighing is called as primary standard substance. This condition implies that the substance should not be hygroscopic, nor oxidized by air, nor affected by carbon dioxide.

Eg. Na_2CO_3 , $AgNO_3$, NaCl, KCl, $K_2Cr_2O_7$, $Na_2C_2O_4$.

Solutions of known concentration, prepared from primary standard substances are called primary standard solutions or any solution whose concentration is unaltered with time is called as primary standard solution.

Secondary Standard : The substance whose composition is altered is called as secondary standard substance, It is used for standardizations and its content of the active substance will be found by comparison against a primary standard.

Eg.: NaOH, $KMnO_4$, $CaCl_2$

1. DETERMINATION OF TOTAL HARDNESS, TEMPORARY HARDNESS AND PERMANENT HARDNESS OF WATER BY EDTA METHOD

EXPT. No. 1 Date: 8/9/16

Aim

To estimate the amount of total hardness, permanent hardness and temporary hardness of the given water sample. You are provided with a standard hard water sample and standard EDTA solution.

Principle

Temporary hardness is largely due to the presence of bicarbonates of Calcium and Magnesium. When the sample of water is boiled, bicarbonates of calcium and magnesium are converted to insoluble carbonates and hydroxides, which can be removed by filtration. The permanent hardness, which is due to the presence of chlorides and sulphates of *Ca* and *Mg*, cannot be removed by boiling.

$$Ca(HCO_3)_2 \xrightarrow{\Delta} CaCO_3 + H_2O + CO_2$$

$$Mg(HCO_3)_2 \xrightarrow{\Delta} Mg(OH)_2 + 2CO_2$$

The Total Hardness is the sum of permanent and temporary hardness, which is determined by complexing with EDTA.

$$M^{2+} + \text{Ind} \longrightarrow \text{M-Ind (wine red)}$$

$$\text{M-Ind} + \text{EDTA} \longrightarrow \text{M-EDTA} + \text{Ind. (Steel blue)}$$

Procedure

Titration I : Standardisation of EDTA

The burette is washed with distilled water and then rinsed with EDTA solution. Then the burette is filled with EDTA solution. 20 ml of standard hard water is taken in a conical flask. 5 ml of buffer solution is added to maintain the pH of the mixture, followed by the addition of 1-3 drops of EBT. The solution is titrated with EDTA. The end point is the appearance of steel blue colour. Titration is repeated to get concordant value. From this the volume of EDTA consumed (V_1) is noted.

Simple Procedure

Content	Titration I	Titration II	Titration III
Burette solution	EDTA	EDTA	EDTA
Pipette Solution	20ml of std. hard water	20ml of sample hard water	20ml of boiled water
Reagent added	5ml of buffer solution	5ml of buffer solution	5ml of buffer solution
Indicator	Eriochrome Black-T	Eriochrome Black-T	Eriochrome Black-T
End point	Appearance of steel blue colour	Appearance of steel blue colour	Appearance of steel blue colour

Standardisation of EDTA

Standard hard water vs EDTA

S.No.	Volume of Std. hard water (ml)	Burette reading		Volume of EDTA consumed (ml)	Concordant Value (ml) V_1	Indicat
		Inital (ml)	Final (ml)			
1	20	00	21.6	21.6	21.6	EBT
2	20	0	24.6	24.6		
3	20	0	21.6	21.6		

Volume of EDTA consumed for std. hard water = V_1 ml = 21.6

Estimation of Total Hardness - Standardised EDTA vs Unknown Hard water

S.No.	Volume of Std. hard water (ml)	Burette reading		Volume of EDTA consumed (ml)	Concordant Value (ml) V_2	Indic
		Inital (ml)	Final (ml)			
1	20	0	10.2	10.2	10.2	
2	20	0	11.	11		
3	20	0	10.2	10.2		

Volume of EDTA consumed for unknown hard water = V_2 ml = 10.2

Standardised EDTA vs Unknown Hard Water (After Boiling)

S.No.	Volume of Std. hard water (ml)	Burette reading		Volume of EDTA consumed (ml)	Concordant Value (ml) V_3	Indica
		Inital (ml)	Final (ml)			
1						
2						
3						

Titration II : Estimation of Total Hardness

The burette is filled with EDTA solution. 20 ml of unknown water sample is taken in the conical flask. 5 ml of buffer solution is added to maintain the pH of the mixture, followed by the addition of 1 -3 drops of EBT. It is titrated with EDTA solution. The end point is the appearance of steel blue colour. Titration is repeated to get concordant value. From this the volume of EDTA consumed (V_2) is noted.

Titration III : Estimation of Permanent Hardness

100 ml of water-Sample is taken in the beaker and boiled till the volume is reduced to about 50 ml. Filter and wash the precipitate with distilled water. The filtrate is collected and makeup the volume to 100 ml with distilled water. 20 ml of this water sample is taken in the conical flask- 5 ml of buffer solution is added to maintain the pH of the mixture, followed by the addition of 1-3 drops of EBT. Then the solution turns wine red colour. It is titrated with EDTA solution. The end point is the appearance of steel blue colour. Titration is repeated to get concordant value. From this the volume of EDTA consumed (V_3) is noted.

Estimation of Temporary Hardness

Temporary hardness is calculated by substracting the permanent hardness from the total hardness as follows.

Temporary hardness = Total hardness - Permanent hardness

Result

Total hardness of water = 472.22 ppm
Temporary hardness of water = __________ ppm
Permanent hardness of water = __________ ppm

VIVA VOCE QUESTIONS:

1. Mention the common units used for expressing hardness of water.
2. Define ppm.
3. What is the simple test for hardness?
4. What is the function of buffer in EDTA titration?
5. What is hard water?
6. What are the different types of hardness?
7. Draw the structure of the (EDTA-M^{2+}) complex formed
8. Wine red color formation after the addition of EBT indicator in hard water is due to______.
9. Formation of Steel blue color at the end is due to__________.

2. ESTIMATION OF ALKALINITY - (Titrimetry)

Expt No. 2

Date 22|09|16

Aim

To determine the alkalinity of a given water sample

Principle

The alkalinity in water is due to the presence of caustic alkalinity — NaOH, KOH, Na_2CO_3, K_2CO_3, $NaHCO_3$ or $KHCO_3$. Bicarbonate alkalinity is due to $Ca(HCO_3)_2$ or $Mg(HCO_3)_2$. This can be estimated by titration against acid.

When a solution containing carbonate is titrated against a strong acid like HCl, the first equivalence point is due to the reaction

$$CO_3^{2-} + H^+ \longrightarrow HCO_3^-$$

This can be indicated by phenolphthalein indicator and the titre value is termed as phenolphthalein alkalinity, P.

The second equivalence point corresponding to the reaction,

$$HCO_3^- + H^+ \longrightarrow H_2O + CO_2$$

is called methyl orange alkalinity, indicated by methyl orange.

The alkalinity due to OH alone is called hydroxide alkalinity.

$$H^+ + OH^- \longrightarrow H_2O$$

The total alkalinity due to all alkaline species is determined using methyl orange indicator, and is denoted as T. But OH^- and HCO_3^- cannot exist together as they simultaneously form CO_3^{2-}

$$OH^- + HCO_3^- \longrightarrow CO_3^{2-} + H_2O$$

Hence all the three (OH^-, HCO_3^-, CO_3^{2-}) cannot exist together. Based on the titre values, different types of alkalinity are evaluated

Short Procedure

Content	Titration I	Titration II
Burette solution	0.1 N H_2SO_4	0.1 N H_2SO_4
Pipette solution	20ml of given water sample I	20ml of given water sample II
Reagent added	———	———
Indicator	Phenolphthalein	Methyl Orange
End point	(i) Disappearance of pink colour	(i) Colour changes from yellow to reddish orange

Estimation of Phenolphthalein Alkalinity

S.No.	Volume of Std. hard water (ml)	Burette reading		Volume of H_2SO_4 (ml)	Concordant Value (ml) V_1	Indica
		Initial (ml)	Final (ml)			
1	20	0	18.4	18.4	18.4	Phen Ptal
2	20	0	18.4	18.4	18.4	Phe Pbal
3						

Volume of H_2SO_4 consumed = ...18.4.......V_1

Normality of H_2SO_4 = ...0.1.........N_1

Volume of water sample = V_2 = 20

Normality of water sample = $\frac{V_1 \times N_1}{V_2}$

Phenolphthalein alkalinity in terms of carbonate P = $\frac{V_1 \times N_1}{V_2} \times 50 \times 1000$ ppm = 5400

2P - M

= 2(4600) - 3800

= 9200 - 3800

Estimation of Total Alkalinity

S.No.	Volume of Std. hard water (ml)	Burette reading		Volume of H_2SO_4 (ml)	Concordant Value (ml) V_2	Indica
		Inital (ml)	Final (ml)			
1	20	0	15.2	15.2	15.2	Methy ora
2	20	0	15.2	15.2	15.2	
3						

Volume of H_2SO_4 consumed = 15.2 V_1

Normality of H_2SO_4 = 0.1 N_1

Volume of water sample = V_2 = 20

Total alkalinity in terms of carbonate M = $\frac{V_1 \times N_1}{V_2}$ x 50 x 1000 ppm = 3800 ppm

$\frac{M}{2}$ = 1900

Interpretation of Various Alkalinity

Titre value	Hydroxide alkalinity	Carbonate alkalinity	Bicarbonate alkalinity
P = 0	0	0	M
P < ½ M	0	2P	M – 2P
P = ½ M	0	2P	0
P > ½ M	2P – M	2 (M – P)	0
P = M	M	0	0

1. When $P = M$, there is only OH^- alkalinity.
2. When $P = 0$, alkalinity is only due to HCO_3^-
3. When $P = ½ M$, only CO_3^{2-} is present.
4. When $P < ½ M$, presence of HCO_3^-, CO_3^{2-} alkalinity.
5. When $P > ½ M$, CO_3^{2-} and OH^- are present.

2(M-P)

= ~~2(1600~~

2(3800 – 4600

= 2(–800)

= –1600

Procedure

DETERMINATION OF PHENOLPHTHALEIN ALKALINITY

20ml of water sample is pipetted out into a clean conical flask. Two drops of phenolphthalein indicator are added and titrated against standard H_2SO_4 taken in the burette. The end point is the disappearance of pink color. Titration is repeated for concordant values.

DETERMINATION OF TOTAL ALKALINITY

20ml water sample is pipetted out into a clean conical flask. Two or three drops of methyl orange indicator are added and titrated against standard H_2SO_4 taken in the burette. The end point is the color change from pale yellow to pale pink. Titration is repeated for concordant values.

Result

Bicarbonate alkalinity = ...0..............ppm
Hydroxide alkalinity = ...5400...........ppm
Carbonate alkalinity = ...1600..............ppm

Viva – Voce questions

1. Alkalinity of water is due to the presence of .... and .... ions.
2. Why all the above three ions cannot exist together?
3. Among the three ions which are the two ions neutralized in phenolphthalein end point?
4. Why OH and HCO_3 cannot exist together in water.

3. ESTIMATION OF DISSOLVED OXYGEN

Expt. No: Date.....................

Aim

To estimate the amount of dissolved oxygen present in the given water sample.

Principle

Dissolved oxygen determines whether biological changes are brought about by aerobic or anaerobic organisms. Dissolved oxygen is one single test to indicate bow aquatic lif is supported. Oxygen in water is determined by Winkler's method - based on the oxidation of KI by dissolved oxygen. However, as the dissolved oxygen in water is in the molecular state, it is not capable of reacting with KI, and so an oxygen carrier like $Mn(OH)_2$ is used to bring about the reaction. The liberated I_2 is titrated against Thiosulphate.

$$MnSO_4 + 2KOH \longrightarrow Mn(OH)_2 + K_2SO_4$$

$$2Mn(OH)_2 + O_2 \longrightarrow 2MnO(OH)_2$$

Manganous Hydroxide

$$MnO(OH)_2 + 2H_2SO_4 \longrightarrow Mn(SO_4)_2 + 3H_2O$$

Manganous Sulphate

$$2Na_2S_2O_3 + I_2 \longrightarrow 2NaI + Na_2S_4O_6$$

Procedure

STANDARDIZATION OF SODIUM THIO SULPHATE

Twenty ml of standard $K_2Cr_2O_7$ is pipetted out into a clean conical flask; one test tube of dilute H_2SO_4 and one test tube of 10% KI are added and the liberated I_2 is titrated immediately against Thio taken in the burette.

Standardisation of Thiosulphate

Standard $K_2Cr_2O_7$ vs Sodium Thiosulphate

S.No.	Volume of Std. $K_2Cr_2O_7$	Burette reading		Volume of Thio (ml)	Concordant Value (ml) V_1	Indica
		Inital (ml)	Final (ml)			
1						
2						
3						

Volume of $K_2Cr_2O_7$ taken = 20 ml

Normality of $K_2Cr_2O_7$ = 0.0125

Volume of Thio consumed V_1 =

NOrmality of Thio

$$= \frac{20 \times 0.0125}{V_1} N$$

Estimation of Dissolved Oxygen

S.No.	Volume of water sample (ml)	Burette reading		Volume of Thio (ml)	Concordant Value (ml) V_2	Indica
		Inital (ml)	Final (ml)			
1						
2						
3						

Calculation

$\frac{1}{2}O_2 = MnO_2 = I_2 = 2$ equivalents $= 2000$ ml 1 N thio

16 g of oxygen $= 16$ g oxygen

2000 ml 1 N thio $= 8$ g oxygen

1000 ml of 1 N thio $= \dfrac{0.8 \times 0.0125}{1000}$ g

1 ml 0.0125 thio $= 0.1$ mg D.O

$$V_2 \text{ ml of } \frac{20 \times 0.0125}{V_1} \text{ N thio} = V_2 \times \frac{20 \times 0.0125}{V_1} \times \frac{0.1}{1 \times 0.01}$$

$$= 2 \times \frac{V_2}{V_1} \text{ mg/100ml}$$

$$= 20 \times \frac{V_2}{V_1} \text{ mg/lit}$$

$$= 20 \times \frac{V_2}{V_1} \text{ ppm}$$

When the solution becomes straw yellow 1 ml of starch is added as indicator and the titration is continued. End point is the disappearance, of blue color and appearance of pale green color. Titration is repeated for concordant values.

ESTIMATION OF DISSOLVED OXYGEN

250 ml of water sample is taken in a bottle and 2 ml of $MnSO_4$ and 2 ml of alkaline Iodide solution ($KI + NaOH + NaN_3$) are added and shaken thoroughly. NaN_3 is added to prevent the interference from Nitrite. To the sample solution, 2 ml of con H_2SO_4 is added and shaken. 100 ml of this solution is titrated against Thio taken in the burette, using starch as the indicator. End point is the disappearance of the blue color.

Result

The amount of dissolved oxygen in a = ...ppm
given water sample

VIVA VOCE QUESTIONS

1. Is the presence of Oxygen necessary in water?
2. What is the Name of the Titration Carried out in the estimation of dissolved oxygen level?
3. Name the indicator used in this titration.

Short Procedure

Content	Titration I	Titration II
Burette solution	Sodium thio Sulphate	Sodium thio Sulphate
Pipette solution	20ml Potassium di chromate	(250ml water + 2ml $MnSO_4$ + 2ml alkaline iodide). Shake Add NaN_3 + 2ml con-H_2SO_4 100ml of above prepared solution
Additional solution	1 test tube of dil. H_2SO_4 and 1 test tube of 10% KI	———
Indicator	1ml of starch	1ml of starch
End point	Appearance of pale green colour	Disappearence of blue colour

4. ESTIMATION OF CHLORIDES IN WATER BY ARGENTOMETRIC METHOD (MOHR'S METHOD)

Ex – 6

Dt – 16 –2–1

Aim

To estimate the amount of chlorides present in the given water sample. A standard solution of sodium chloride is provided with an approximate N/20 solution of silver nitrate.

Principle

Natural water contains chloride ions in the form of NaCl, KCl, $Cacl_2$ and $MgCl_2$. The total chloride ion can be estimated by Argentometric method It is known as Mohr's method. Here Ag+ ion in solution reacts with chloride ions in the presence of potassium chromate as the indicator to form sparingly soluble silver salt.

$$AgNO_3 + NaCl \longrightarrow AgCl + NaNO_3$$

When all the chloride ions are removed, a colour change from yellow to reddish orange is noticed as end point of the titration.

$$2AgNO_3 + K_2CrO_4 \longrightarrow Ag_2CrO_4 + 2KNO_3$$

Procedure

I Standardardisation of silver nitrate

The burette is washed and filled with silver nitrate. 10 ml of sodium chloride is pipettted out in to a clean conical flack. 1 ml of 2 % potassium chromate indicator is added. Then the solution is titrated against silver nitrate solution. At the end point, the solution changes its colour from yellow to reddish brown. The titration is repeated for concordant values.

II Estimation of chloride

10 ml of water (5ml Tap water + 5ml Dish water) is pipetted out in to clean conical flask. 1 ml of 2 % potassium chromate indicator is added. Then the solution is titrated against silver nitrate solution. At the end point, the solution changes its colour from yellow to reddish brown. The titration is repeated for concordant values.

Short Procedure

S.No.	Content	Titration I	Titration II
1	Burette solution	Silver nitrate	Silver nitrate
2	Pipette solution	20ml of sodium chloride	20ml of water sampl
3	Reagent added	--------	--------
4	Indicator	Mixture of Potassium Chromate Potassium dichromate	Mixture of Potassium Chro Potassium dichromate
5	End point	Appearance reddish brown	Appearance reddish bro

Equivalent weight of chlorine = 35.45

Titration I Standardization of silver nitrate

Sodium chloride Vs silver nitrate

S.No.	Volume of NaCl (ml)	Burette reading		Volume of silver nitrate (ml)	Concordant Value (ml)	Indicator
		Inital (ml)	Final (ml)			
1	20	0	21.1	21.1	21.1	Mixture of Potassium dichromate
2	20	0	21.1	21.1		

Calculation

Volume of sodium chloride (V_1) = 20ml

Normality of sodium chloride (N_1) = 0.005 N

Volume of silver nitrate (V_2) = 21.1--- ml (titre value)

Normality of silver nitrate (N_2) = ?

$$N_2 = \frac{V_1 \ N_1}{V_2}$$

Titration II Estimation of chloride

Water sample Vs silver nitrate

S.No.	Volume of water sample (ml)	Burette reading		Volume of silver nitrate (ml)	Concordant Value (ml)	Indicator
		Inital (ml)	Final (ml)			
1	20	0	15.7	15.7	15.7	Mixture of Potassium dichromate
2	20	0	15.7	15.7		

alculation

Volume of water sample (V_1) = 10ml

Normality of water sample (N_1) = ?

Volume of silver nitrate (V_2) = 15.7 ml

Normality of silver nitrate (N_2) = 1/20 N

$$N_1 = \frac{V_2 N_2}{V_1}$$

= 0.03925 N

mount of chloride ion present in 1 litre of the water sample = Eq Wt Cl X N_1

= X gms ~~0.66725~~ 1.3916

mount of chlorides ion present in 100ml of the water sample = X/10 gms

0~~.066725~~.

0.13916

Result

Amount of chlorides present in the given solution ~~6.6 715~~ $\times 10^{-3}$ 0.13916 gm

16/2

VIVA-VOCE QUESTIONS

1 Name the titration carried out to estimate the presence of chloride ion in water?

2 In which form chloride is existing in water?

3 What is the name of the precipitate formed in this titration?

4 What will happen if you do not rinse the apparatus by distilled water?

5. ESTIMATION OF COPPER BY EDTA METHOD

Expt No: 3

Date: 20/10/1

Aim

To estimate the amount of copper in the given solution using EDTA. You are provided with a 0.01 M solution of EDTA and standard $CuSO_4$ solution, of strength 0.01M.

Principle

Copper forms red coloured complex with Fast Sulphon Black F-indicator and the colour reaction is specific for copper ions in ammoniacal medium. In the direct titration of copper in ammoniacal solution, the colour change at the end point is from magenta or purple to dark green.

Procedure:

Standardisation of EDTA

Standard $CuSO_4$ (20ml) solution is pipetted out into a clear conical flask and diluted to 50ml using distilled water. Five ml of concentrated ammonia solution and 2 drops of Fast Sulphon Black F-indicator solution are added. The solution is then titrated against EDTA solution taken in the burette until the colour changes from purple to dark green.

Estimation of Copper

The given copper solution is made upto the mark in a 100 ml standard flask and shaken well. Twenty ml of the solution is pipetted out into a clean conical flask and diluted to 50 ml using distilled water. Five ml of concentrated ammonia solution and 2 drops of Fast Sulphon Black F-indicator solution are added. The solution is then titrated against EDTA solution taken in the burette until the colour changes from purple to dark green.

Short Procedure

Content	Titration I	Titration II
Burette solution	EDTA	EDTA
Pipette solution	Std. $CuSO_4$ 20ml + 30ml water	20ml of unknown solution + 30ml water
Indicator	5ml ammonia & 2-3 drops fast sulphon black-F	5ml ammonia & 2-3 drops fast sulphon black-F
End point	Purple to dark green	Purple to dark green

Viva Voce Questions

1. What is the indicator used?
2. What is the colour of the complex formed with indicator?

STANDARDISATION OF EDTA SOLUTION

STANDARD $CUSO_4$ VS EDTA SOLUTION

S.No.	Volume of Std. $CuSO_4$ solution taken (ml)	Burette reading		Volume of EDTA consumed (ml)	Concordant Value (ml)	Indicat
		Inital (ml)	Final (ml)			
1	20	0	21.5	21.5	22	FSB [illegible]
2	20	0	22	22		
3	20	0	22	22		

CALCULATION

Volume of Std. Copper solution taken = 20 ml

Strength of Copper solution = 0.01 M

Volume of EDTA consumed = V_1

Strength of EDTA

$$X = \frac{20 \times 0.01}{V1} = \frac{20 \times 0.01}{22}$$

ESTIMATION OF COPPER

EDTA VS GIVEN COPPER SOLUTION

S.No.	Volume of Copper solution taken (ml)	Burette reading		Volume of EDTA consumed (ml)	Concordant Value (ml)	Indicat
		Inital (ml)	Final (ml)			
1	20	0	14	14		
2	20	0	14·5	14·5	14·5	FSB
3	20	0	14·5	14·5		

Volume of EDTA consumed = V_2 = 14·5

Strength of EDTA = X = 9.0909×10^{-3}

Volume of Copper solution taken = 20 ml

Strength of Copper solution = $\frac{V_2 \times X}{20} = Y$

Amount of copper present in the given solution = Y x 63.54 /10 g

= 0.0415 g

$$y = \frac{14.5 \times 9.0909 \times 10^{-3}}{20} = 6.5409 \times 10^{-3}$$

$$= 6.5409 \times 10^{-3} \times 63.54/10$$

$$= 0.0415 \text{ gs}$$

Result

Amount of copper present in the given solution = 0.0415 grams

6. Estimation of Iron in water by spectrophotometry

EX : 6

Date :- 30/8/17

Aim

To estimate the amount of ferric ion (Fe^{3+}) present in the water sample using spectrophotometer.

Principle

When light is incident upon a homogeneous medium, a part of the incident light is reflected, a part is absorbed by the medium, and the remainder is allowed to transmit as such, If I_o denotes the incident light- I_r the reflected light, I_a the absorbed light and I_t the transmitted light, then one can write.

$$I_o = I_a + I_t + I_r$$

The following laws govern the absorptron of light by the molecule.

Lambert's law: "When a beam of light is allowed to pass through a transparent medium, the rate of decrease of intensity with the thickness of medium is directly proportional to the intensity of incident light". Mathematically lambert's law may be stated as follows,

$$-dI/dt \ \alpha \ I \quad \text{or} \quad dI/dI = K I$$

Where, I = intensity of incident light of wavelength .

t = thickness of the medium

k= proportionality factor

On integrating the above equation with limit $I = I_o$ when $t = 0$ then,

$$\text{In } I_o/I_t = Kt$$

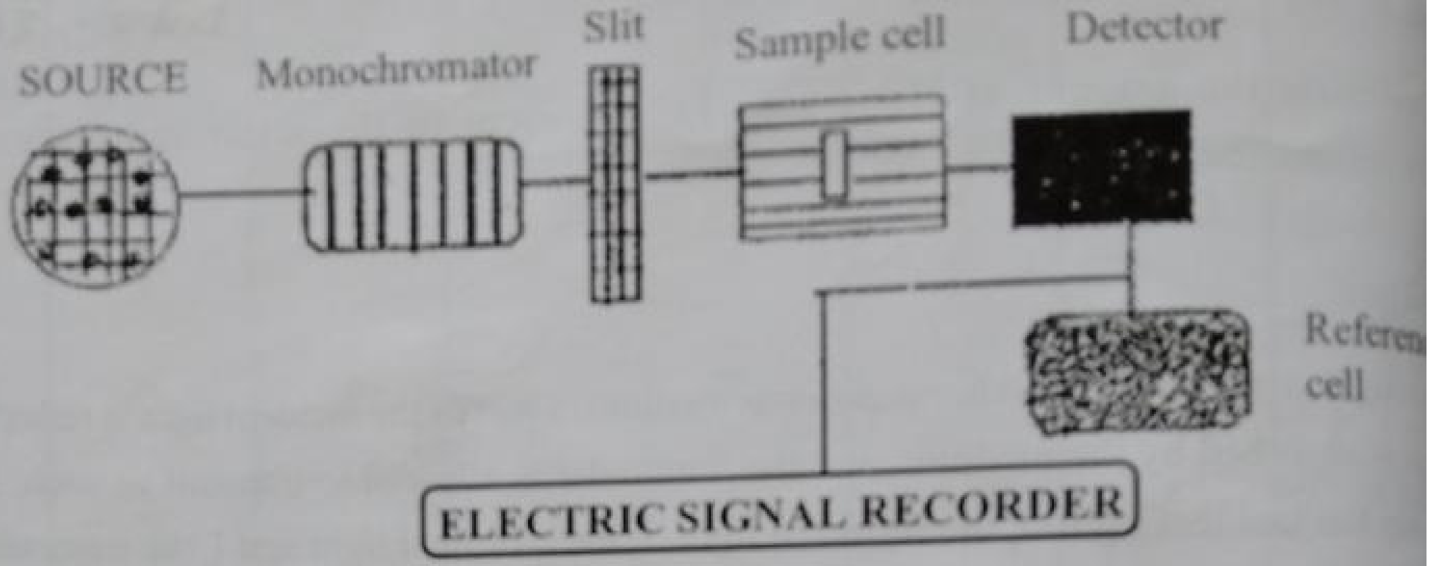
$$I_t = I_o e^{-Kt}$$

The ratio I_o/I_t is termed as transmittance (opaciy) and the ratio is termed as the absorbance, A (optical density or extinction coefficient, E) of the medium.

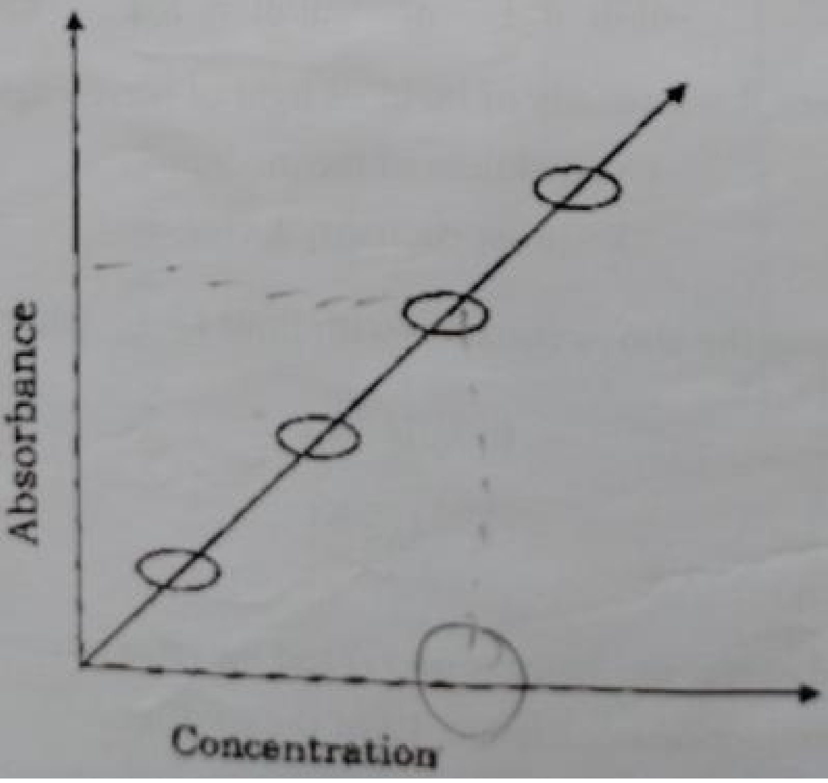
Absorbance at Different Concentrations

S.No	Volume of Fe^{3+} Solution (ml)	Volume of *SCN* Solution (ml)	Volume of HNO_3 Solution (ml)	Volume of water (ml)	Final volume (ml)	Cone of Fe^{3+} Solution (ppm)	Absorb (A
1.	1	1	1	7	10	10	0.1
2.	2	1	1	6	10	20	0.3
3.	3	1	1	5	10	30	0.4
4.	4	1	1	4	10	40	0.5
5.	5	1	1	3	10	50	0.72
6.							
7.	Fe^{3+} +	H_2O					
8.		8ml	+ 1 ml	1 SCN			
9.			1 ml	HNO_3	10m	→ 14	0.6
10.							

480-500T



Calibration Plot



Beer's law: " The intensity of a beam of monochromatic light decreases exponentiall with the increase in concentration of the absorbing substance arithmetically". By combinin the these two laws, we get

$$\text{Log } I_0/I_t = \epsilon\, Cx \quad \text{(or)} \quad A = \epsilon Cx$$

The above equation is fundamental equation of spectrophotometry.

It is important to remark here that there exists a relationship between the absorbance A, transmittance T and the molar absorption coefficient, ϵ .

In order to get a good result, a careful attention is extremely important while preparing a coloured solution by adding a suitable reagent. Such reagents are known as chromogenic reagents- When ammonium thiocyanate is added to the solution containing Fe^{3*} ions, a blood red colour is formed due to the formation of ferric thiocynate complex which absorbs white light in the blue region of wave length, = 480 nm. .

$$Fe^{3+} + 6KSCN — [Fe(SCN)_6]^{3-} + 6K^+$$

Procedure

Spectrophotometer is switched on and warmed up for 15 min. Distilled water is taken in the cell (cuvette) and it is placed in the cell holder of spectrophotometer. Then the meter is calibrated by fixing 100 % transmittance or 0 % absorbance. Then a series of solutions of known concentration are prepared. Then absorbance of each solution is measured. Finally a calibration curve is obtained by plotting absorbance against concentration.

Result

The amount of Ferric iron in the given water sample = .42 ppm

Viva-Voce Questions

1. Write the beer - lamberts law and explain the parameter involved.
2. What is calibration curve?
3. What is the color of the complex formed.

7. CONDUCTOMETRIC TITRATION OF STRONG ACID WITH STRONG BASE

Expt. No: 5

Date : 23/2/17

Aim

To determine the strength of a strong acid (like *HCl*) conductometrically. You are provided with 0.1N *NaOH*.

Procedure

The conductivity cell is washed with water, rinsed with conductivity water. Twenty ml of 0.1N *HCl* is pipetted out into a clean 100 ml beaker. The conductivity cell is dipped into it. The burette is filled with *NaOH* solution and clamped above the beaker. One ml *NaOH* solution is added from the burette and stirred well. The conductance of the solution is measured. Similarly conductance is measured for each 1 ml additions of *NaOH* from the burette.

Principle

A solution of electrolytes conducts electricity due to the presence of ions. Since specific conductance of a solution is proportional to the concentration of ions in it, conductance of the solution is measured during titration. .

When sodium hydroxide is added slowly to the hydrochloric acid, it gets neutralized as shown by the following equation.

$$HCl + NaOH \qquad NaCl + H_2O$$

During the addition of sodium hydroxide, conductivity of the solution decreases slowly. This is because of the removal of fast moving H^+ ion by slow moving Na^+ ions. This decreasing trend continues till the end point is reached.

After the complete neutralization of all HC1, addition of excess of sodium hydroxide causes sudden increase in the conductance. This is due to the presence of excess of hydroxide ions in solution.

Initially the measured value of conductance gradually decreases; after the equivalence point the value increases steadily. A graph is drawn by taking conductance in the Y axis and the volume of *NaOH* in the X axis. The point of intersection of the two straight lines gives the end point.

Result

Strength of hydrochloric acid - ......0.015............N

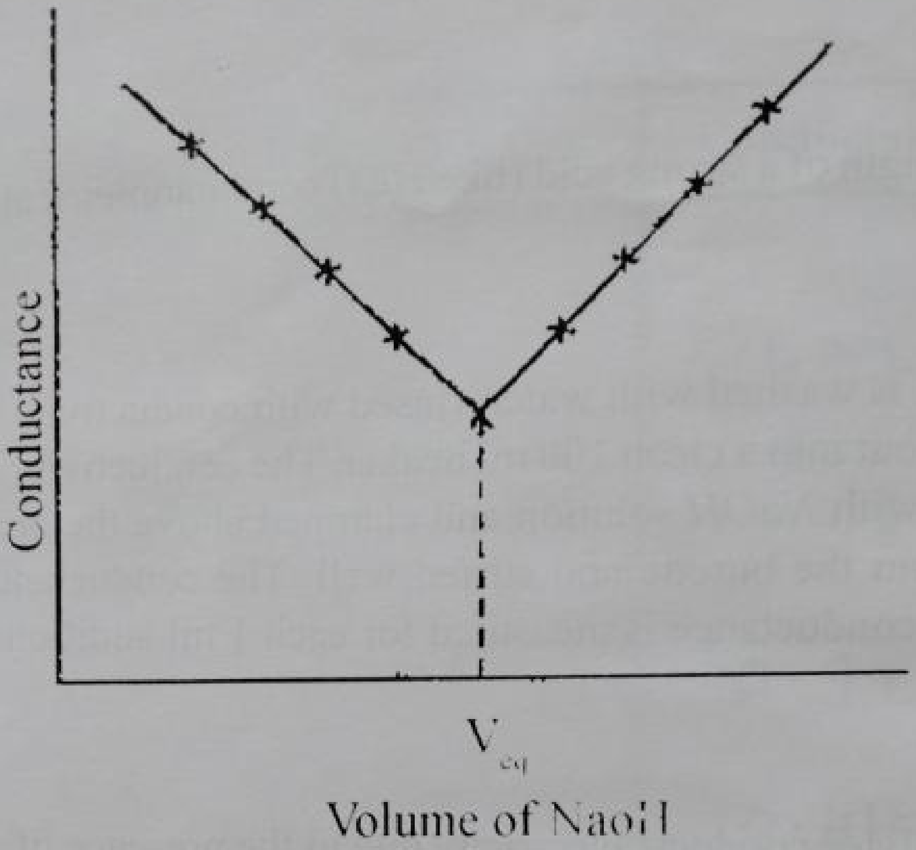
23/2

Viva Voce Questions

1. Explain the principle of conductometric titrations.
2. Will conductivity of the solution increase on dilution? Why?
3. State two advantages of condutometric titractions.
4. Before the addition of alkali the conductance of the acid solution is ---- due to ----
5. What is ionized water?

Measurement of Conductance - Standard Sodium Hydroxide vs Hydrochloric Acid

S.No.	Volume of $NaOH$ (ml)	Conductance (mho)
1.	0	1.37
2.	1	1.08
3.	2	0.72
4.	3	0.44
5.	4	0.53
6.	5	0.61
7.	6	0.71
8.	7	0.81
9.	8	0.89
10.	9	0.98
11.	10	1.07



Calculation

Normality of sodium Hydroxide $N_1 = 0.1$

Volume of Sodium Hydroxide from the graph $= V_1 = 3$

Volume of hydrochloric acid $= V_2$ ml $= 20$

Normality of hydrochloric acid (N_2) $= \dfrac{V_1 \times N_1}{V_2}$

$$= \frac{0.1 \times 3}{20}$$

$$= 0.015 \text{ N}$$

8. DETERMINATION OF MOLECULAR WEIGHT OF A POLYMER BY VISCOSITY AVERAGE METHOD

Expt. No:

Date:..........................

Aim

To determine the molecular weight of a polymer.

Principle

When a high molecular weight polymer is dissolved in a solvent, the viscosity of the solvent increases. This increase in viscosity of the solvent depends on the concentration C, and the molecular weight of the polymer M. When the densities of the polymer solutions are not very much different from that of the solvent, the viscosity is proportional to the flow time (t). The flow times t (solution) and t_0(solvent) can be used to calculate other desired quantities. If n_0 is the viscosity of the pure solvent and n that of the solution of a given polymer, then the relative viscosity can be related to the flow time as

$$\frac{\acute{\eta}}{\acute{\eta}_0} = \frac{t}{t_0}$$

The specific viscosity of a polymer solution η_{sp} is given by

$$\acute{\eta}\,sp = \frac{\acute{\eta}}{\acute{\eta}_0} - 1 = \acute{\eta}_r - 1$$

where $\acute{\eta}_r$ = relative viscosity

The ratio $\acute{\eta}_{ep}/C$, the relative increase in specific viscosity per unit concentration of the polymer is known as reduced viscosity, which depends on the molecular weight of the polymer

$$\acute{\eta}_i = \lim_{C \to 0} \acute{\eta}_{sp}/C$$

is found out by plotting $\acute{\eta}_{sp}$ - against C, where ti is intrinsic viscosity. From the equation,

$$\acute{\eta}_i = K \times M^a \text{ (Mark Houwink equation)}$$

the molecular weight M of the polymer can be determined, K and "a" are constants for a given polymer.

Calculation

Viscosity data for polyvinyl alcohol in water.

Flow time for solvent t_0

Conc C	Flow time t (s)	$\frac{t}{t_0} = \eta_r$	$\eta_{sp} = \eta_r - 1$	$\frac{\eta_{sp}}{C}$

Calculation

K for polyvinyl alcohol =

a for polyvinyl alcohol =

Volume of the solvent =

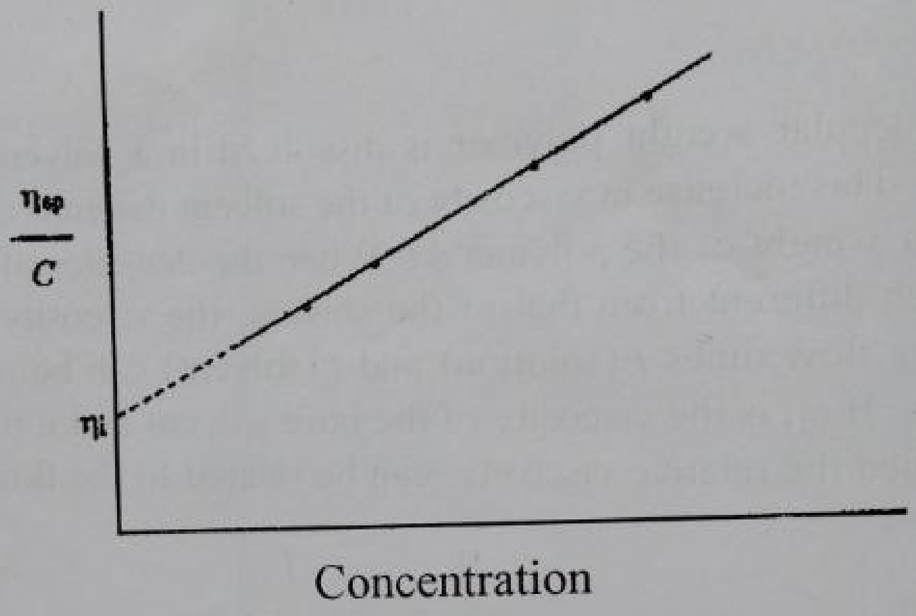
Concentration of the polymer solution =

$$\acute{\eta}_i = \lim \acute{\eta}_{sp}$$
$$= KM^{a}$$

$$D_p = \frac{M}{m} \text{ (M= mol. wt of polymer, m = mol. wt of monomer)}$$

$$\acute{\eta}_i = K \times M^a$$

The molecular weight M of the polymer can be determined; K and a are constan given polymer.



Calculation

According to Mark-Hownik equation,

$$\acute{\eta}_i = K M^a$$

$$\log \acute{\eta}_i = \log K + a\log M$$

$$\log M = \left[\frac{\log \acute{\eta}_i - \log K}{a}\right]$$

$$M = \text{Anti log}\left[\frac{\log \acute{\eta}_i - \log K}{a}\right]$$

Where M = molecular weight of polymer

$\acute{\eta}_i$ = intrinsec viscosity

$$\text{Degree of polymerization} = \frac{\text{Molecular weight of the polymer}}{\text{Molecular weight of the monomer}}$$

Procedure

The viscometer is first washed with water and then with acetone and dried. The viscometer is clamped vertically in a thermostat. 10 ml of the solvent is pipetted out into the reservoir of the viscometer. The upper bulb of the viscometer is filled with the solvent, (water) by suction. The rubber tube attached to the limb of the viscometer is released and as the solvent starts flowing, the flow time of the solvent to flow from the upper mark to lower mark is noted by using a stop watch (t_0). The procedure is repeated for concordant values.

1% of the polymer solution (1 g of polyvinyl alcohol in 100 ml of water) is prepared. From this, desired dilutions of the polymer are prepared in five different standard flasks. Solvent is poured out of the viscometer. Now the flow time for each concentration of the polymer is determined as done for the solvent, pipetting 10 ml

every time. From the flow times, $\acute{\eta}r$, $\acute{\eta}_{sp / C}$ and and $\acute{\eta}_{sp / C}$

and a plot of $\acute{\eta}_{sp / C}$ against C is made to get $\acute{\eta}i$.

Result

1. The molecular weight of a given polymenr = ____________
2. Degree of polymerization of a given polymer = ____________

Viva-Voce Questions

1. Define polymer.
2. What is mark-hawnik equation? Explain the terms in it.
3. Name the apparatus you are using for flow time measurement

Viscosity - Molecular Weight Constants for Polymer Solvent System at 30^{0}C

Polymer	Solvent	K x 10_^{5} g/dl	A
Polyvinyl acetate	Acetone Benzene	10.2 56.3	0.72 0.62
Polyvinyl alcohol	Water	45.3	0.64
Polyvinyl chloride	Chlorobenzene Cyclohexanone Tetrahydro furan	71.2 16.3 83.3	0.59 0.77 0.83

9. pH Measurements For Acid - Alkali Titrations

Expt. No. 13

Date:......................

Aim

To determine the strength of approximately 0.01 N hydrochloric acid solution by pH titration. You are provided with 0.1 N sodium hydroxide solution.

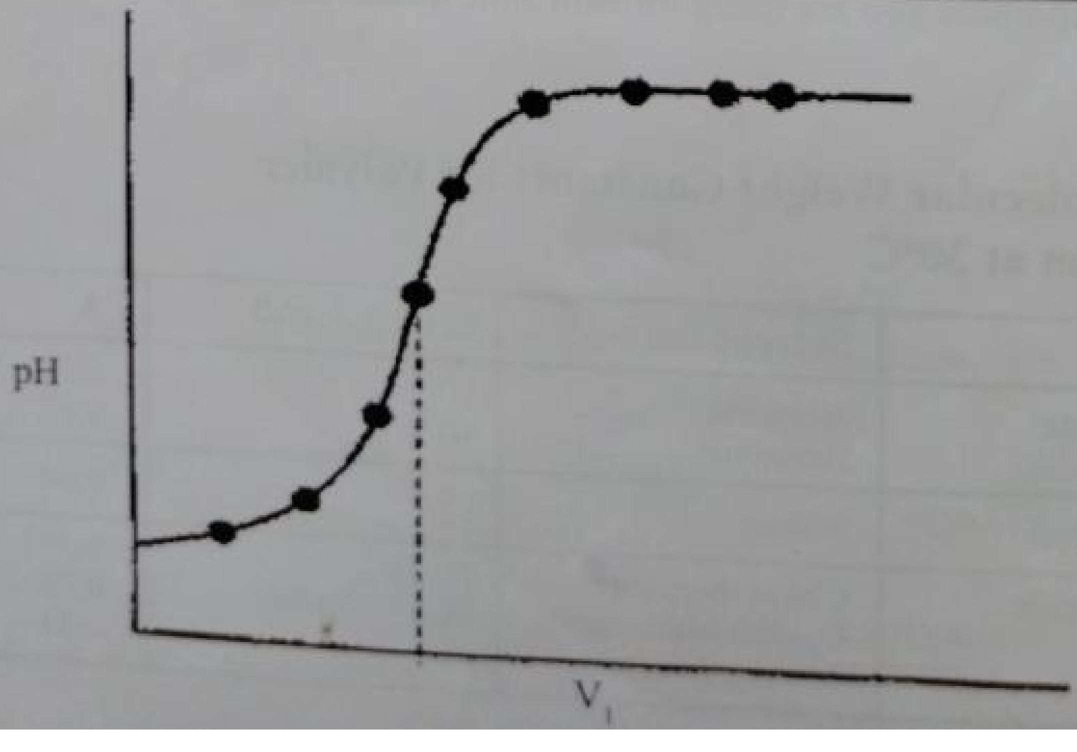
Principle

pH titrations are generally used to fine out equivalence point or end point of coloured solutions of acid or alkali where there is problems in using indicators. During the acid-alkali titrations the H^+ ions of the acid is progressively consumed, increasing the pH only slightly.

But as the end point is reached, the H^+ ions react with OH of the alkali to form water molecules and further addition of alkali increases the OH^- ions. The change in H^+ ion to OH ions with a small volume change is denoted by a steep rise in peak when ? pH / ? V (y-axis) versus volume of alkali added V (x-axis) and this point in x-axis denotes the equivalence point or end point.

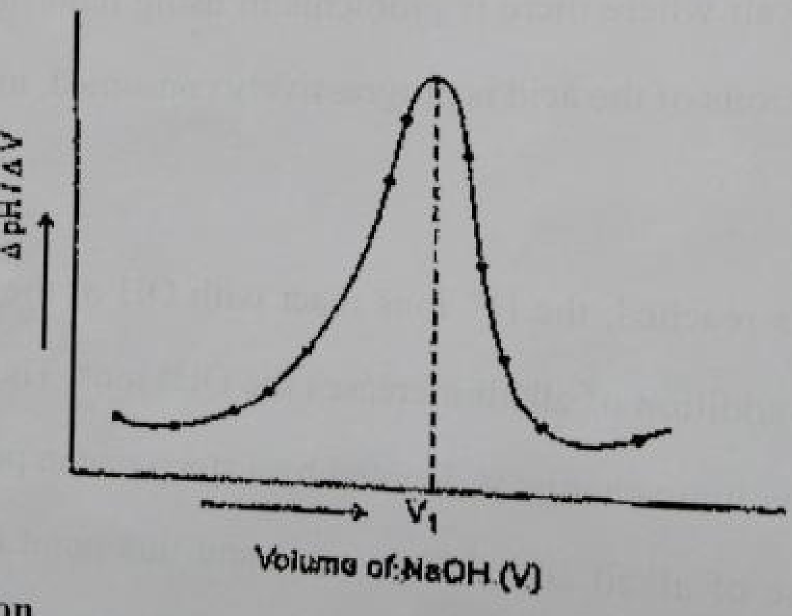
Standard Sodium hydroxide vs hydrochloric acid

S.No	Volume of NaOH	pH



Standard Sodium hydroxide vs hydrochloric acid

S.No.	Volume of NaOH	pH	ΔV	ΔpH	$\frac{\Delta pH}{\Delta V}$



Calculation

$$\underset{\text{Sodium hydroxide}}{V_1\ N_1} = \underset{\text{Hydrochloric acide}}{V_2\ N_2}$$

$$N_2 = \frac{V_1 N_1}{V_2}$$

$$= \frac{V_1 \times 0.1}{50}$$

Procedure

Make up the given HC1 acid solution into a 100 ml. Standard flask. Fill the burette with the given NaOH solution.Take 50 ml. of the made up acid solution in a 100 ml. Beaker and insert the pH glass-calomel electrode into the acid solution, switch on the pH meter and note the initial pH of the acid solution. Then, add gradually 1 ml. each of sodium hydroxide solution through the burette, followed by stirring or shaking the beaker gently and note the pH reading each time for the specific volume of the sodium hydroxide added. This is repeated till a sharp jump in pH value is obtained. From this trial titration the equivalence point range is obtained from the graph drawn by plotting pH Vs volume of titrant added.

The solution is discarded and the same cell is formed with fresh aliquot of HCl solution (20ml). The experiment is repeated by adding NaOH solution in 0.1 ml portions in the region of sharp increase.

Tabulate the reading as shown. Plot the graph ?pH / ? V in the y-axis and the volume of NaOH added V in the x-axis as shown in the figure. From the sharp peak in the second graph, the volume of sodium hydroxide corresponding to the equivalence point or end point is obtained.

Result:

The exact strength of hydrochloric acid = ...N

Viva-Voce Questions

1. Define pH of a solution.
2. What electrode and instrument you are using for pH measurements.

10. ESTIMATION OF FERROUS IRON BY POTENTIOMETRIC TITRATION

Aim

To estimate the amount of ferrous iron IN the given ferrous ammonim sulphate solution by potentiometric titration using a standard potassium dichromate solution of strength O.1 N.

Principle

When potassium dichromate solution is added to an acidified ferrous solution, it oxidizes ferrous to ferric ($Fe^{2+} \longrightarrow Fe^{3+}$) and a redox couple is set up. The cell representation for this titration is as follows.

$$\underset{\text{calomel electrode}}{Hg / Hg_2Cl_{2(s)}\, KCl_{satd}} \,//\, Fe^{2+} / Fe^{3+}, (H^+)/Pt$$

Addition of potassium dichromate solution increases the Fe^{3+} and decreases the ratio Fe^{2+} / Fe^{3+} which increases the observed emf. At the equivalent point, the concentration of Fe^{2+} reduces to zero and a new redox couple is just set up which is indicated by a sudden jump in the observed emf value.

Procedure

10 ml of the given ferrous solution is pipetted out in to a 100 ml beaker. 10 ml of dil.H_2S0_4 (4 N) and adequate amount of distilled water is added so as to immerse .the electrode well in solution mixture. A clean platinum wire electrode, a dip type calomel electrode and glass stirrer is placed in to the solution. This forms a complete cell. The leads from the calomel and platinum electrode are connected to the negative and positive terminals of the potentiometer respectively.

The burette is filled with a standard potassium dichromate solution and is so mounted above the beaker that its tip is dipped inside the liquid level. In the trial experiment 1 ml of potassium dichromate solution is added to the solution in the beaker. stirred well and the steady emf of the cell is measured. In the same way, the experiment is continued till a sharp jump in the emf is observed. From this the equivalence point range is obtained from the graph drawn by plotting emf Vs volume of titrant added.

The solution is discarded and same cell is formed with fresh aliquot of ferrous solution. The experiment is replaced by adding potassium dichromate solution of 0.1 ml portions in the region of sharp increase.

Titration (Trial)

Standard Potassium dichromate vs Ferrous Iron

S.No.	Volume of $K_2Cr_2O_7$ (ml)	Emf (volts

Measurement of EMF - Titration of Ferrous Iron with Potassium Dichromate

S.No.	Volume of titrant (ml)	*E* measured (volt)	ΔE	ΔV	$\frac{\Delta E}{\Delta V}$

Calculation

Strength of Potassium dichromate $= N_1$

Volume of potassium dichromate $= V_1$

Volume of Ferrous iron solution $= V_2$

Strength of Ferrous iron Solution $= \frac{N_1 V_1}{V_2}$

Amount of Ferrous iron oin the 1000 (ml) of solution $= X \times 55.85$ g

Amount of Ferrous iron in the Whole of the given solution (100ml) $= \frac{X \times 55.85}{10}$ g

Location of end point

From the difference between the emf values of successive additions, “E = E_{2}- - E_{1} and from the volume differences “V « $V_{2} - V_{1}$, the derivative “E/?”V is calculated. A graph is drawn by plotting “E/?”V in Y- axis and volume of titrant in then X- axis. The volume corresponding to the peak in this plot gives the equivalence point of the redox reaction.

Result

Amount of ferrous ion present in one litre of the given solution = ―――――――― g/lit

VIVA-VOCE QUESTIONS

1. Mention the type of titration.
2. What is the function of salt bridge?
3. Electrode potential in this titration depends upon ―――――― & ―――――― ions

11. Conductometric precipitation titration using $BaCl_2$-Na_2S0_4

Aim

To determine the amount of Barium chloride present in one litre of the given solution by conductormetric titration using a standard sodium sulphate of strength ——————N

Principle

A solution of electrolytes conducts electricity due to the presence o ions. Since specific conductance of a solution is proportional to the concentration of ions in it, conductance of the solution is measured during titration.In the precipitation titration, ions are converted to insoluble precipitate, which will not contribute the conductance. When sodium hydroxide is added slowly to the Barium chloride, it gets precipitated while the chloride ions remain unchanged.

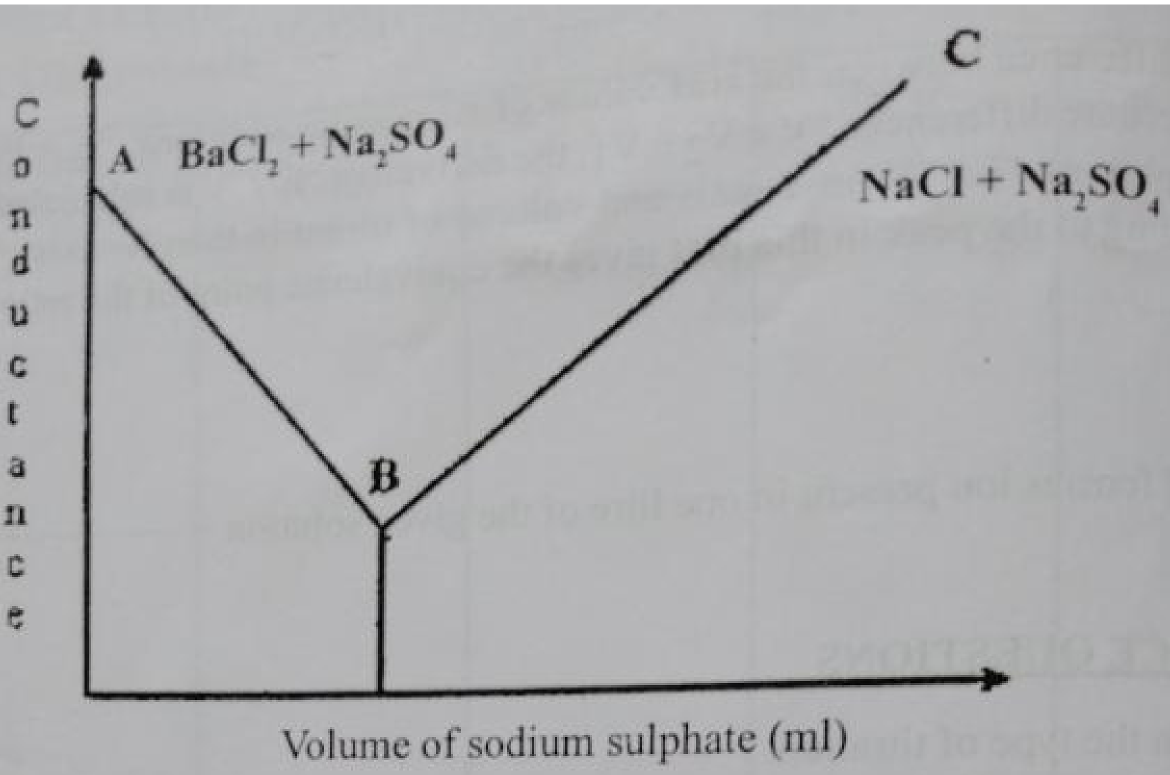
$$Ba^{2+} + 2C1^{-} + 2Na^{+} + SO_4{}^{2-} \longrightarrow BaSO_4 + 2Na^{+} + 2Cl^{-}$$

The Barium ions in the solution are replaced by free Na^+ ions. Since the mobility Na^+ ions is less that of Ba^{2+} ions the conductance of the solution decreases. After the end point, when all the Ba^{2+} ions are replaced, further addition of sodium sulphate increases the conductance. This is due to the increase of Na^+ and $SO_4{}^{2-}$.

Procedure

Micro burette is filled with sodium sulphate solution. A conductivity cell is placed in the beaker containing a solution of barium chloride (20 mi $BaCl_2$ & 30 ml distilled water). Two terminal of the cell is connected to the conductivity meter. Now a constant volume of sodium sulphate is added from the micro burette to the solution and a change in the conductivity is recorded for each addition.

During the addition of Sodium sulphate, conductivity decreases through AB and further addition causes a steep increase in conductance through BC. End point of the reaction is obtained from the graph drawn by plotting the volume of sodium sulphate with conductance. From the end point, the amount of Barium chloride acid present in the 1 litre of the given mixture is calculated.



S.No.	Volume of sodium sulphate (ml)	Conductance (mho)
1		
2		
3		
4		
5		decrease
6		
7		
8		
9		
10		
11		
12		
13		
14		increase
15		
16		
17		
18		
19		
20		

Calculation

Step 1 Determination of normality of $BaCl_2$

Volume of Barium chloride (V_1) = 20 ml

Strength of hydrochloric acid (N_1) = ?

Volume of Sodium sulphate (V_2) = ________ ml (end point from the grap

Strength of Sodium sulphate (N_2) = ________ N

According to the law of volumetric analysis, $V_1N_1 = V_2N_2$

$$N_1 = \frac{V_2 N_2}{V_1}$$

= ________ N

Strength of Barium chloride = ________ N

Step II Determination of amount of $BaCl_2$

Amount of Barium chloride present in 1 lit of the given solution = St. of $BaCl_2$ x Eq W

= St.of $BaCl_2$ x 122.14

= ________ gm/lit

Result

Amount of barium chloride present in 1 litre of the given solution =------------ g

VIVA-VOCE QUESTIONS

1. Define conductance
2. Explain the principle of conductometric titrations.
3. Will conductivity of a solution increase on dilution? Why?
4. What is cell constant?
5. State two advantages of condutometric titrations.
6. Before the addition of alkali the conductance of the acid solution is ----------------du to-------------
7. After the neutralization point the conductance increases in the titration of stron acid against strong base is due to the presence of ------------------
8. What is ionized water?

12. Determination of water of crystallization of a crystalline salt ($CuSO_4$-$5H_2O$)

Aim

To determine the quantity of water of hydration present in $CuSO_4$ $5H_2O$) You are provided with a sample of A.R. $CuSo_4$ $5H_20$.

Principle

$CuSO_4$ $5H_2O$ is a blue crystalline solid. The salt is hydrated with five molecule of water which is responsible for the colour of the salt. When it is healed, loss of water molecule occurs resulted with appearance of wlrite solid

$$CuSO_4\ 5H_2O \qquad CuSO_4 + 5H_20$$

According to stoichiometric equati

$$CuSO_4\ 5H_2O \qquad CuSO_4 + 5H_2O$$

$$(\text{mol. Wt} = 249.68) \qquad (159.68) \qquad (90)$$

i.e., 249.68 gm of $CuSO_4$ $5H_2O$ contains 90 gms of water

then, X gms of $CuSC_4$ $5H_2O$ contains = X x 90 /249.68 gms of water

Procedure

Silica crucible is washed and healed to about 200° C in a hot air oven. Then it is cooled in a desiccator and then weighed. The process of heating, cooling and weighing is repeated till a constant is recorded

Let the weight of empty silica crucible - W gms

Now a definite quantity of given A.R. $CuSO_4$ $5H_2O$ is taken in the weighted silica crucible and roasted until blue colour changes into white. Then it is coded in a desiccator and weighed. The process of heating, coolingand weighing is repeated till a constant is recorded

Let the weight of empty silica crucible + residue ($CuSO_4$) = W_2 gms

The weight of residue ($CuSO_4$) is obtained from the difference in weights of W_1 and W_2

Then, Weight of the residue, (W_2 - W_1) gms

Result

Water of crystallization of crystalline salt, $CuSO_4$ $5H_20$ = ______________ gms

VIVA-VOCE QUESTIONS

1. Define crystallization
2. What is the molecular weight of $CuSO_4$?
3. Why silica gel used in desiccators?
4. What are the substances used to remove the moisture?
5. What happen, when $CuSO_4$ is roasted?

Calculation

Weight of empty silica crucible, W1 = ______________ gms

weight of empty silica crucible + residue ($CuSO_4$), W_2 = ______________ gm

Weight of the residue, (W_2—W_1) = ______________ gms

i.e., Weight of the $CuSO_4$ ______________ gms

Thus x gms of $CuSO_4$ $5H_20$ contains x - (W_2 - W_1) gms of water

100 gms of $CuSO_4$ $5H_20$ contains, x - (W_2-W_1) X 100/x

Water of crystallization of crystalline $CuSO_4$ $5H_20$ = ______________ gms

Preparation of Reagents

Reagent	Strength	Details of Preparation
Acetic acid	4N	250 ml glacial acelic acid per litre of distille water
Hydrochloric acid	4N	330 ml con. HCl per liter of distilled water
Nitric acid	4N	250 ml con. HNO_3 per litre of distilled water
Sulphuric acid	4N	110 ml con. H_2SO_4 per litre of distilled water
Ammonium hydroxide	4N	270 ml liquor ammonia per litre
EDTA solution (Disodiumsalt)	0.01 M	3.72 g disodium salt of EDTA per litre distilled water
Eriochrome black-T in-dicator		0.5 g of solid EBT in 50 ml of alcohol
Calcium carbonate solution	1 mg/ml	Dissolve 1 g of $CaCO_3$ in dil HCl and make up to one litre
Ammonium chloride ammonium hydroxide buffer	pH=10	Dissolve 67.5 g of NH_4Cl in 570ml of con. ammonia solution and make up to one litre.
Silver nitrate	0.1 N	16.9 g of $AgNO_3$ in one litre of distilled water
Sodium chloride	1 N	58.44 g of $NaCl$ per litre of distilled water
Potassium chloride	1 N	74.56 g of KCl
Ammonium thiocyanate	0.1 M	8.5 g NH_4SCN in 1 litre of distilled water

Molecular Weight of Hardness and Alkalinity Producing Sal

Name of the chemical	Mole. Formula of the Salt	Eq.weight	Molecular W of the Salt
Calcium bi carbonate	$Ca(HCO_3)_2$	-	162
Magnesium bi carbonate	$Mg(HC0_3)_2$	-	146
Calcium carbonate	$CaCO_3$	50	100
Ethylene di amine tetraacetic acid	$CH_2N(CH_2COOH)_2(CH_2COONa)_2\ 2H_2O$	372.2	-
Ferrous sulphate	$FeSO_4 7H_2O$	278.0	-
Ferrous Ammonium Sulphate	$Fe(NH_4)_2(S0_4)_2\ 6H_2O$	392.0	-
Copper sulphate	$CuSO_4\ 5H_2O$	250.0	-
Potassium Dichromate	$K_2Cr_2O_7$	49.0	
Potassium hydroxide	KOH	56.0	
Potassium Permanganate	$KMnO_4$	31.6	
Sodium carbonate	Na_2CO_3	53.0	
Sodium Thiosulphate	$NaS_2O_3\ 5H_2O$	248.2	
Sodium hydroxide	NaOH	40.0	
Sulphuric acid	H_2SO_4	49.0	
Hydrochloric acid	HCl	36.5	
Nitric acid	HNO_3	63.00	

Preparation of Reagents

Reagent	Strength	Details of Preparation
Potassium thiocyanate	0.1 M	10.5 g $KSCN$ in 1 litre of Distilledwater
Potassium chromate	5%	5 g of K_2CrO_4 in 100 ml of distilled water
Iron III indicator		Dissolve 40 g ammonium Iron III sulphate in 100 ml and add few drops of 6M HNO_3
Potassium dichromate	1 N	49 g of $K_2Cr_2O_7$ in 1 litre
Ferrous ammonium sulphate	1 N	Dissolve 392 g of FAS in distilled water and required quantities of con H_2SO_4 and dilute to one litre
Fast Sulphon Black -F indicator		Dissolve a pinch of the indicator in-distilled water and dilute to 100 ml
Starch solution	1%	Dissolve 1 g of soluble starch in water and add to 100 ml of boiling water
Potassium iodide	10%	100 g of KI per litre of distilled water
Sodium hydroxide	1 N	40g of $NaOH$ in 1 litre of distilled water

NAME: MATAM DHARSHAN
REG. NO: U18AE051
AERO-A

S.NO	Name of Experiment	Sign
1.	Determeniation of Hardness of water by EDTA method (Date: 10.6.18)	10
2.	Estimation of alkalinity (Date 12.6.18)	10
3.	Estimation of copper by EDTA method (Date: 18.7.18)	10
4.	Estimation of chlorides in water by argenoto-metric method (Date: 25.7.18)	10
5.	Conductemetric titration of strong acid with strong base (Date: 26.7.18)	10
6.	Estimation of Iron in water by spectrophotom-etery	10

Determination of total hardness of water by EDTA Method:-

Aim:- To Estimate the amount of total hardness of the given water sample. you are provided with a std. hardness sample and std. EDTA solution.

principal :- Tempuary hardness is largly due to presence of bi-carbonate of ca & Mg then the sample of water is boiled, bi-carbonate of ca & Mg are converted to insoluble carbonate's & hydroxide's, which can be removed by filteration. The permenant hardness is due to presence of the chlorides & sulphides of ca & Mg, can't be removed by boiling.

Equation :-

$$Ca(HCO_3)_2 \xrightarrow{\Delta} CaCO_3 + H_2O + CO_2$$

$$Mg(HCO_3)_2 \xrightarrow{\Delta} Mg(OH)_2 + 2CO_2$$

The total hardness is sum of temperary & permenant hardness which is determine by complexing in with EDTA.

$$M^{2+} \text{ indicator} \longrightarrow M \text{ indicator (wine red)}$$

$$M\text{-Indicator} + EDTA \longrightarrow M\text{-}EDTA + \underset{\text{(steal bule)}}{\text{indicator}}.$$

procedure:- titration - I :- standradisation of EDTA.

The burette is washed with distilled water then raind with EDTA solution, then the burette is filled with EDTA solution and 20ml of std. hardness of water is taken in a conical flask. 5ml of the Mixture, flowed by the addition 2 or 3 drops of EBT. The solution is titrated with EDTA. The End point is apperance of steal bule colour. titration is repeated to get the concordant value. For this the volume of EDTA is consived is noted (V₁).

Constent	Titration - I	Titration - II
Burette Solution	EDTA	EDTA
Pipette Solution	20ml of Hard water ↓ standard	20ml of Sample Hard water
reagent	5ml of Buffer solution	5ml of Buffer solution
Indicator	EBT	EBT
The End point	wine red to steal Blue	wine red to steal blue.

Standardisation of EDTA

S.No	Volume of std. hard water (ml)	Burette reading		Volume of EDTA consumed (ml)	concordant volume (ml) V_1	Indicator
		Initial	Final			
1.	20 ml	0 ml	20 ml	20 ml	21 ml	EBT
2.	20 ml	0 ml	21 ml	21 ml		

The volume of EDTA consumed for std. H.W = V_1 = 21 ml.

① Determination of total hardness of water by EDTA Method:-

Aim:- To Estimate the amount of total hardness of the given water sample. you are provided with a std. hardness sample and std. EDTA solution.

principal :- Temperary hardness is largly due to presence of bi-carbonate of ca & Mg then the sample of water is boiled, bi-carbonate of ca & Mg are converted to insoluble carbonate's & hydroxide's, which can be removed by filtration. The permenant hardness is bue to presence of the chlorides & sulphides of ca & Mg, can't be removed by boiling.

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Estimation of total H.W - standardised EDTA Vs unknown Hard water.

S.NO	volume of ~~std.~~ unknown Hard water (ml)	Burette Reading		volume of EDTA consumed (ml)	constant volume (ml) V_2	Indicator
		Initial	Final			
1.	20 ml	0ml	9.5	9.5	9.5	EBT
2.	20ml	0ml	9.5	9.5		

Volume of EDTA consumed for unknow H.W = V_2 = 9.5ml

Calculation :-

1ml of standard hardness water

= 1ml of $CaCO_3$

V_1 ml of EDTA = 20ml of std. Hard water

1ml of EDTA = $\frac{20}{V_1}$ ml of $CaCO_3$

20ml of unknown sample = V_2 ml of EDTA

= $\frac{20 \times V_2}{V_1}$ mg of $CaCO_3$

1000ml of unknown sample = $\frac{1000 \times 20 \times V_2}{20 \times V_1}$ mg of $CaCO_3$

total hardness = $\frac{V_2}{V_1} \times 1000$ mg / lit = x ppm.

Tritation-II :- Estimation of total hardness.

The burette is filled with EDTA solution, 20ml of unknown water sample is taken into the conical flask. 5ml of Buffer solution is added to maintain the P_H of mixture, flowed by the addition of 2 or 3 drop's of EBT. It is tritated with EDTA solution. The end it appearance steal blue colour. The tritation is repeated to get the concordant value. For this volume of EDTA consumed is noted (B_2).

Result :-

Total hardness of water = 452% ppm.

Calculation ;

The volume of EDTA consumed std. Hard water $V_1 = 21ml$

The volume of EDTA consumed at unknown H.W $V_2 = 9.5ml$

$$\text{Total hardness} = \frac{V_2}{V_1}\ \text{ppm}$$

$$= \frac{9.5ml}{21ml} = \frac{4.52}{10} = 0.452\ \text{ppm}.$$

21) 9.5 (0.

21) 95 (4.52
84
110
105
60
42
12/11.

∴ Total hardness = 0.452 ppm.

= 0.452 × 1000

= 452 ppm

8/8/17

9+1
10

Ex-② **2. Estimation of Alkalinity -(Titrimetry)** 5-09-2017

Aim: To determine the alkalinity of a given water sample,

principle: the alkalinity in water due to a presence of caustic alkalinity - $NaOH$, KOH, Na_2CO_3, K_2CO_3, $NaHCO_3$ or $KHCO_3$ Bicarbonate alkalinity is due to $ca(HCO_3)_2$ or $Hg(HCO_3)_2$ This can be estimated by Titration against acid.

When a solution containing carbonate is tibrated against a storng acid like HCl, the first equivalence point is due to reaction.

$$CO_3^{2-} + H^+ \longrightarrow HCO_3^-$$

This can be indicated by phenophatalein point indicator and the titre value is termed as phonophatalein alkalinity.

The second Equivalence point co-orresponding to reaction $HCO_3^- + H^+ \longrightarrow H_2O + CO_2$ is called methylorange alkalinity indicated by methylor-nge alkanlity due to OH alone is called OH^- alkanlinty

$$H^+ + OH^- \longrightarrow H_2O$$

The total alkalinity due to all alkaline species is determined using methylorge indicator and is denoted as T But OH^- and HCO_3^- can't exist together as they simultaneous form CO_3^{2-}

$$OH^- + HCO_3^- \longrightarrow CO_3^{2-} + H_2O$$

Hence, all the titre values, different types alkanity is Evalued.

procedure:

Determination of phenolphalen alkalinity:-

20ml of water sample is pipetted out into a clean conical flask. Two drops of phenolphalen indicator are added and titrated against std. H_2SO_4 taken in the burette. The End point is the disappearance of pink colour. Titration is repeated to the concordant value.

Short procedure:

content	Titration-I	Titration-II
Burette solution	$0.1N H_2SO_4$	0.1N of H_2SO_4
pipette solution	20ml of given water sample-I	20ml of given water sample-II
Reagent added	—	—
Indicator	phenopthalein	methyl orange.
End point	i) Disappearance of pink colour	i) colour change from yellow to reddish orange

Estimation of Phenopthalein Alkalinity.

S.NO	vol. of std. hard water (ml) sample	Burette reading		vol. of H_2SO_4	concordant value (V_1)	Indicator
		Initial (ml)	final (ml)			
1	20 ml	0	17.5	ml 17.5	17.5	phenopthal
2	20 ml	0	17.5	ml 17.5		
3						

volume of H_2SO_4 consumed = 17.5 ml

Normality of H_2SO_4 = 0.1 N

vol of water sample = V_2 = 20 ml

Normality of water sample = $\frac{V_1 \times N_1}{V_2}$ = 0.087 N

phenolpthalein alkalinity in term's of carbonate

$P = \frac{V_1 \times N_1}{V_2} \times 50 \times 1000$ ppm

Determination of total alkalinity :-

aomal of water sam

S.NO	volume of std. hard water (ml)	Burette reading		volume of H_2SO_4 (ml)	constant value (ml) V_2	Ind cat
		Intial (ml)	Final (ml)			
1	20 ml	0	25.5	25.50 ml	25.5 ml	meth
2	20 ml	0	25.5	25.50 ml		orang

Vol of H_2SO_4 concumed $= V_1 = 25.5$ ml

Normality of H_2SO_4 $= N_1 = 0.1N$

Volume of water sample $= V_2 = 20$ ml

total alkalinity in terms of carbonate

$$= \frac{V_1 \times N_1}{V_2} \times 50 \times 1000 \text{ ppm}$$

Calculation =

$$= \frac{17.5 \times 0.1}{20} = \frac{1.75}{20} = \frac{0.175}{2} = 0.087$$

$$= \frac{V_1 \times N_1}{V_2} = \frac{25.5 \times 0.1}{20} = \frac{0.255}{2} = 0.1275$$

$= 0.087$

then

$P = 0.087 \times 50 \times 1000 = 87 \times 50 = 4350$ ppm

$M = 0.1275 \times 50 \times 1000 = 127.5 \times 50 = 6375$ ppm

then $P = 4350$ ppm $M/2 = \frac{6375}{2} = 3125$

3187.5 ppm

$\boxed{P > M/2}$

Determination of total alkalinity :-

20ml of water sample is pipetted out into a clean conical flask. 2 or 3 drops of methyl orange is indicator are added and titrated against std. H_2SO_4 taken in the burette. The end point of the colour change is pale yellow to pale pink. Titration is repeated for concordant values.

Titre value	Hydroxide alkalinity	Carbonate alkalinity	Bicarbonate alkalinity
$P=0$	0	0	M
$P < \frac{1}{2}M$	0	$2P$	$M-2P$
$P = \frac{1}{2}M$	0	$2P$	0
$P > \frac{1}{2}M$	$2P-M$	$2(M-P)$	0
$P=M$	M	0	0

⇒ Hydroxide alkalinity $= \overset{2P-M}{2(4350) - 6375} = 12700 - 6375 = 6325$ ppm

Bicarbonate alkalinity = 0

Carbonate alkalinity $= \overset{2(M-P)}{2(6375-4350)} = 2(2025) = 4050$ ppm

Result :

Bicarbonate alkalinity = 0 ppm

Hydroxide alkalinity = 6325 ppm

Carbonate alkalinity = 4050 ppm.

29/9/18

Exp-3 Estimation of Copper by EDTA Method

24/10/2017

Aim: To Estimate the amount of copper in the given solution using EDTA you are provided with a 0.01 M solution of EDTA and std. $CuSO_4$ solution of strength 0.01M.

Principle:

copper form's red colour complex fast sulphon Black-f- indicator and the colour reaction is specific or copper ions in amonical medium. In the direct tritation of cupper in amonical solution, the colour change at the End point is form megenta or purple to dar green.

Procedure: Standardisation of EDTA:-

std. $CuSO_4$ (20ml solution is pipetted out into a lear conical flask and diluted to 50ml using distilled ater. five ml of concentration amonia solution.

alculation:

Volume of std. copper solution taken = 20ml

strength of copper solution = 0.01M

volume of EDTA consumed = V_1 = 21.0 ml

Strength of EDTA $x = \frac{20 \times 0.01}{V_1}$

$= \frac{20 \times 0.01}{21.0} = 9.523 \times 10^{-3}$ M

= 0.0095 M

Short procedure

content	Titration-I	titration-II
Burette solution	EDTA	EDTA
Pipette solution	Std. $CuSO_4$ 20ml + 80ml water	20ml of unknown solution + 80ml water
Indicator	5ml ammonia & 2-3 drops fast sulphan Black-f	5 ml ammonia & 2-3 drops fast sulphan black-f
End point	purple to dark green	purple to drak green

Standardisation of EDTA solution

Standard $CuSO_4$ vs EDTA method.

S.NO	Volume of std $CuSO_4$ solution taken (ml)	Burette reading		Volume of EDTA solu consumed	concordant value (V_1)	Indicator
		Initial	final			
1	80ml	0ml	21.0	21.0	21.0	FSB
2	20ml	0ml	22.0	22.0		FSB

Estimation of copper

EDTA Vs given copper solution:

S.NO	Volume of copper sol. taken (ml)	Burette reading intial ml	final ml	volume of EDTA consumed (ml)	concordant volume (ml)	In Co
1	20 ml	0 ml	13.5 ml	13.5 ml	13.5 ml	Fi
2	20 ml	0 ml	13.5 ml	13.5 ml		Fi

Volume of EDTA consumed = V_2 = 13.5 ml

strength of EDTA $x = 9.523 \times 10^{-3} M$

volume of copper solution taken = 20 ml

then, $V_2 = 13.5$ ml $x = 9.523 \times 10^{-3} M$

then, $\frac{13.5 \times 9.523 \times 10^{-3} M}{20} = 6.428 \times 10^{-3} M$

strength of copper solution $= \frac{V_2 \times x}{20} = y = 6.4$

$\therefore y = 6.428 \times 10^{-3} M$

Amount of copper present in the given solution

$= \frac{y \times 63.54}{10 g} = \frac{63.54 \times 6.428 \times 10^{-3} m}{10 g} = 0.0408$ gram and 2 drop's of fast solution sulphon Black-f Indicator solution are added. The solution is then titrate.f. against EDTA solution taken in the burette untill the colour changes from purple to dark green

Estimation of copper:-

The given copper solution is made upto the mark in a 100ml standard flask and shaken well. Twenty ml of the solution is pipetted out in a clean conical flask and diluted to 50ml using distilled water 5ml of concentrated ammonia solution and 2 drop's of fast sulphan. Black f- indicator solution are added the solution taken in the Burette untill the colour changes from purple to dark green.

10/10

24/1/17

Result:- Amount of copper present in the given solution = 0.0408 gram's

Exp: Estimation of chlorides in water by Argentometry Method (Mohr's Method)

Aim: To estimate the amount of chloride present in the given water sample. A std. solution of sodium chloride is provided with an approximate N/20 solution of silver nitrate

Principle: Natural water contains chloride ions in the form of $NaCl$, KCl, $CaCl_2$ and $MgCl_2$. The total chloride ion can be estimated by Argentometric method. It is known as Mohr's method. Here Ag^+ ion in solution reacts with chloride ions in the presence of potassium chromate as the indicator to form sparingly soluble silver salt.

$$AgNO_3 + NaCl \longrightarrow AgCl + NaNO_3$$

when all the chlorides ions are removed, a color change from yellow to reddish orange is noticed as end point of the titration.

$$2 AgNO_3 + K_2Cr_2O_4 \longrightarrow Ag_2CrO_4 + 2 KNO_3$$

Produre:- I. Standardisation of silver nitrate

The burette is washed and filled with silver nitrate 10ml of sodium chloride is pipette out in to a clear conical flask. 1 ml of 2% potassium chromate indicator is added then the ion solution tritrated against silver nitrate solution. At the end point, the solution changes its colour from yellow to reddish brown.

II. Estimation of Chloride:

10ml of water is pipetted out into clean conical 1ml of 2%.p chloride indicated. is added. then the solⁿ is tritrated against silver nitrate solⁿ. at the end point, the solⁿ changes its color from yellow to reddish brown. The titration is repeated

Short procedure;-

S.NO	content	Titration-I	Titration-II
1.	Burette solution	silver Nitrate	silver Nitrate
2.	Pipette solution	20ml of sodium chloride	20ml of water sample
3.	Reagent added	-	-
4.	Indicator	Mixture of pottasium Chromate pottasium dichoramate	Mixture of potassi choramate potassium dicromate
5.	End point	Appearence reddish brown	Appearence reddish brown.
	Equivalent	weight of chlorine = 35.45	

Titration-I Standardisation of silver Nitrate
sodium chloride Vs silver nitrate

S.NO	Volume of Nacl	Burette reading		Volume of silver nitrate	concordant value	Ind ca
		intial	final			
1.	20ml	0	20	20	20	Pota -ium chro -ate
2.	20ml	0	20	20		

Calculation:-

Volume of sodium chloride (V_1) = 20 ml

Normality of sodium chloride (N_1) = 0.005 N

Volume of silver nitrate (V_2) = 20 ml (titrate value)

Normality of silver nitrate (N_2) = ?

$$N_2 = V_1 N_1 / V_2$$

$$N_2 = 0.05\ N$$

Tittation-II Estimation of chloride

water sample Vs silver Nitrate

S.NO	Volume of wt sample (ml)	Burette reading initial	Burette reading final	Volume of silver Nitrate	concordant value
1,	20 ml	0	19	19	
2	20 ml	0	19	19	19

Calcultion:

Volume of water Sample (V_1) = 10 ml

Normality of water Sample (N_1) = ?

Volume of silver nitrate (V_2) = 19 ml

Noramility of silver Nitrate =

$N_1 = \frac{V_2 N_2}{V_1}$

$= \frac{V_2 \times N_2}{V_1} = \frac{0.05 \times 19}{20}$

$= 0.0475N$

Amount of chloride ion present in 1litre of the water sample = Eq. wt. Cl × N_1

= x gms

Amount of chloride ion present in 100ml of the water sample = x/10 gms

Amount of Cl ion present in lit of water sample

= Eq. wt of Cl × N_1

= 0.0475 × 35.5

= 1.42 ml

Cl present in 100ml of water

$= \frac{1.42}{10} = 0.142$ gm

18

10/10

Result: Amount of chloride present in the given solution = 0.142 gms.

Ex:-6

conductometry titration of strong Acid with strong Base.

Aim:- To determine the strength of a strong acid like HCl) conductometrically. you are provided with 0.1N NaOH.

Procedure :- The conductivity cell is washed with water, rinsed with conductivity water. Twenty ml of 0.1 N HCl pipetted out into a clean 100ml beaker. The conductivity cell is dipped into it. The burette is filled with NaOH solution and clamped above the beaker. 1ml NaOH solution is added to the burette and stirred well. The conductance of the solution is measured. similarly conductance is measured for each 1ml additions of NaOH from the burette.

Principle :-

A solution of electrolytes conducts Electricity due to the presence of ions. since, specific conductance of a solution is proportional to the concentration of ions on it, conductance of the solution is measured during titration.

when sodium hydroxide is added slowly to the hydrochloric acid, it gets neutralized as shown by the following equation.

$$HCl + NaOH \longrightarrow NaCl + H_2O$$

During the addition of sodium hydroxide, conductivity of the solution decreases slowly. This is the because of removal of fast moving H^+ ions by slow

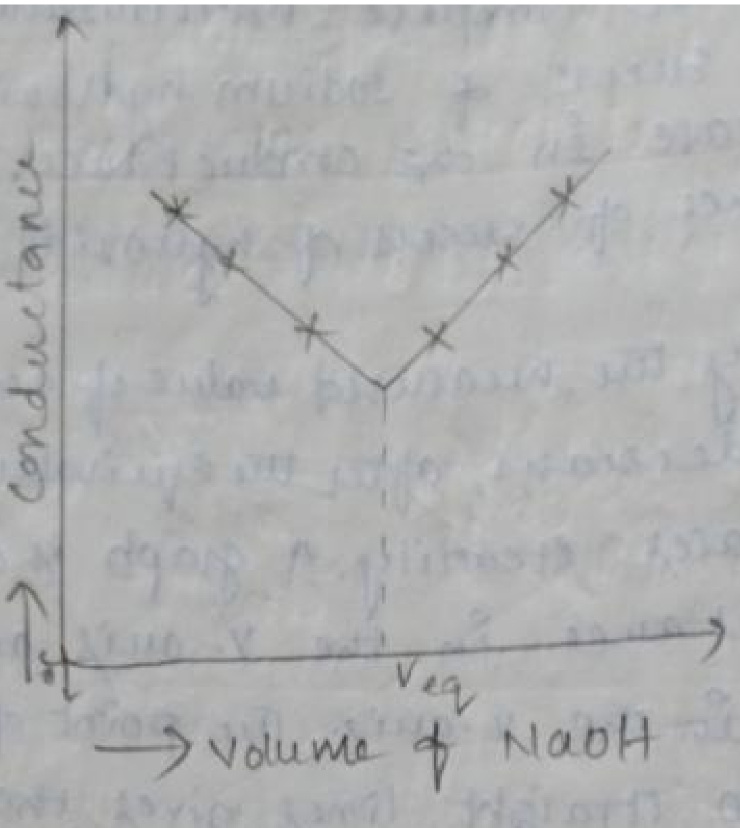
Measurement of conductance - standard sodium hydroxide vs hydrochloric acid.

S.NO	Volume of NaOH (ml)	Conductance (mho)
1	1 ml	0.41
2	2 ml	0.20
3	3 ml	0.27
4	4 ml	0.40
5	5 ml	0.53
6	6 ml	0.67
7	7 ml	0.79
8	8 ml	0.69
9	9 ml	0.99
10	10 ml	1.83

moving Na^+ ion's. This decreasing trend continues till the End point is reached.

After the complete neutralization of all HCl, addition of Excess of sodium hydroxide causes sudden increase in the conductance. This is due to the presence of Excess of hydroxide ions in solution.

Initially the measured value of conductance gradually decreases, after the Equivalence point the value increases steadily. A graph is drawn by taking conductance in the Y-axis and the volume of NaOH in the x-axis. The point of intersection of the two straight lines gives the End point.



Calculation :-

Normality of sodium hydroxide — 0.5 N_1

Volume of sodium hydroxide from the graph — 1.8 ml V_1

Volume of hydrochloric acid — 20 ml V_2

Normality of hydrochloric acid (N_2) — $\frac{V_1 \times N_1}{V_2}$

$= \frac{1.8 \times 0.5}{20}$

$= \frac{0.9}{20}$

$= 0.045$

Result :-

Strength of hydrochloric acid

= 0.045 N.

10/10

Ex:-5 Estimation of Iron In water by spectrophotometry-

Aim:-

To Estimate the amount of ferric (Fe^{2+}) present in the water sample using spectrophotometer.

principle:-

$$I_0 = I_a + I_t + I_r$$

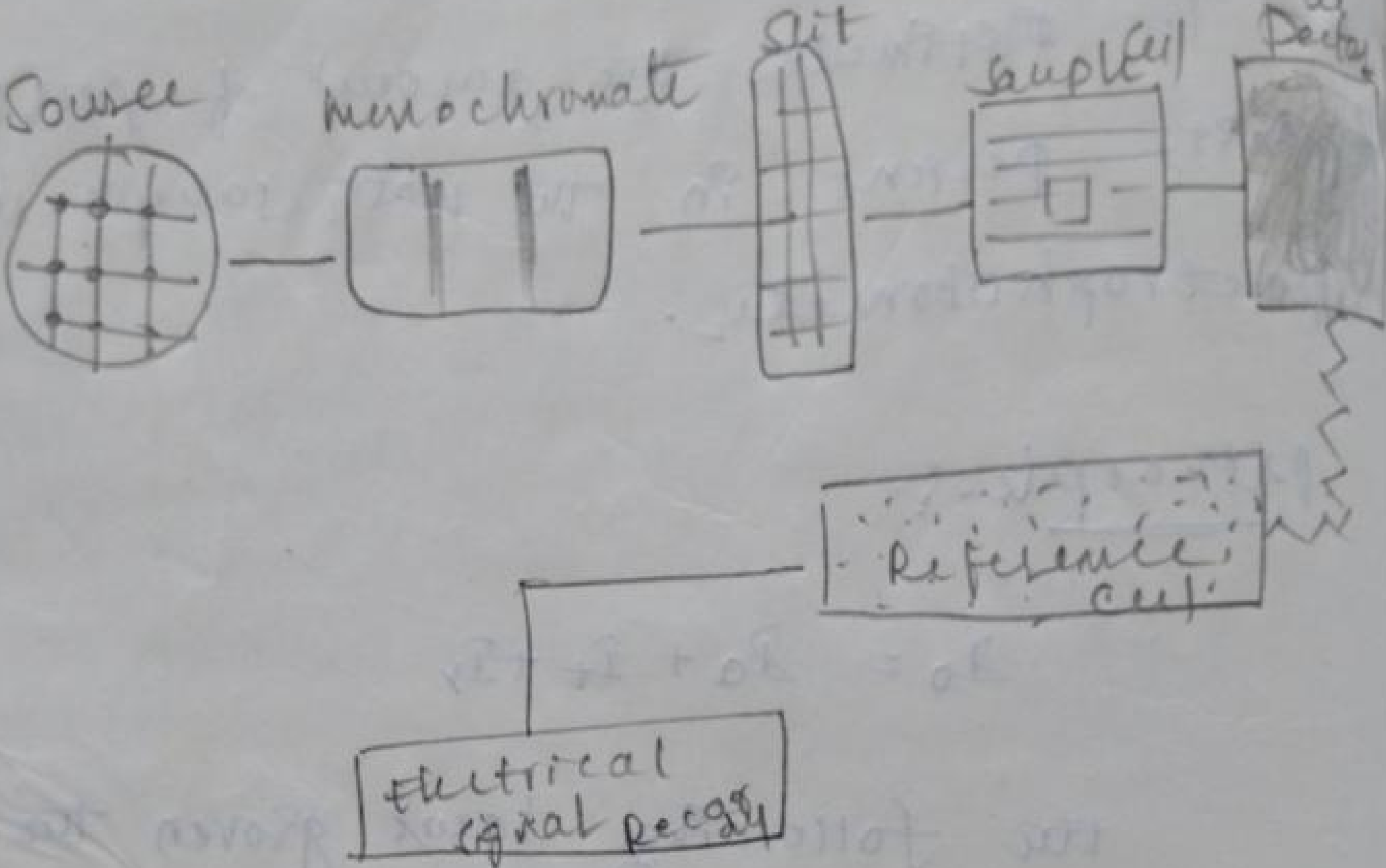
the following laws govern the absorption of light by the molecules.

lambert's law:-

when a beam of light is allowed to pass through transparent medium, the rate of decrease of intensity with the thickness of medium is directly $\propto^{nal}$ mathematically lamberts law. as follows.

Absorbance of Different Concentration.

Volume of Fe^{3+} soln (ml)	volume of SCN soln (ml)	volume of HNO_3 soln (ml)	volume of water (ml)	Con of Fe^{3+} soln (ppm)	Absorbance (A)
1	1	1	7	10	0.950
2	1	1	6	20	1.284
3	1	1	5	30	1.508
4	1	1	4	40	1.684
5	1	1	3	50	1.829
unknown	1	1		10	1.390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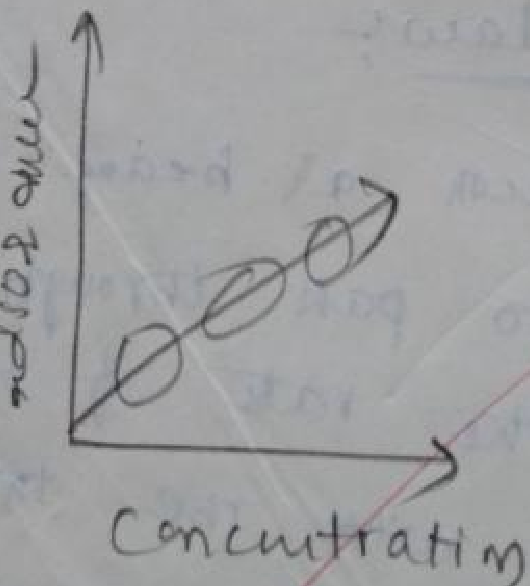
Reference cell
Electrical signal recorder


absorbance
Concentration

$-dI/dt \propto I$ (or) $dI/dt = kI$

On Integrating the above Equation with limit

$I = I_0$ when $t = 0$ then,

$\ln I_0/I_t = kt$

$I_t = I_0 e^{-kt}$

the ration I_0/I_t is termed as transmitted as the ration is termed as the absorbance, ~~of~~ the medium.

Beer's law;-

the Intensity of a beam of mono-chromatic light decreases Exponentially with increase in concentration of absorbing substance.

we get

$\log I_0/I_t = \varepsilon c x$ (or) $A = \varepsilon c x$.

Er of Spechtrometry.

In order to get a good result, a careful attention is extremely important adding a substable reagent. Such reagents ammonium thiocyate is added to the soln is formed due to the containing Fe^{3+} ions. Red blood colour is formed due to the formation of ferric thiocynate complex.

$$Fe^{3+} + 6KSCN \longrightarrow [Fe(SCN)_6]^{3-} + 6K^+$$

20/10

Result :-

The amount of ferric iron in the given water sample 20 ppm

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(Declared as Deemed-to-be-University under section 3 of UGC Act 1956)

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BHARATH INSTITUTE OF SCIENCE AND TECHNOLOGY

173, Agaram Road, Selaiyur, Chennai - 600 073. Tamil Nadu, India.

RECORD NOTE BOOK

Name : MATAM DHARSHAN

Reg. No : U20AE051

Year /Sem : I-year I/II - SEM

Branch : AERO

Subject : chemistry Lab

Bharath

INSTITUTE OF HIGHER EDUCATION AND RESEARCH

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Name [redacted] MATAM DHARSHAN

Course B. TECH Branch AEROSPACE

Year 2019 - 2020 Semester 2nd

Register No. [redacted] U18AE051

Certified to be the bonafide Record of work done by the above student in the Engineering CHEMISTRY U18BSCH2L4 laboratory during the 2nd Semester in the Academic Year 2018-2019

3/5/19

Signature of the Lab-in-charge

Signature of the Head of Dept.

Submitted for the practical examination held on 19/5/19

Internal Examiner

External Examiner

INSTRUCTIONS FOR MAINTAINING THE RECORD NOTE BOOK

1. The Record should be written neatly in ink on the pages of the right hand side and the diagrams / drawings to be drawn on the pages of the left hand side in pencil.

2. Every Experiment should begin on a new page.

3. The right hand side pages of the record should contain :
    - I. SI. No. and date of performance of the Experiment in the margin at the top
    - ii. Experiment No. and the title of the Experiment on the first line followed by
    - iii. Aim of the Experiment.
    - iv. A list of apparatus required.
    - v. Description of the apparatus.
    - vi. Theory of the Experiment in brief.
    - vii. Inference of the result.

4. The left hand side pages of the Record should contain :
    - I. Neat sketches of apparatus used and full page graphs wherever possible.
    - ii. Diagrams of Electrical connections neatly drawn.
    - iii. Observation (to be entered in a tabular form neatly wherever possible)
    - iv. A detailed account of manipulation.

CONTENTS

Completed

Expt. No. 1

Date : 10.8.18

DETERMINATION OF TOTAl HARDNESS BY EDTA METHOD

Aim- To estimate the amount of total hardness, parmanent hardness and temporary hardness of the given water sample. You are provided with a standard hard water sample and standard EDTA Solution.

principle: Temporary hardness is largely due to the presence of bicarbonate of Calcium and Magnesium. When the sample of water is boiled, bicarbonates of calcium and Magnesium are converted to insoluble carbonates and hydroxides, which can be removed by fillteration. The permanent hardness, which is due to the presnce of chlorides and sulphates of Ca and Mg, cannot be removed by boiling.

$$Ca(HCO_3)_2 \xrightarrow{\Delta} CaCO_3 + H_2O + CO_2$$
$$Mg(HCO_3)_2 \xrightarrow{\Delta} Mg(OH)_2 + 2CO_2$$

The total hardness is the sum of permanent and temporary hardness, which is determined by Complexing with EDTA.

$M^{2+} + Ind \rightarrow M\text{-}Ind$ (Wine Red)

$M\text{-}Ind + EDTA \rightarrow M\text{-}EDTA + Ind$ (Steel blue)

Simple Procedure

Content	Titration 1	Titration II
1. Burette Solution	EDTA	EDTA
2. Pipetted Solution	20ml of std. hardwater	20ml of Sample hard water
3. Reagent added	5ml of buffer Solution	5ml of buffer Solⁿ.
4. Indicator	Eriochrome Black-T	Erichrome Black-T
5. End point.	Appearance of steel blue colour	Appearance of steel blue colour.

Standardisation of EDTA

Standard hard water EDTA

S.No.	Volume of Std. Hard Water (ml)	Burette reading		Volume of EDTA Consumed (ml)	Concordant Value (ml) V_1	Indicator
		Initial (ml)	Final (ml)			
1.	20	0	26.0	26.0	26.0	EBT
2.	20	0	26.0	26.0		

Volume of EDTA Consumed for std. Hard Water = V_1 ml

= 26 ml

Estimation of Total Hardness - Standandised EDTA V_1 Unknown Hand Water.

S.No	Volume of std. hard water (ml)	Burette reading Initial	Burette reading final	Volm of EDTA Consumed (ml)	Concordant Value (ml) V_2	Indicator
1	20	0	26·8	26·8	26·8	EBT
2	20	0	26·8	26·8		

Volume of EDTA Consumed for unknown hard water = V_2 ml
= 26·8 ml

Calculation

Total hardness = $\frac{V_2}{V_1} \times 1000$ mg/lit (or) ppm

$= \frac{26.8}{26} \times 1000$

$= 1030.76$

Procedure -

Titration - I :- Standardisation of EDTA.
The burette is washed with distilled water and then rinsed with EDTA Solution. 20ml of standard hard water is taken in a Conical flask. 5ml of buffer solution is added to maintain the pH of the mixture, followed by the addition of 1-3 drops of EBT. The Solution is titrated with EDTA. The end point is the appearance of steel blue Colour. Titration is repeated to get concordant value. From this the Volume of EDTA Consumed (V_1) is noted.

Titration - II : Estimation of Total hardness
The burette is filled with EDTA Solution. 20ml of unknown water sample is taken in the Conical flask. 5ml of buffer Solution is added to maintain the pH of the mixture, followed by the addition of 1-3 drop of EBT. It is titration with EDTA Solution. The end point is the appearance of steel blue Colour. Titration is repeated to get Concordant Value. From this the volume of EDTA Consumed (V_2) is noted.

29/4/19

Result-

Total hardness of water = 1030 ppm.

xpt. No. 2

ate : 2.11.18

ESTIMATION OF COPPER BY EDTA METHOD

Aim- To estimate the amount of copper in the given solution using EDTA. You are provided with a 0.01M Solution of EDTA. and standard $CuSO_4$ Solution, of strength 0.01 M.

Principle- Copper forms red coloured complex with Fast Sulphon Black F- indicator and the colour reaction is specific for copper ions in ammonical medium. In the direct titration of copper in ammonical solution, the colour change at the end point solution, the colour change at the end point is from magenta or purple to dark green

Procedure-

Standardisation of EDTA-

Standard $CuSO_4$ (20 ml) solution is pipetted out into a clean conical flask and diluted to 50ml using distilled water. Five ml of concentrated ammonia solution and 5 drops of Fast Sulphon Black F- indicator solution are added. The solution is then titrated against EDTA solution taken in the burette until the colour changes from purple to dark green.

Short Procedure

Content	Titration I	Titration II
Burette Solution	EDTA	EDTA
Pipette Solution	Std. $CuSO_4$ 20ml + 30ml Water	20 ml of Unknown Solu +30 ml water
Indicator	5ml ammonia & 5ml fast Sulphon black-F	5ml ammonia & 5m fast Sulphon black-
End point	purple to dark green	purple to dark gree

Standardisation of EDTA Solution-

S.No	Vol^m of Std. $CuSO_4$ Solution taken (ml)	Burette reading Initial (ml)	Final (ml)	Volume of EDTA Consumed (ml)	Concordant Value (ml)	Indicator
1	20	0	21.6	21.6	21.6	BB-F
2	20	0	21.6			

Calculation-

Volume of Std. Copper solution taken = 20 ml

Strength of Copper Solution = 0.01 M

Volume of EDTA Consumed = V_1

Strength of EDTA $X = \frac{20 \times 0.01}{21.6} = 0.0092$

Estimation of Copper

EDTA Vs Given Copper Solution.

S.No	Vol^m of Copper Solution taken (ml)	Burette reading		Volume of EDTA Consumed (ml)	Concordant Value (ml)	Ind
		Initial	Final			
1	20	0	16.4	16.4	16.4	PSB-
2	20	0	16.4			

Volume of EDTA Consumed = V_2 = 16.4

strength of EDTA = X = 0.0092

Volume of Copper solution taken = 20 ml

strength of Copper Solution = $\frac{V_2 \times X}{20}$

Y = 0.007544

Amount of Copper present in the given solution = $\frac{Y \times 63.54}{10}$ g

= 0.04793 g

Estimation of Copper-

The given Copper Solution is made upto the mark in a 100 ml standard flask and shaken well. Twenty m of the Solution is pippetted out into a clean conical flask and diluted to 50 ml using distilled water. Five ml of Concentrated ammoni solution and 5 drop of Fast sulphon black F-indicator solution are added. The Solution is then titrated against EDTA solution taken in the burette until the colour changes from purple to dark green.

29/4/19

Result- Amount of Copper present in the given Solution = 0.04793 grams

Expt. No. 3
Date : 6.3.19

CONDUCTIVITY TITRATION OF STRONG ACID WITH STRONG BASE

Aim- To determine the strength of a strong acid (like HCl) conductometrically. You are provided with 0.1 N NaOH.

Procedure-

The conductivity cell is washed with water rinsed with conductivity water. Twenty ml of 0.1 N HCl is pipetted out into a clean 100 ml beaker. The conductivity cell is dipped into it. The burette is filled with NaOH solution and clamped above the beaker. One ml of NaOH solution is added from the burette and stirred well. The conductance of the solution is measured. Similarly conductance is measured from each 1 ml additions of NaOH from the burette..

Principle-

A solution of electrolytes conducts electricity due to the presence of ions. Since specific conductance of a solution is proportional to the concentration of ions in it, conductance of the solution is measured during titration when sodium hydroxide is added slowly to the hydrochloric acid, it gets neutralized as shown by the following equation.

Measurement of Conductance - Standard Sodium Hydroxide Vs Hydrochloric Acid.

S.No	Volume of NaOH (ml)	Conductance (mh
1.	0	2.46
2.	1	1.52
3.	2	0.74
4.	3	1.33
5.	4	1.86
6.	5	2.46
7.	6	2.93
8.	7	3.41
9.	8	3.95
10.	9	4.41
11.	10	4.83

Calculation

Normality of NaOH = N_1 = 0.1

Volume of Sodium Hydroxide from the graph = V_1 = 2

Volume of HCl = V_2 ml = 20

Normality of HCl (N_2) = $\frac{V_1 \times N_1}{N_2}$

N_2 = 0.01N

$HCl + NaOH \rightarrow NaCl + H_2O$

During the addition of the sodium hydroxide conductivity of the solution decreases slowly. This is because of the removal of fast moving H^+ ion by slow motion Na^+ ions. This decreasing trend continues till the end point is reached.

After the complete neutralization of all HCl, addition of excess of sodium hydroxide causes sudden increase in conductance. This is due to the presence of excess of hydroxide ions in solution.

Initially the measured value of conductance gradually decreases, after the equivalance point the value increases steadly. A graph is drawn by taking conductance in the Y-axis and the volume of NaOH in the X-axis. The point of intersection of the two straight lines gives the end point

Result :

Strength of hydrochloric acid: 0.01 N

Expt. No. 4

Date : 20.2.19

Estimation of chlorides in water By Argentometric Method.

Aim- To estimate the amount of chlorides present the given water sample. A standard solution of Sodium chloride is provided with an approximate N/20 solution of silver nitrate.

Principle- Natural water contains chloride ions in the for of NaCl, KCl, $CaCl_2$, and $MgCl_2$. The total chlorine ion can be estimated by Argentometric method. It is known as Mohr's method. Here Ag^+ ion in solution in reacts with chloride ions in the presence of potassium chromat as the indicator to form sparingly soluble silver salt.

$$AgNO_3 + NaCl \longrightarrow AgCl + NaNO_3$$

When all the chloride ions are removed, a colour change from yellow to reddish orange is noticed as end point of the titration.

$$2AgNO_3 + K_2Cr_2O_4 \longrightarrow Ag_2CrO_4 + 2KNO_3$$

Procedure-

I. Standardisation of silver nitrate.

The burette is washed and filled with silver nitrate. 20 ml of sodium chloride is pipetted

Short Procedure

S.No	Content	Titration 1	Titration 4
1	Burette Solution	Silver nitrate	Silver nitrate
2	pipette Solution	20ml of NaCl	20 ml of water Sol
3	Reagent added	———	———
4	Indicator	potassium Chromate	potassium chroma
5.	End point	Appearance reddish brown	Appearance reddis brown.

Equivalent Weight of chloride = 35.45

Titration I Standardization of Silver nitrate.
Sodium chloride Vs Silver nitrate.

S.No	Volume of NaCl (ml)	Burette Reading		Volm of Silver nitrate (ml)	Concordant Value (ml)	Indica
		Initial	Final			
1.	20	0	23.7	23.7	23.7	pot. Chrom-ate.
2.	20	0	23.7			

<u>Calculation</u> - Volume of Sodium chloride (V_1) = 20 ml
Normality of Sodium chloride (N_2) = 0.005 N
Volume of Silver nitrate (V_2) = 23.7 ml
Normality of Silver nitrate (N_2) = $\frac{V_1 N_1}{V_2}$
= 0.00421

Titration II. Estimation of chloride Water Sample V, Silver nitrate.

S.No	Volm of Water Sample (ml)	Burette reading		Volm of Silver nitrate (ml)	Concordent (ml)	Indic
		Initial	Final			
1	20	0	13.6	13.6	13.6	Potassium chromate
2	20	0	13.6			

Calculation -

Volumne of water sample (V_1) = 20 ml

Normality of water sample (N_1) = 0.0028

Volume of Silver nitrate (V_2) = 13.6 ml

Normality of Silver nitrate (N_2) = 0.004 N.

$$N_1 = \frac{V_2 N_2}{V_1}$$

$$= 0.0028$$

Amount of chloride ion present in 1 lts of the water sample = Eq wt × N_2

= X gm

= 0.0028×35.45

= 0.101

Amount of chloride ion present in 100ml of the water sample

$= \frac{X}{10}$ g

$= \frac{0.101}{10}$ gm = 0.0101 gm

out into a clonical flask. 1 ml of 2% potassium Chromate indicator is added. Then the solution is titrated against silver nitrate solution. At the end point, the solution changes its colour form yellow to reddish brown changes its colour from yellow to reddish brown. The titration is repeated for Concordant Values.

II. Estimation of chloride.

20 ml of Water is pipetted out in to clean Conical flask. 1 ml of 2% potassium chromate indicator is added. Then the Solution is titrated against silver nitrate solution. At the end point, the solution changes its colour from yellow to reddish brown. The titration is repeated for Concordant Values.

Result -
Amount of chlorides present in the given solution = 0.0101 mg/lit or ppm.

2/5/19

Estimation Of Allcalinity

Aim- To determine the alkalinity of a given water sample.

principle- The allcalinity in water is due to the presence of caustic alkalinity - NaOH, KOH Na_2CO_3, K_2CO_3, $NaHCO_3$ or $KHCO_3$. Biccarbonate allcalinity is due to $Ca(HCO_3)_2$ or $Mg(HCO_3)_2$. This can be estimated by titration against acid.
When a solution containing carbonate is titrated against a strong acid like HCl, the first equivalence point of is due to the reaction.

$$CO_3^{2-} + H^+ \longrightarrow HCO_3^-.$$

This can be indicate by phenolphtalein indicator and the titrate value is termed as phenolphatein allcalinity, P. The Seccond equivalence point Corresponding to the reaction.

$$HCO_3^- + H^+ \longrightarrow H_2O + CO_2.$$

is called methyl orange allcalinity, indicated by methyl orange.

The alkalinity due to OH alone is called hydroxide allcalinity.

$$H^+ + OH^- \longrightarrow H_2O$$

Short Procedure

Content	Titration-I	Titration-II
Burette Solution	0.1N H_2SO_4	0.1 M H_2SO_4
Pipette Solution	20ml of given water Sample I	20ml of given water Sample
Reagent added	—	—
Indicator	phenolphthalein	Methyl orange
Endpoint.	i) Disappearance of pink Colour	i) Colour changes from yellow to reddish orange.

Estimation of phenolphthalein Alkalinity :-

S.No	Volm of Std. hard water ml	Burette reading initial	Burette reading Final	Volm of H_2SO_4	Concordant Value (ml)	Indica
1.	20	0	19.7	19.7	19.7	phenolphtha
2.	20	0	19.7			

Volume of H_2SO_4 Consumed = 19.7 , V_1

Normality of H_2SO_4 = 0.1 , N_1

Volume of water sample = V_2 = 20

Normality of the water sample = $\frac{V_1 \times N_1}{N_2} = \frac{19.7 \times 0.1}{20}$

Phenolphatein alkalinity interms of carbonate P=

$$= \frac{19.7 \times 0.1}{20} \times 50 \times 1000 \text{ ppm}$$

$$P = 4925 \text{ ppm}$$

Estimation of Total Alkalinity:

S.No	Volume of Std. hard water (ml)	Burette Reading		Volume of H_2SO_4 (ml)	Concordant Value (ml)	Indic
		initial	final			
1.	20	0	32.4	32.4	32.4	methyle orange
2.	20	0	32.4			

Volume of H_2SO_4 Consumed, V_1 = 32.4
Normality of H_2SO_4, N_1 = 0.1

Volume of water Sample = 20
Total alkalinity in terms of Carbonate M $= \frac{V_1 \times N_1}{V_2} \times 50 \times 1000$ ppm

= 8100 ppm

$$\frac{1}{2} M = \frac{8100}{2} = 4050 \text{ ppm}$$

The total alkalinity due to all alkaline species is determined using methyl orange indicator, and is denoted as T. But OH^- and HCO_3^- cannot exist together as they simultaneously from CO_3^{2-}.

$$OH^- + HCO_3^- \longrightarrow CO_3^{2-} + H_2O$$

Hence all the three (OH^-, HCO_3^-, CO_3^{2-}) cannot exist together. Based on the titre value, different types of alkalinity are evaluated.

Procedure-

Determination of phenolphthalen Alkalinity-

20 ml of water sample is pipetted out into a clean conical flask. Two drop of phenolphthalen indicator are added and titrated against standard H_2SO_4 taken in the burette. The end point is the disapperance of pink colour. Titration is repeated for concordant values.

Determination of Total alkalinity,

20 ml water sample is pipetted out into a clean conical flask. Two or three drops of methyl orange indicator are added and

Interpretation of Various Alkalinity :

Titrate Value	Hydroxide allcalinity	Carbonate allcalinity	Bicarbonate allcalinity
$P=0$	0	~~2p~~ 0	M
$P<\frac{1}{2}M$	0	2p	$M-2p$
$P=\frac{1}{2}M$	0	2P	0
$P>\frac{1}{2}M$	$2P-M$	$2(M-P)$	0
$P=M$	M	0	0

1) when $P=M$, there is only OH^- allcalinity
2) when $P=0$, allcalinity is only due to HCO_3^-
3) when $P<\frac{1}{2}M$, present of HCO_3^- , CO_3^{2-} allcalinity
4) when $P=\frac{1}{2}M$, only CO_3^{2-} is present
5) when $P>\frac{1}{2}M$, CO_3^{2-} and OH^- are present

$P>\frac{1}{2}M$

$2P-M$ ⇒ Hydroxide Allcalinity

$2\times4925-8100=1750$ ppm

$2(M-P)$ ⇒ Carbonate Allcalinity

$2(8100-4925) =$ 6350 ppm

titrated against standard H_2SO_4 taken in the burette. The end point is the Colour change from pale yellow to pale pink colou Titration in repeated for concordant Val

Result :-

Bicarbonate allcalinity = 0 ppm
Hydroxide allcalinity = 1250 ppm
Carbonate allcalinty = 6350 ppm

3/5/19

BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH

Department of Chemistry

Academic Year (2018-2019) Even Sem

First Internal Test - CO ATTAINMENT

BPC2L1 - Chemistry lab (Obeservation)

S.No	Reg.No	Name	Attendance	Ex.1	Ex.2	Ex.3	Ex.4	Ex.5	Ex.6	Ex.7	Ex.8	Ex.9	Ex.10	TOTAL
1	U18AE001	VALLURI SAI PRASANNA	P	10	10	9	10	7	10	6	10	10	8	9
2	U18AE002	KAMMARY SHASHANK CHARY	P	10	7	5	9	10	8	9	9	8	5	8
3	U18AE003	GUNAVANTH B	P	10	7	5	9	10	8	9	9	8	5	8
4	U18AE004	PRASANTH P	P	10	7	5	9	10	8	9	9	8	5	8
5	U18AE005	KONDAVETI HEM CHANDRA	P	10	10	10	10	10	10	10	10	10	10	10
6	U18AE006	ASIF R	P	8	10	9	10	6	10	8	9	10	10	9
7	U18AE007	NALLAPASETTI BALRAJ	P	7	5	2	10	10	9	10	10	10	7	8
8	U18AE008	SARADARAMAN S	P	6	2	2	5	5	4	5	3	2	6	4
9	U18AE009	KARAMREDDY SUNAYANI	P	10	10	10	10	10	10	10	10	10	10	10
10	U18AE010	BESWIN VERSHID R V	P	2	6	7	6	3	6	6	3	7	4	5
11	U18AE011	MANAV J	P	10	10	3	10	6	6	9	10	6	10	8
12	U18AE012	KALLURU GIRI	P	4	8	2	5	6	2	5	8	5	5	5
13	U18AE013	SRIDHAR V	P	7	9	8	8	5	8	6	2	10	7	7
14	U18AE014	LOKESH KUMAR R	P	10	10	10	9	10	10	9	8	10	4	9
15	U18AE015	ARUNACHALA RAAM S	P	6	8	7	3	8	8	9	7	5	9	7
16	U18AE016	GOWRA BHASKAR NAGESH	P	10	10	10	10	10	10	10	10	10	10	10
17	U18AE017	SANJAY H	P	10	10	10	10	10	10	10	10	10	10	10
18	U18AE018	GALAPALLY VINAY KUMAR	P	10	10	10	10	10	10	10	10	10	10	10
19	U18AE019	SUBIKSHA V	P	10	10	10	10	10	10	10	10	10	10	10
20	U18AE020	JAMES BOAZ	P	9	8	9	8	9	9	8	9	2	9	8
21	U18AE021	SRI CHARAN CHINTHA	P	9	8	9	8	9	9	8	9	2	9	8
22	U18AE022	SATHI SAI SRINIVASAN VISWANADH REDDY	P	10	7	9	4	10	10	10	10	10	10	9
23	U18AE023	GAJULA VINAY SAI	P	4	9	6	6	10	5	8	10	7	5	7
24	U18AE024	TANKANTI DIWAKAR REDDY	P	8	9	10	8	7	4	10	4	10	10	8
25	U18AE025	BENSON THOMAS	P	7	3	5	3	5	9	7	2	7	2	5
26	U18AE026	NITHYASREE V	P	2	9	5	9	9	10	6	7	9	4	7
27	U18AE027	NALLAMALLI YOGA NAGA SAI BHAVYA	P	6	10	9	9	10	8	8	10	10	10	9
28	U18AE028	VISHNU D	P	6	10	9	9	10	8	8	10	10	10	9
29	U18AE029	KAKKALA KISHORE KUMAR	P	5	8	3	10	8	10	10	7	9	10	8
30	U18AE030	CHALLA GOUTHAM	P	10	9	10	8	10	9	9	10	9	6	9
31	U18AE031	BANDI NAGARAJA GOPAL	P	7	6	6	10	8	7	9	3	4	10	7
32	U18AE032	MIRIYALA PHANI RAJ	P	10	10	10	10	10	10	10	10	10	10	10
33	U18AE033	MONISHA A	P	10	10	10	10	10	10	10	10	10	10	10
34	U18AE034	ANIRUTHAN B	P	10	10	10	6	9	9	10	6	10	10	9
35	U18AE035	THIMANANI SURYA LAKSHMI PRASAD	P	7	6	4	9	4	7	2	2	10	9	6
36	U18AE036	PANDAVULA PAVAN KALYAN	P	10	9	10	10	10	8	7	6	10	10	9
37	U18AE037	GOSKULA SOWMYA	P	10	9	10	10	10	8	7	6	10	10	9
38	U18AE038	GADE REVANTI	P	8	7	4	4	3	3	2	3	3	3	4
39	U18AE039	KATKURI VISHNUVARDHAN REDDY	P	3	3	10	2	7	8	3	2	3	9	5
40	U18AE040	SHAIK AYAZ	P	10	9	4	9	7	10	4	10	10	7	8
41	U18AE041	SIKHAKOLLI S V DATTA PAVAN KUMAR	P	4	3	2	2	2	7	4	2	2	2	3
42	U18AE042	BOMMU BHASKARA PRASAD REDDY	P	8	10	4	9	6	10	8	10	5	10	8
43	U18AE043	MUNDRU LAKSHMI SOWJANYA	P	8	10	4	9	6	10	8	10	5	10	8
44	U18AE044	KANCHAMREDDY VISWASREE	P	8	10	4	9	6	10	8	10	5	10	8
45	U18AE045	KOLLA BABA SATISH	P	8	10	6	3	2	4	3	7	8	9	6
46	U18AE046	KOTIPALLI RUSHENDRA MURALI KRISHNA	P	10	10	10	10	10	10	10	10	10	10	10
47	U18AE047	MASANI MIDHUN KUMAR	P	9	9	9	10	6	10	9	10	8	10	9
48	U18AE048	MALLIDI DIVYA SAI RAJYA LAKSHMI	P	9	9	9	10	6	10	9	10	8	10	9
49	U18AE049	RANGU BHARATH KUMAR	P	10	5	5	10	7	8	8	9	8	6	8
50	U18AE050	KOTHACHERUVU SAI PRATHIMA	P	10	10	10	10	10	10	10	10	10	10	10
51	U18AE051	MATAM DHARSHAN	P	10	10	10	10	10	10	10	10	10	10	10
52	U18AE052	PRAVEEN KUMAR GNC	P	5	10	2	8	10	10	4	6	7	8	7
53	U18AE053	VIJAYARANGAN M	P	5	10	2	8	10	10	4	6	7	8	7
54	U18AE054	REVU HIMAKARTHIK	P	5	10	2	8	10	10	4	6	7	8	7
55	U18AE055	GOVIND JANAKI SAI	P	4	4	7	2	10	5	9	7	6	6	6
56	U18AE056	TEEGALA DURGA SAI KUMAR	P	3	2	3	3	2	2	10	8	4	3	4
57	U18AE057	KATTA KARTHIK	P	9	9	8	9	10	8	4	9	9	5	8
58	U18AE058	MUPPIDI SAI VENKATA REDDY	P	10	10	10	10	10	10	10	10	10	10	10
59	U18AE059	DANDU SAI SRAVAN VARMA	P	3	3	6	4	3	3	2	2	2	2	3
60	U18AE060	YERRAMSETTI GANDHI LAKSHMI SATYA SAI	P	3	8	2	8	3	3	3	3	2	9	4
61	U18AE061	THULLURI ASHOK KUMAR	P	6	10	8	10	5	7	10	10	8	8	8
62	U18AE062	ARPIT KUMAR KOURAV	P	7	4	4	5	2	7	2	5	2	2	4
63	U18AE063	SANA GOPI CHAND	P	8	9	4	2	10	7	10	9	10	6	8
65	U18AE065	MOHAMMED NEHA TABASSUM AZHARUDDIN	P	10	9	4	9	10	10	9	10	10	10	9
66	U18AE066	SUREDDY VENKATA SAI KARTHIK REDDY	P	10	7	4	8	10	6	4	7	2	4	6
67	U18AE067	MOHAMMAD TAJ ALI	P	10	9	6	4	2	10	8	9	10	7	8
68	U18AE068	GIDDALURI NAVEEN BABU	P	5	9	10	8	10	10	8	10	7	7	8
69	U18AE069	CHINNA LAKSHMAMMA GARI NARENDRA REDDY	P	5	5	9	10	10	5	8	10	7	7	8
70	U18AE070	VASANTHALA HASWITH	P	5	10	9	5	3	2	3	6	7	7	6
71	U18AE071	JAMES L	P	4	10	9	7	3	8	10	6	6	7	7
72	U18AE072	GURRAM SAI PRADEEP	P	3	10	10	7	5	10	9	6	4	7	7
73	U18AE073	DEVPROTIM MUKHER JEE	P	9	10	10	7	2	3	9	7	9	7	7
74	U18AE074	MULA MADHU	P	10	10	2	3	10	3	8	8	10	7	7
75	U18AE075	GOWDA RISHI	P	3	4	2	10	6	7	10	9	2	7	6

BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH

Department of Chemistry

Academic Year (2018-2019) Even Sem

BPC2L1 - Chemistry lab (Record)

S.No	Reg.No	Name	Attendance	Ex.1	Ex.2	Ex.3	Ex.4	Ex.5	Ex.6	Ex.7	Ex.8	Ex.9	Ex.10	TOTAL
1	U18AE001	VALLURI SAI PRASANNA	P	10	10	10	10	10	10	10	10	10	10	10
2	U18AE002	KAMMARY SHASHANK CHARY	P	10	10	10	10	10	10	10	10	10	10	10
3	U18AE003	GUNAVANTH B	P	10	10	10	10	10	10	10	10	10	10	10
4	U18AE004	PRASANTH P	P	10	10	10	10	10	10	10	10	10	10	10
5	U18AE005	KONDAVETI HEM CHANDRA	P	10	10	10	10	10	10	10	10	10	10	10
6	U18AE006	ASIF R	P	10	10	10	10	10	10	10	10	10	10	10
7	U18AE007	NALLAPASETTI BALRAJ	P	10	10	10	10	10	10	10	10	10	10	10
8	U18AE008	SARADARAMAN S	P	10	7	4	4	5	4	4	3	4	5	5
9	U18AE009	KARAMREDDY SUNAYANI	P	10	10	10	10	10	10	10	10	10	10	10
10	U18AE010	BESWIN VERSHID R V	P	8	5	6	6	10	10	7	8	10	10	8
11	U18AE011	MANAV J	P	8	10	10	10	8	9	9	8	9	9	9
12	U18AE012	KALLURU GIRI	P	5	4	7	4	7	3	7	5	5	3	5
13	U18AE013	SRIDHAR V	P	10	10	10	10	10	10	10	10	10	10	10
14	U18AE014	LOKESH KUMAR R	P	10	8	10	9	9	9	9	9	7	10	9
15	U18AE015	ARUNACHALA RAAM S	P	10	8	10	9	9	9	9	9	7	10	9
16	U18AE016	GOWRA BHASKAR NAGESH	P	10	10	10	10	10	10	10	10	10	10	10
17	U18AE017	SANJAY H	P	10	10	10	10	10	10	10	10	10	10	10
18	U18AE018	GALAPALLY VINAY KUMAR	P	10	6	10	4	8	10	10	5	8	9	8
19	U18AE019	SUBIKSHA V	P	10	6	10	4	8	10	10	5	8	9	8
20	U18AE020	JAMES BOAZ	P	10	10	10	10	10	10	10	10	10	10	10
21	U18AE021	SRI CHARAN CHINTHA	P	10	6	10	4	8	10	10	5	8	9	6
22	U18AE022	SATHI SAI SRINIVASAN VISWANADH REDDY	P	10	10	10	10	10	10	10	10	10	10	10
23	U18AE023	GAJULA VINAY SAI	P	9	6	6	6	10	6	6	7	7	7	7
24	U18AE024	TANKANTI DIWAKAR REDDY	P	9	10	4	10	10	10	10	9	10	8	9
25	U18AE025	BENSON THOMAS	P	3	5	8	5	3	5	3	4	4	10	5
26	U18AE026	NITHYASREE V	P	9	9	7	10	10	9	8	9	9	10	9
27	U18AE027	NALLAMALLI YOGA NAGA SAI BHAVYA	P	9	9	7	10	10	9	8	9	9	10	9
28	U18AE028	VISHNU D	P	6	8	8	5	10	9	4	7	5	7	7
29	U18AE029	KAKKALA KISHORE KUMAR	P	6	8	8	6	10	9	4	7	5	7	7
30	U18AE030	CHALLA GOUTHAM	P	10	9	10	10	10	7	8	8	8	10	9
31	U18AE031	BANDI NAGARAJA GOPAL	P	7	4	10	10	7	9	4	5	7	7	7
32	U18AE032	MIRIYALA PHANI RAJ	P	10	10	10	10	10	10	10	10	10	10	10
33	U18AE033	MONISHA A	P	7	4	3	7	7	5	5	9	7	6	6
34	U18AE034	ANIRUTHAN B	P	10	10	10	10	10	10	10	10	10	10	10
35	U18AE035	THIMANANI SURYA LAKSHMI PRASAD	P	10	10	10	10	10	10	10	10	10	10	10
36	U18AE036	PANDAVULA PAVAN KALYAN	P	10	6	9	10	4	8	8	7	8	10	8
37	U18AE037	GOSKULA SOWMYA	P	10	7	10	10	10	6	9	9	10	9	9
38	U18AE038	GADE REVANTI	P	7	5	9	9	6	6	6	7	10	5	7
39	U18AE039	KATKURI VISHNUVARDHAN REDDY	P	3	9	9	4	4	3	5	7	7	9	6
40	U18AE040	SHAIK AYAZ	P	8	10	10	5	3	9	9	9	10	7	8
41	U18AE041	SIKHAKOLLI S V DATTA PAVAN KUMAR	P	10	10	10	10	10	10	10	10	10	10	10
42	U18AE042	BOMMU BHASKARA PRASAD REDDY	P	4	3	10	8	5	4	8	5	10	3	6
43	U18AE043	MUNDRU LAKSHMI SOWJANYA	P	8	9	10	6	10	8	10	10	9	10	9
44	U18AE044	KANCHAMREDDY VISWASREE	P	8	9	10	6	10	8	10	10	9	10	9
45	U18AE045	KOLLA BABA SATISH	P	10	10	10	10	10	10	10	10	10	10	10
46	U18AE046	KOTIPALLI RUSHENDRA MURALI KRISHNA	P	8	9	10	6	10	8	10	10	9	10	9
47	U18AE047	MASANI MIDHUN KUMAR	P	6	4	7	3	9	6	3	3	6	3	5
48	U18AE048	MALLIDI DIVYA SAI RAJYA LAKSHMI	P	10	10	10	10	10	10	10	10	10	10	10
49	U18AE049	RANGU BHARATH KUMAR	P	10	10	10	10	10	10	10	10	10	10	10
50	U18AE050	KOTHACHERUVU SAI PRATHIMA	P	10	10	10	10	10	10	10	10	10	10	10
51	U18AE051	MATAM DHARSHAN	P	10	10	10	10	10	10	10	10	10	10	10
52	U18AE052	PRAVEEN KUMAR GNC	P	10	10	10	10	10	10	10	10	10	10	10
53	U18AE053	VIJAYARANGAN M	P	6	10	9	8	6	7	3	8	8	5	7
54	U18AE054	REVU HIMAKARTHIK	P	7	8	3	3	5	6	8	4	6	10	6
55	U18AE055	GOVIND JANAKI SAI	P	10	10	10	10	10	10	10	10	10	10	10
56	U18AE056	TEEGALA DURGA SAI KUMAR	P	9	5	6	7	7	8	7	5	10	6	7
57	U18AE057	KATTA KARTHIK	P	10	10	10	10	10	10	10	10	10	10	10
58	U18AE058	MUPPIDI SAI VENKATA REDDY	P	4	9	9	4	5	8	4	8	6	3	6
59	U18AE059	DANDU SAI SRAVAN VARMA	P	10	10	10	10	10	10	10	10	10	10	10
60	U18AE060	YERRAMSETTI GANDHI LAKSHMI SATYA SAI	P	4	3	10	4	5	3	3	5	5	8	5
61	U18AE061	THULLURI ASHOK KUMAR	P	10	7	10	10	8	6	9	10	10	10	9
62	U18AE062	ARPIT KUMAR KOURAV	P	10	3	5	6	5	9	8	4	6	4	6
63	U18AE063	SANA GOPI CHAND	P	10	10	9	10	7	8	5	6	5	10	8
64	U18AE064	KALNETE VENKAT SAI	P	10	10	9	10	7	8	5	6	5	10	8
65	U18AE065	MOHAMMED NEHA TABASSUM AZHARUDDIN	P	10	10	10	10	10	10	10	10	10	10	10
67	U18AE067	MOHAMMAD TAJ ALI	P	10	9	10	7	10	9	9	9	7	10	9
68	U18AE068	GIDDALURI NAVEEN BABU	P	8	9	10	6	10	8	10	10	9	10	9
69	U18AE069	CHINNA LAKSHMAMMA GARI NARENDRA REDI	P	10	10	10	10	10	10	10	10	10	10	10
70	U18AE070	VASANTHALA HASWITH	P	8	9	10	6	10	8	10	10	9	10	9
71	U18AE071	JAMES L	P	6	4	7	3	9	6	3	3	6	3	5
72	U18AE072	GURRAM SAI PRADEEP	P	10	10	10	10	10	10	10	10	10	10	10
73	U18AE073	DEVPROTIM MUKHER JEE	P	10	7	10	10	10	6	9	9	10	9	9
74	U18AE074	MULA MADHU	P	7	5	9	9	6	6	6	7	10	5	7
75	U18AE075	GOWDA RISHI	P	3	9	9	4	4	3	5	7	7	9	6

BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH

Department of Chemistry

Academic Year (2018-2019) Even Sem

BPC2L1 - Chemistry lab (model exam)

S.No	Reg.No	Name	Atten dance	CO1	CO2	CO3	TOTAL	Scored			%age			CO Attained		
				Q.1	Q.2	Q.3		CO1	CO2	CO3	CO1	CO2	CO3	CO1	CO2	CO
								30	30	40						
1	U18AE001	VALLURI SAI PRASANNA	P	23	5	7	35	23	5	7	77	17	18	Y	N	N
2	U18AE002	KAMMARY SHASHANK CHARY	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
3	U18AE003	GUNAVANTH B	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
4	U18AE004	PRASANTH P	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
5	U18AE005	KONDAVETI HEM CHANDRA	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
6	U18AE006	ASIF R	P	28	24	33	85	28	24	33	93	80	83	Y	Y	Y
7	U18AE007	NALLAPASETTI BALRAJ	P	24	27	24	75	24	27	24	80	90	60	Y	Y	N
8	U18AE008	SARADARAMAN S	P	30	28	37	95	30	28	37	100	93	93	Y	Y	Y
9	U18AE009	KARAMREDDY SUNAYANI	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
10	U18AE010	BESWIN VERSHID R V	P	28	18	39	85	28	18	39	93	60	98	Y	N	Y
11	U18AE011	MANAV J	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
12	U18AE012	KALLURU GIRI	P	28	28	24	80	28	28	24	93	93	60	Y	Y	N
13	U18AE013	SRIDHAR V	P	28	18	19	65	28	18	19	93	60	48	Y	N	N
14	U18AE014	LOKESH KUMAR R	P	5	4	21	30	5	4	21	17	13	53	N	N	N
15	U18AE015	ARUNACHALA RAAM S	P	30	15	10	55	30	15	10	100	50	25	Y	N	N
16	U18AE016	GOWRA BHASKAR NAGESH	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
17	U18AE017	SANJAY H	P	30	30	30	90	30	30	30	100	100	75	Y	Y	Y
18	U18AE018	GALAPALLY VINAY KUMAR	P	27	29	29	85	27	29	29	90	97	73	Y	Y	N
19	U18AE019	SUBIKSHA V	P	28	28	39	95	28	28	39	93	93	98	Y	Y	Y
20	U18AE020	JAMES BOAZ	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
21	U18AE021	SRI CHARAN CHINTHA	P	28	28	39	95	28	28	39	93	93	98	Y	Y	Y
22	U18AE022	SATHI SAI SRINIVASAN VISWANADH REDDY	P	22	28	40	90	22	28	40	73	93	100	Y	Y	Y
23	U18AE023	GAJULA VINAY SAI	P	21	19	30	70	21	19	30	70	63	75	Y	N	Y
24	U18AE024	TANKANTI DIWAKAR REDDY	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
25	U18AE025	BENSON THOMAS	P	27	19	39	85	27	19	39	90	63	98	Y	N	Y
26	U18AE026	NITHYASREE V	P	17	21	12	50	17	21	12	57	70	30	N	Y	N
27	U18AE027	NALLAMALLI YOGA NAGA SAI BHAVYA	P	27	29	39	95	27	29	39	90	97	98	Y	Y	Y
28	U18AE028	VISHNU D	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
29	U18AE029	KAKKALA KISHORE KUMAR	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
30	U18AE030	CHALLA GOUTHAM	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
31	U18AE031	BANDI NAGARAJA GOPAL	P	16	22	37	75	16	22	37	53	73	93	N	Y	Y
32	U18AE032	MIRIYALA PHANI RAJ	P	18	12	40	70	18	12	40	60	40	100	N	N	Y
33	U18AE033	MONISHA A	P	22	16	7	45	22	16	7	73	53	18	Y	N	N
34	U18AE034	ANIRUTHAN B	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
35	U18AE035	THIMANANI SURYA LAKSHMI PRASAD	P	24	14	32	70	24	14	32	80	47	80	Y	N	Y
36	U18AE036	PANDAVULA PAVAN KALYAN	P	30	27	38	95	30	27	38	100	90	95	Y	Y	Y
37	U18AE037	GOSKULA SOWMYA	P	10	11	34	55	10	11	34	33	37	85	N	N	Y
38	U18AE038	GADE REVANTI	P	26	29	40	95	26	29	40	87	97	100	Y	Y	Y
39	U18AE039	KATKURI VISHNUVARDHAN REDDY	P	7	30	33	70	7	30	33	23	100	83	N	Y	Y
40	U18AE040	SHAIK AYAZ	P	7	30	33	70	7	30	33	23	100	83	N	Y	Y
41	U18AE041	SIKHAKOLLI S V DATTA PAVAN KUMAR	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
42	U18AE042	BOMMU BHASKARA PRASAD REDDY	P	9	20	31	60	9	20	31	30	67	78	N	N	Y
43	U18AE043	MUNDRU LAKSHMI SOWJANYA	P	15	13	27	55	15	13	27	50	43	68	N	N	N
44	U18AE044	KANCHAMREDDY VISWASREE	P	15	13	27	55	15	13	27	50	43	68	N	N	N
45	U18AE045	KOLLA BABA SATISH	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
46	U18AE046	KOTIPALLI RUSHENDRA MURALI KRISHNA	P	28	28	39	95	28	28	39	93	93	98	Y	Y	Y
47	U18AE047	MASANI MIDHUN KUMAR	P	11	14	30	55	11	14	30	37	47	75	N	N	Y
48	U18AE048	MALLIDI DIVYA SAI RAJYA LAKSHMI	P	15	23	22	60	15	23	22	50	77	55	N	Y	N
49	U18AE049	RANGU BHARATH KUMAR	P	18	21	31	70	18	21	31	60	70	78	N	Y	Y
50	U18AE050	KOTHACHERUVU SAI PRATHIMA	P	27	30	33	90	27	30	33	90	100	83	Y	Y	Y
51	U18AE051	MATAM DHARSHAN	P	27	30	33	90	27	30	33	90	100	83	Y	Y	Y
52	U18AE052	PRAVEEN KUMAR GNC	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
53	U18AE053	VIJAYARANGAN M	P	29	24	2	55	29	24	2	97	80	5	Y	Y	N
54	U18AE054	REVU HIMAKARTHIK	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
55	U18AE055	GOVIND JANAKI SAI	P	1	25	39	65	1	25	39	3	83	98	N	Y	Y
56	U18AE056	TEEGALA DURGA SAI KUMAR	P	29	18	33	80	29	18	33	97	60	83	Y	N	Y
57	U18AE057	KATTA KARTHIK	P	24	22	39	85	24	22	39	80	73	98	Y	Y	Y
58	U18AE058	MUPPIDI SAI VENKATA REDDY	P	14	7	24	45	14	7	24	47	23	60	N	N	N
59	U18AE059	DANDU SAI SRAVAN VARMA	P	29	28	38	95	29	28	38	97	93	95	Y	Y	Y
60	U18AE060	YERRAMSETTI GANDHI LAKSHMI SATYA SAI	P	29	19	32	80	29	19	32	97	63	80	Y	N	Y
61	U18AE061	THULLURI ASHOK KUMAR	P	25	30	0	55	25	30	0	83	100	0	Y	Y	N
62	U18AE062	ARPIT KUMAR KOURAV	P	30	18	32	80	30	18	32	100	60	80	Y	N	Y
63	U18AE063	SANA GOPI CHAND	P	16	13	36	65	16	13	36	53	43	90	N	N	Y
64	U18AE064	KALNETI VENKAT SAI	P	16	13	36	65	16	13	36	53	43	90	N	N	Y
65	U18AE065	MOHAMMED NEHA TABASSUM AZHARUDDIN	P	18	12	40	70	18	12	40	60	40	100	N	N	Y
66	U18AE066	SUREDDY VENKATA SAI KARTHIK REDDY	P	22	16	7	45	22	16	7	73	53	18	Y	N	N
67	U18AE067	MOHAMMAD TAJ ALI	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
68	U18AE068	GIDDALURI NAVEEN BABU	P	24	14	32	70	24	14	32	80	47	80	Y	N	Y
69	U18AE069	CHENNA LAKSHMAMMA GARI NARENDRA REDDY	P	30	27	38	95	30	27	38	100	90	95	Y	Y	Y
70	U18AE070	VASANTHALA HASWITH	P	10	11	34	55	10	11	34	33	37	85	N	N	Y
71	U18AE071	JAMES L	P	26	29	40	95	26	29	40	87	97	100	Y	Y	Y
72	U18AE072	GURRAM SAI PRADEEP	P	7	30	33	70	7	30	33	23	100	83	N	Y	Y
73	U18AE073	DEVPROTIM MUKHER JEE	P	7	30	33	70	7	30	33	23	100	83	N	Y	Y
74	U18AE074	MULA MADHU	P	30	30	40	100	30	30	40	100	100	100	Y	Y	Y
75	U18AE075	GOWDA RISHI	P	9	20	31	60	9	20	31	30	67	78	N	N	Y

CO -ATTAINMENT				
	MARKS	THRES	ATTAIN	STUDENTS
CO1	30	70	65.68%	44
CO2	30	70	62.69%	42
CO3	40	70	67.17%	45

BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH

Department of Chemistry

Academic Year (2018-2019) Even Sem

Model Examination - CO ATTAINMENT

BPC2L1 - Chemistry lab (Semester)

								Scored			%age			CO Attained	
S.No	Reg.No	Name	Attendance	CO1	CO2	CO3	TOTAL	CO1	CO2	CO3	CO1	CO2	CO3	CO1	CO2
				Q.1	Q.2	Q.3		30	30	40	73	68	73		
1	U18AE001	YALLURI SAI PRASANNA	P	2	25	38	65	2	25	38	7	83	95	N	Y
2	U18AE002	KAMMARY SHASHANK CHARY	P	28	29	40	97	28	29	40	93	97	100	Y	Y
3	U18AE003	GUNAVANTH B	P	27	28	40	95	27	28	40	90	93	100	Y	Y
4	U18AE004	PRASANTH P	P	29	27	38	94	29	27	38	97	90	95	Y	Y
5	U18AE005	KONDAVETI HEM CHANDRA	P	30	30	40	100	30	30	40	100	100	100	Y	Y
6	U18AE006	ASIF R	P	22	30	38	90	22	30	38	73	100	95	Y	Y
7	U18AE007	NALLAPASETTI BALRAJ	P	30	21	31	82	30	21	31	100	70	78	Y	Y
8	U18AE008	SARADARAMAN S	P	18	19	35	72	18	19	35	60	63	88	N	N
9	U18AE009	KARAMREDDY SUNAYANI	P	30	30	40	100	30	30	40	100	100	100	Y	Y
10	U18AE010	RESWIN VERSHID R V	P	28	20	29	77	28	20	29	93	67	73	Y	N
11	U18AE011	MANAV J	P	30	30	34	94	30	30	34	100	100	85	Y	Y
12	U18AE012	KALLURU GIRI	P	13	14	36	63	13	14	36	43	47	90	N	N
13	U18AE013	SRIDHAR V	P	27	19	31	77	27	19	31	90	63	78	Y	N
14	U18AE014	LOKESH KUMAR R	P	6	19	37	62	6	19	37	20	63	93	N	N
15	U18AE015	ARUNACHALA RAAM S	P	7	29	33	69	7	29	33	23	97	83	N	Y
16	U18AE016	GOWRA BHASKAR NAGESH	P	29	30	40	99	29	30	40	97	100	100	Y	Y
17	U18AE017	SANJAY H	P	28	30	39	97	28	30	39	93	100	98	Y	Y
18	U18AE018	GALAPALLY VINAY KUMAR	P	28	29	32	89	28	29	32	93	97	80	Y	Y
19	U18AE019	SUBIKSHA V	P	25	28	39	92	25	28	39	83	93	98	Y	Y
20	U18AE020	JAMES BOAZ	P	29	30	35	94	29	30	35	97	100	88	Y	Y
21	U18AE021	SRI CHARAN CHINTHA	P	21	29	37	87	21	29	37	70	97	93	Y	Y
22	U18AE022	SATHI SAI SRINIVASAN VISWANADH REDDY	P	29	27	38	94	29	27	38	97	90	95	Y	Y
23	U18AE023	GAJULA VINAY SAI	P	23	12	35	70	23	12	35	77	40	88	Y	N
24	U18AE024	TANKANTI DIWAKAR REDDY	P	30	28	34	92	30	28	34	100	93	85	Y	Y
25	U18AE025	BENSON THOMAS	P	23	20	26	69	23	20	26	77	67	65	Y	N
26	U18AE026	NITHYASREE V	P	27	18	20	65	27	18	20	90	60	50	Y	N
27	U18AE027	NALLAMALLI YOGA NAGA SAI BHAVYA	P	28	28	38	94	28	28	38	93	93	95	Y	Y
28	U18AE028	VISHNU D	P	23	27	39	89	23	27	39	77	90	98	Y	Y
29	U18AE029	KAKKALA KISHORE KUMAR	P	28	19	40	87	28	19	40	93	63	100	Y	N
30	U18AE030	CHALLA GOUTHAM	P	29	29	37	95	29	29	37	97	97	93	Y	Y
31	U18AE031	BANDI NAGARAJA GOPAL	P	17	29	26	72	17	29	26	57	97	65	N	Y
32	U18AE032	MIRIYALA PHANI RAJ	P	26	30	31	87	26	30	31	87	100	78	Y	Y
33	U18AE033	MONISHA A	P	21	17	26	64	21	17	26	70	57	65	Y	N
34	U18AE034	ANIRUTHAN B	P	27	30	40	97	27	30	40	90	100	100	Y	Y
35	U18AE035	THIMANANI SURYA LAKSHMI PRASAD	P	17	27	31	75	17	27	31	57	90	78	N	Y
36	U18AE036	PANDAVULA PAVAN KALYAN	P	27	30	33	90	27	30	33	90	100	83	Y	Y
37	U18AE037	GOSKULA SOWMYA	P	18	15	39	72	18	15	39	60	50	98	N	N
38	U18AE038	GADE REVANTI	P	30	18	29	77	30	18	29	100	60	73	Y	N
39	U18AE039	KATKURI VISHNUVARDHAN REDDY	P	18	25	19	62	18	25	19	60	83	48	N	Y
40	U18AE040	SHAIK AYAZ	P	21	27	29	77	21	27	29	70	90	73	Y	Y
41	U18AE041	SIKHAKOLLI S V DATTA PAVAN KUMAR	P	28	24	32	84	28	24	32	93	80	80	Y	Y
42	U18AE042	BOMMU BHASKARA PRASAD REDDY	P	11	17	39	67	11	17	39	37	57	98	N	N
43	U18AE043	MUNDRU LAKSHMI SOWJANYA	P	11	19	40	70	11	19	40	37	63	100	N	N
44	U18AE044	KANCHAMREDDY VISWASREE	P	16	21	32	69	16	21	32	53	70	80	N	Y
45	U18AE045	KOLLA BABA SATISH	P	25	27	38	90	25	27	38	83	90	95	Y	Y
46	U18AE046	KOTIPALLI RUSHENDRA MURALI KRISHNA	P	28	29	40	97	28	29	40	93	97	100	Y	Y
47	U18AE047	MASANI MIDHUN KUMAR	P	18	19	25	62	18	19	25	60	63	63	N	N
48	U18AE048	MALLIDI DIVYA SAI RAJYA LAKSHMI	P	27	14	36	77	27	14	36	90	47	90	Y	N
49	U18AE049	RANGU BHARATH KUMAR	P	22	28	29	79	22	28	29	73	93	73	Y	Y
50	U18AE050	KOTHACHERUVU SAI PRATHIMA	P	28	29	40	97	28	29	40	93	97	100	Y	Y
51	U18AE051	MATAM DHARSHAN	P	29	30	36	95	29	30	36	97	100	90	Y	Y
52	U18AE052	PRAVEEN KUMAR GNC	P	29	25	40	94	29	25	40	97	83	100	Y	Y
53	U18AE053	VIJAYARANGAN M	P	13	26	23	62	13	26	23	43	87	58	N	Y
54	U18AE054	REVU HIMAKARTHIK	P	28	29	27	84	28	29	27	93	97	68	Y	Y
55	U18AE055	GOVIND JANAKI SAI	P	13	27	32	72	13	27	32	43	90	80	N	Y
56	U18AE056	TERGALA DURGA SAI KUMAR	P	9	26	32	67	9	26	32	30	87	80	N	Y
57	U18AE057	KATTA KARTHIK	P	20	27	40	87	20	27	40	67	90	100	N	Y
58	U18AE058	MUPPIDI SAI VENKATA REDDY	P	18	28	16	62	18	28	16	60	93	40	N	Y
59	U18AE059	DANDU SAI SRAVAN VARMA	P	28	24	30	82	28	24	30	93	80	75	Y	Y
60	U18AE060	YERRAMSETTI GANDHI LAKSHMI SATYA SAI	P	27	29	6	62	27	29	6	90	97	15	Y	Y
61	U18AE061	THULLURI ASHOK KUMAR	P	29	27	14	70	29	27	14	97	90	35	Y	Y
62	U18AE062	ARPIT KUMAR KOURAV	P	26	29	10	65	26	29	10	87	97	25	Y	Y
63	U18AE063	SANA GOPI CHAND	P	6	30	36	72	6	30	36	20	100	90	N	Y
64	U18AE064	KALNETE VENKAT SAI	P	11	19	40	70	11	19	40	37	63	100	N	N
65	U18AE065	MOHAMMED NEHA TABASSUM AZHARUDDIN	P	16	21	32	69	16	21	32	53	70	80	N	Y
66	U18AE066	SUREDDY VENKATA SAI KARTHIK REDDY	P	25	27	38	90	25	27	38	83	90	95	Y	Y
67	U18AE067	MOHAMMAD TAJ ALI	P	28	29	40	97	28	29	40	93	97	100	Y	Y
68	U18AE068	GEDDALURI NAVEEN BABU	P	18	19	25	62	18	19	25	60	63	63	N	N
69	U18AE069	CHENNA LAKSHMAMMA GARI NARENDRA REDDY	P	27	14	36	77	27	14	36	90	47	90	Y	N
70	U18AE070	VASANTHALA HASWITH	P	22	28	29	79	22	28	29	73	93	73	Y	Y
71	U18AE071	JAMES L	P	28	29	40	97	28	29	40	93	97	100	Y	Y
72	U18AE072	GURRAM SAI PRADEEP	P	29	30	36	95	29	30	36	97	100	90	Y	Y
73	U18AE073	DEVPROTIM MUKHERJEE	P	29	25	40	94	29	25	40	97	83	100	Y	Y
74	U18AE074	MULA MADRI	P	13	26	23	62	13	26	23	43	87	58	N	Y
75	U18AE075	GOWDA RISHI	P	28	29	27	84	28	29	27	93	97	68	Y	Y

CO-ATTAINMENT				
	MARKS	THRES	ATTAIN	STUDENTS
CO1	30	70	71.85%	48
CO2	30	70	76.12%	51
CO3	40	74	77.62%	52

BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH

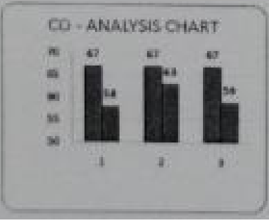
Department of Chemistry

Academic Year (2018-2019) Even Sem

First Internal Test - CO ATTAINMENT

Indirect - CO Attainment

S.No	Reg.No	Name	CO1	CO2	CO3	CO1	CO2	CO3
1	U18AE001	VALLURI SAI PRASANNA	2	3	5	N	Y	Y
2	U18AE002	KAMMARY SHASHANK CHARY	5	5	4	Y	Y	Y
3	U18AE003	GUNAVANTH B	3	3	5	Y	Y	Y
4	U18AE004	PRASANTH P	3	5	5	Y	Y	Y
5	U18AE005	KONDAVETI HEM CHANDRA	3	3	4	Y	Y	Y
6	U18AE006	ASIF R	5	3	3	Y	Y	Y
7	U18AE007	NALLAPASETTI BALRAJ	5	4	4	Y	Y	Y
8	U18AE008	SARADARAMAN S	4	4	1	Y	Y	N
9	U18AE009	KARAMREDDY SUNAYANI	4	5	5	Y	Y	Y
10	U18AE010	BESWIN VERSHID R V	3	4	3	Y	Y	Y
11	U18AE011	MANAV J	4	3	3	Y	Y	Y
12	U18AE012	KALLURU GIRI	4	4	4	Y	Y	Y
13	U18AE013	SRIDHAR V	3	4	5	Y	Y	Y
14	U18AE014	LOKESH KUMAR R	4	1	3	Y	N	Y
15	U18AE015	ARUNACHALA RAAM S	4	3	5	Y	Y	Y
16	U18AE016	GOWRA BHASKAR NAGESH	4	5	5	Y	Y	Y
17	U18AE017	SANJAY H	4	5	5	Y	Y	Y
18	U18AE018	GALAPALLY VINAY KUMAR	4	5	2	Y	Y	N
19	U18AE019	SUBIKSHA V	5	4	2	Y	Y	N
20	U18AE020	JAMES BOAZ	5	4	3	Y	Y	Y
21	U18AE021	SRI CHARAN CHINTHA	4	5	3	Y	Y	Y
22	U18AE022	SATHI SAI SRINIVASAN VISWANADH RE	4	4	2	Y	Y	N
23	U18AE023	GAJULA VINAY SAI	3	4	4	Y	Y	Y
24	U18AE024	TANKANTI DIWAKAR REDDY	3	3	2	Y	Y	N
25	U18AE025	BENSON THOMAS	1	4	4	N	Y	Y
26	U18AE026	NITHYASREE V	3	5	3	Y	Y	Y
27	U18AE027	NALLAMALLI YOGA NAGA SAI BHAVYA	4	5	3	Y	Y	Y
28	U18AE028	VISHNU D	5	5	3	Y	Y	Y
29	U18AE029	KAKKALA KISHORE KUMAR	4	5	3	Y	Y	Y
30	U18AE030	CHALLA GOUTHAM	5	5	5	Y	Y	Y
31	U18AE031	BANDI NAGARAJA GOPAL	5	5	5	Y	Y	Y
32	U18AE032	MIRIYALA PHANI RAJ	4	4	5	Y	Y	Y
33	U18AE033	MONISHA A	2	2	5	N	N	Y
34	U18AE034	ANIRUTHAN B	3	5	2	Y	Y	N
35	U18AE035	THIMANANI SURYA LAKSHMI PRASAD	3	4	2	Y	Y	N
36	U18AE036	PANDAVULA PAVAN KALYAN	5	5	3	Y	Y	Y
37	U18AE037	GOSKULA SOWMYA	5	5	4	Y	Y	Y
38	U18AE038	GADE REVANTI	2	5	4	N	Y	Y
39	U18AE039	KATKURI VISHNUVARDHAN REDDY	2	4	5	N	Y	Y
40	U18AE040	SHAIK AYAZ	3	3	5	Y	Y	Y
41	U18AE041	SIKHAKOLLI S V DATTA PAVAN KUMAR	4	3	3	Y	Y	Y
42	U18AE042	BOMMU BHASKARA PRASAD REDDY	2	2	4	N	N	Y
43	U18AE043	MUNDRU LAKSHMI SOWJANYA	2	5	4	N	Y	Y
44	U18AE044	KANCHAMREDDY VISWASREE	5	4	3	Y	Y	Y
45	U18AE045	KOLLA BABA SATISH	5	5	3	Y	Y	Y
46	U18AE046	KOTIPALLI RUSHENDRA MURALI KRISH	4	5	3	Y	Y	Y
47	U18AE047	MASANI MIDHUN KUMAR	5	5	5	Y	Y	Y
48	U18AE048	MALLIDI DIVYA SAI RAJYA LAKSHMI	5	5	5	Y	Y	Y
49	U18AE049	RANGU BHARATH KUMAR	4	4	5	Y	Y	Y
50	U18AE050	KOTHACHERUVU SAI PRATHIMA	2	2	5	N	N	Y
51	U18AE051	MATAM DHARSHAN	3	5	2	Y	Y	N
52	U18AE052	PRAVEEN KUMAR GNC	3	4	2	Y	Y	N
53	U18AE053	VIJAYARANGAN M	5	5	3	Y	Y	Y
54	U18AE054	REVU HIMAKARTHIK	5	5	4	Y	Y	Y
55	U18AE055	GOVIND JANAKI SAI	2	5	4	N	Y	Y
56	U18AE056	TEEGALA DURGA SAI KUMAR	2	4	5	N	Y	Y
57	U18AE057	KATTA KARTHIK	3	3	5	Y	Y	Y
58	U18AE058	MUPPIDI SAI VENKATA REDDY	4	3	3	Y	Y	Y
59	U18AE059	DANDU SAI SRAVAN VARMA	2	2	4	N	N	Y
60	U18AE060	YERRAMSETTI GANDHI LAKSHMI SATYA	2	5	4	N	Y	Y
61	U18AE061	THULLURI ASHOK KUMAR	5	4	3	Y	Y	Y
62	U18AE062	ARPIT KUMAR KOURAV	3	3	4	Y	Y	Y
63	U18AE063	SANA GOPI CHAND	3	3	5	Y	Y	Y
64	U18AE064	KALNETE VENKAT SAI	3	2	5	Y	N	Y
65	U18AE065	MOHAMMED NEHA TABASSUM AZHARU	4	2	3	Y	N	Y
66	U18AE066	SUREDDY VENKATA SAI KARTHIK RED	5	4	5	Y	Y	Y
67	U18AE067	MOHAMMAD TAJ ALI	3	4	2	Y	Y	N
68	U18AE068	GIDDALURI NAVEEN BABU	5	5	3	Y	Y	Y
69	U18AE069	CHINNA LAKSHMAMMA GARI NARENDR	5	5	4	Y	Y	Y
70	U18AE070	VASANTHALA HASWITH	3	4	2	Y	Y	N
71	U18AE071	JAMES L	5	5	3	Y	Y	Y
72	U18AE072	GURRAM SAI PRADEEP	5	5	4	Y	Y	Y
73	U18AE073	DEVPROTIM MUKHER JEE	2	5	4	N	Y	Y
74	U18AE074	MULA MADHU	2	4	5	N	Y	Y
75	U18AE075	GOWDA RISHI	3	3	5	Y	Y	Y



BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH

Department of Chemistry

Academic Year (2018-2019) Even Sem

First Internal Test - CO ATTAINMENT

BPC2L1 - Chemistry lab (Obeservation)

Direct - CO Attainment

	MODEL	SEE	CIE CLASS AVERGARE %
CO1	65.67	71.64	69.85
CO2	62.69	76.12	72.09
CO3	67.16	77.61	74.48

BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH

Department of Chemistry

Academic Year (2018-2019) Even Sem

First Internal Test - CO ATTAINMENT

Total - CO Attainment

	DIRECT ATTAINMENT	INDIRECT ATTAINMENT	TOTAL ATTAINMENT
CO1	69.85	86.57	71.52
CO2	72.09	94.03	74.28
CO3	74.48	88.06	75.84

BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH

Department of Chemistry

Academic Year (2018-2019) Even Sem

First Internal Test - CO ATTAINMENT

CO Attainment Gap Analysis

	TARGET %AGE	ATTAINED %AGE	GAP
CO1	70	72	-2
CO2	70	74	-4
CO3	74	76	-2