Viva Voce Questions

General Questions

1. How do you express strength of a solution?

Ans: Normality or Molarity.

2. What is normality?

Ans: A unit of concentration expressed as equivalents per litre.

It is defined as number of gram equivalent weight of substance dissolved in one litre of water.

3. What is Molarity?

Ans:; Another way of expressing concentration, the way that we will use most in this course, is called **molarity**. Molarity is the number of moles of solute dissolved in one liter of solvent. The units, therefore are moles per, specifically it's moles of solute per liter of solent.

$$\text{Molarity} = \frac{\text{Moles of solute}}{\text{Liter of solution}}$$

4. What is Acid?

Ans: Arrhenius acid: a substance which ionizes in aqueous solution to yield hydronium ions (H_3O^+)
Lewis acid: a substance which acts as an electron pair donor
Bronsted-Lowry acid: a substance which acts as a proton (H^+) donor
e.g; CH_3 COOH, EDTA, H_2SO_4, HCl, etc

5. What is weak acid?

Ans: An acid that only partially ionizes in aqueous solution. Put another way, it has a small Keq e.g.; CH_3COOH , benzoic acid ,etc

6. What is strong acid?

Ans: An acid which dissociates completely in aqueous solution: HCl, $HNO_3$and H_2SO_4

7. What is Base?

Ans: Arrhenius base: a substance which ionizes in aqueous solution to yield hydroxide ions (OH)
Lewis base: a substance which acts as an electron pair acceptor
Bronsted-Lowry base: a substance which acts as a proton (H+) acceptor

8. What is weak base?

Ans: A base that only partially ionizes in aqueous solution (has a lowKeq)

e.g ; NH_3, $(NH_3)_2CH_2$, $(NH_3)3CH$,

9. **What is strong base?**

Ans: A base which dissociates completely in aqueous solution.

e.g ; NaOH , KOH , RbOH , etc

10. What is oxidizing agent?

Ans: The acceptor of electrons in an oxidation-reduction reaction.

e.g.; $K_2 Cr_2 O_7$, KM_nO_4,etc

11. What is Reducing agent?

Ans: The electron donor in an oxidation-reduction reaction.

e.g; All alkali metals, $SnCl_2$, $LiAlH_4$, etc

12. What is Oxidation?

Ans: Oxidation is the chemical process in which loss of electrons takes place, resulting increases in oxidationnumber.

13. What is reduction?

Ans; Reduction is the chemical process in which gain of electrons takes place, resulting decreases in oxidationnumber.

14. What is standard solution?

Ans; Standard solution is one, whose concentration (Normality or molarity) is known.
e.g ; 0.1NaCl, Or 0.05N EDTA Or 0.01$K_2Cr_2O_7$,etc

15. What is solute?

Ans; In a solution, the part(s) present in lower mol quantities.e.g ;NaCl ,KCl , NaOH ,KOH etc solutes

16. What is solvent?

Ans; In a solution, the part present in greatest mol quantity.eg ; water etc

17. What is solution?

Ans; A homogenous mixture of one or more solutes dissolved in a solvent.
e.g ;NaCl ,KCl , NaOH ,KOH etc solutes are dissolved in solvent to form solution.

18. What is Titration?

Ans; It is a process in which strength of unknown solution is determined by known concentration solution by using suitable indicator.

19. What is titrant?

Ans; A solution of known concentration which is added (titrated) to another solution to determine its concentrationof a second chemical species.

20. What is Indicator?

Ans; Indicator is the chemical substance which indicates correct end point by color change.e.g ; EBT ,Patton and Reeder ,Starch ,$KMnO_4$,etc
Indicators are mainly classified into three types

1. Acid Base indicators —E.g ; phenopthalein
2. Redox indicators————E.g ; phenanthroline , Methylene blue
3. Metal ion indicators—— E.g; EBT, Patton and Redder,etc

21. What is end point?

Ans; End point is the stage where the two chemical reactions just end by color change.

22. What is pipette?

Ans; Calibrated devices used for liquid measurement.

23. What is endothermic reaction?

Ans; Chemical reaction heat is absorbed.

24. What is exothermic reaction?

Ans; Chemical reaction heat is evolved.

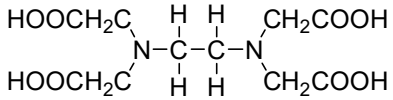
EXPT. NO. 1

Estimation of Total hardness of water by EDTA complexometric method

1. **What is hard Water?**
   Hard water is one which consumes considerable amount of soap to produce foam or lather, and that also produce scale in hot water pipes, heaters, boilers etc.,
2. **What is meant by total hardness of water?**
   The sum of both temporary and permanent hardness together called as total hardness of water.
3. **How are the waters classified based on the degree of hardness?**

Soft water	0-75 mg/litre
Moderately hard water	75-150 mg/litre
Hard water	150-300 mg/litre
Very hard water	> 300 mg / litre

4. **How is hardness of water caused?**
   Hardness of water is caused by divalent cations in association with anions such as HCO_3^- , SO_4^{2-}, Cl^-, SiO_3^{2-} etc. The principal hardness causing cations are calcium and magnesium.
5. **How temporary hardness is causes?**
   Temporary hardness causes due to association of bicarbonates with bivalent cations like calcium and magnesium.
6. **How the permanent hardness causes?**
   Permanent hardness causes due to association of chloride and sulphate ions with bivalent cations like calcium and magnesium ions.
7. **How temporary hardness is be removed?**
   The temporary hardness of water can be removed by boiling the water during which bicarbonates decomposes to give carbonates.
8. **How do you express the total hardness of water?**
   Total hardness is express as part per million of $CaCO_3$(ppm).
9. **What is EDTA?**
   EDTA is Ethylene Diamine Tetra Acetic acid. It is good example for hexadentate ligand.
10. **Write the structure of EDTA**



11. **Why disodium salt of EDTA preferred in EDTA titration?**
    EDTA is sparingly soluble in water therefore its disodium salt is preferred.
12. **Why ammonia solution is added during the preparation of EDTA solution?**
    Ammonia solution is added during the preparation of EDTAsolution to increase the rate of dissolution of EDTA.

13. What is buffer solution?

The solution which resist change in the pH value even after adding small amount of acid or a base to it, is called a buffer solution.

14. Why ammonia -ammonia chloride buffer added?

Ammonia ammonium chloride buffer is added to maintain the pH of 10, the desired pH for the titration

15. Why the indicator Erichrome Black -T (EBT) shown wine red colour at the beginning and blue color at the end?

When a small amount of Erichrome Black-T, which is blue in color, is added to hard water with a pH of about 10, it combines with a few of the calcium and magnesium ions to form a weak complex which is wine red in color as shown in the equation.

$$M^{2+} + EBT \rightarrow \underset{\text{wine red complex}}{(M\text{-}EBT)}$$

During the titration with EDTA, all free hardness ions are complexed according to the equation.

$$M^{2+} + EDTA \rightarrow \underset{\text{Stable complex}}{M\text{-}EDTA}$$

$$M\text{-}EBT + EDTA \rightarrow M\text{-}EDTA + \underset{\text{(Blue color)}}{EBT}$$

This action frees the Erichrome Back-T indicator from the complex (M-EBT), and the wine red color change to a blue color at the end of the titration.

16. Why are the titrations involving EDTA is carried out slowly towards the end point?

The titrations involving EDTA are carried out slowly towards the end point because, the rate of formation of the metal complex of EDTA is very slow.

17. What is the chemical name of Eriochrome Block T?

The chemical name of Erichrome Black T is Sodium - 1 [(1- hydroxy 2-naphthylazo) -6-nitro-2-naphthol-4-sulphonate]. **{SHNNNS}**

EXPT. NO. 2

Determination Of Calcium Oxide In The Given Sample Of Cement Solution (Rapid EDTA Method)

1. **What are the Constituents of cement?**
   Oxides of Calcium, magnesium, iron, aluminium and silicon are the constituents of cement.
2. **What is the prime constituent of Cement?**
   Calcium Oxide is a prime constituent of Cement.
3. **What is the role of glycerol?**
   Glycerol is added to get the sharp end point.
4. **What is the function of diethylamine?**
   Diethylamine is added to maintain a pH of about 12.5
5. **What is role of NaOH?**
   NaOH is added to mask the magnesium ions, it reacts with magnesium ions to form magnesium hydroxide.
6. **Why Erichrome Black-T indicator cannot be used in the experiment?**
   Erichrome Black-T indicator cannot be used in this experiment, because, it forms a very weak complex with calcium ions at a pH range of 12-14.
7. **Which is the indicator used in the determination of CaO in cement solution?**
   Patton and Reeder's indicator is sued in the determination of CaO in cement solution.

EXPT. NO. 3

Determination of Percentage of Copper in Brass Using Standard Sodium Thiosulphate Solution

1. **What is Brass?**
   Brass is an alloy.
2. **What is an alloy?**
   Alloy is a homogeneous solid mixture of two or more metals.
3. **What are the constituent of Brass?**
   Copper (50-90%) and Zinc (20-40%). It also contains small quantities of tin, lead and iron.
4. **How is Brass solution prepared?**
   Brass solution is prepared by dissolving the brass foils in 1:1 nitric acid.
5. **What is the purpose of adding urea?**
   Urea is added to destroy the oxides of nitrogen.
6. **Why ammonium hydroxide is added to the brass solution?**
   Ammonium hydroxide is added to neutralize excess of mineral acid (Nitric acid).
7. **What the bluish white precipitate formed after adding ammonia solution?**
   Cupric hydroxide complex is formed after adding ammonium hydroxide solution.
8. **Why acetic acid added?**
   Acetic acid is added to neutralise the excess of ammonium hydroxide and also to make the solution slightly acidic.
9. **Why potassium iodide added to brass solution although Copper in brass is determined?**
   Cupric ions do not react with sodium thiosulphate solution. However, cupric ions oxidise potassium iodide and iodine is liberated. The amount of iodine liberated is equal to the amount of cupric ions present in the solution.

   $$2Cu^{2+} + 4KI \longrightarrow Cu_2I_2 + I_2 + 4K^+$$

10. **How is iodine estimated?**
    The amount of iodine liberated is estimated by titrating it against standard sodium thiosulphate solution using starch as an indicator.
11. **What is the reaction that occurs betwen iodine and sodium thiosulphate?**
    Iodine reacts with sodium thiosulphate to form sodium iodide and sodium tetrathionate which are colourless products.

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

12. **Why starch indicator added towards the end point?**
    If the intensity of iodine is more, the indicator, starch forms a stable water insoluble complex with iodine. As a result, the volume of sodium thiosulphate consumed will be less than expected.
13. **What is the white precipitate left at the end point?**
    The white precipitate produced at the end point is cuprous Iodide.
14. **What is the problem if HNO_3 is not destoryed?**
    In this experiment we are expecting only Cu ions to oxidise the KI, if we are not remove HNO_3, that HNO_3 will also oxidise the process. Therefore we can't get accurate result.
15. **What is the difference between Iodometry and Iodimetry?**

Iodometry	Iodimetry
The process in which we make the I_2 to liberate and liberated I_2 is titrated Vs $Na_2S_2O_3$	The process in which the titration is conductucted against added I_2 Vs $Na_2S_2O_3$

EXPT. NO. 4

Determination of Iron in Given Sample of Haematite ore Solution

1. **What is main constituent of haematite ore?**

   Haematite is an important ore of iron containing mainly ferric oxide (Fe_2O_3)

2. **Give the other forms of iron ore?**

   Magnetite (Fe_3O_4), Siderite ($FeCO_3$), Iron pyrites (FeS_2), etc., are the other forms of the iron ore.

3. **What is the role of stannous chloride?**

   Stannous chloride reduces ferric ion to ferrous ion and a slight excess is added to ensure complete reduction.

   $2FeCl_3 + SnCl_2 \rightarrow FeCl2 + SnCl_4$

4. **Why mercuric chloride added?**

   Mercuric chloride is added to remove the excess of stannous chloride. Mercuric chloride reacts with stannous chloride to form a silky white precipitate of mercurous chloride.

   $SnCl_2 + 2HgCl_2 \rightarrow Hg_2Cl_2 + SnCl_4$

5. **What happens when the excess of stannous chloride is not removed?**

   If the excess of stannous chloride is not removed, the ferric ions formed during the course of the titration get reduced to ferrous ions.As a result, the volume of titrant, potassium dichromate consumed will be more.

6. **What is the indicator used?**

   Potassium ferricyanide, $K_3[Fe(CN)_6]$ used as external indicator.

7. **Why Potassium ferricyanide cannot not be used as internal indicator?**

   Potassium ferricyanide cannot be sued as an internal indicator in the analysis of haematite because, potassium ferricyanide combines irrevarsibly with ferrous ion to form a deep blue ferrous ferricyanide complex (Tumbull's blue). These ferrous ions involved in complex formation are not available for reaction with potassium dichromate. Moreover, the end point cannot be detected as there is no color

   change.

   $3Fe^{2+} + K_3[Fe(CN)_6] \rightarrow Fe_3\,[Fe(CN)_6]_2 + 6K^+$

8. **Why Potassium ferrocyanide cannot be used as an indicator in the estimation of Iron?**

   Potassium ferrocyanide cannot be used as an indicator in the estimation because, ferrocyanide does not react with ferrous iron.

9. **Why the color of the indicator drop remains the same at the end point?**

   At the end point there are no more ferrous ions available to react with the indictor, as they are oxidized to ferric ions by the time the end point is reached.

10. **What is the reaction that occurs during the titration?**

    Acidified potassium dichromate oxidises ferrous iron present in the heamatite solution to ferric iron and itself get reduced to chromate ion.

    $6Fe^{2+} + Cr_2O_7^{2} + 14H^+ \longrightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$

EXPT. NO. 5

Determination of Chemical Oxygen Demand (COD) of the Waste Water

1. What is Chemical Oxygen Demand?

It is the amount of oxygen required for the complete oxidation of organic and inorganic matter present in the sample of water by a strong oxidising agent such as acidified potassium dichromate.

2. What general groups of organic compounds are not oxidized in the COD test?

Aromatic Hydrocarbons and pyridine are not oxidized in COD test.

3. What is the role of silver sulphate?

Silver sulphate acts as catalyst in the oxidation of straight chain aliphatic hydrocarbons and acetic acid. Oxidation is effective in presence of silver ions.

4. What is the role of more mercuric sulphate?

Chloride ions normally present in high concentration in waste water undergo oxidation in COD tests and cause very high results. Mercuric ions of mercuric sulphate bind the chloride ions present waste water to form poorly ionised mercuric chloride and prevent the precipitation of silver halide by making halide ions unavailable.

5. What are the products formed after COD analysis?

During COD analysis organic matter is completely oxidized to carbon dioxide and water by acidified potassium dichromate solution.

6. Why is sulphuric acid added during the preparation of standard FAS solution?

Sulphuric acid is added to prevent the hydrolysis of ferrous sulphate in to ferrous hydroxide.

7. What is composition of Ferroin?

Ferroin is ferrous 1, 10-Phenanthroline sulphate.

8. Mention a few application of COD test in environmental engineering practice.

i) The COD test is extensively used in the analysis of industrial wastes.

ii) It is particularly valuable in survey designed to determine and control losses to sewage systems.

iii) The COD is helpful in indicating toxic conditions and the presence of biologically resistant organic substances.

9. What is the limitation of COD?

One of the chief limitations of COD test is its inability to differentiate between biologically oxidisable and biologically inert organic matter also, it does not provide any evidence of the rate at which the biologically active material would be stabilized under conditions that exist in name.

10. What is the difference between BOD and COD?

BOD	COD
1. It is limited only for organic matter	1. It is for both organic and Inorganic matter
2. The amount of oxygen required by the micro organism to oxidize only organic matter.	2. It is the amount of oxygen required to oxidise both organic and Inorganic by strong oxidising agent such as acidified potassium dichromate.
3. The Amount duration	3. Less duration

11. Why the titration carried out in acidic medium?

Because $K_2Cr_2O_7$ liberatesnascent oxygen required for oxidation in presence of dil H_2SO_4

$$\mathbf{K_2Cr_2O_7 + 4H_2SO_4 \rightarrow K_2SO_4 + Cr_2\,(SO_4)_3 + 4H_2O + 3\,(O)}$$

EXPT. NO. 6

Estimation of Percentage of Available Chlorine in the Given Sample of Bleaching Powder (Iodometric Method)

1. **What is bleaching powder?**

   A powder containing calcium hypochlorite, used chiefly to remove colour from materials.

2. **Which indicator is used?**

   Starch is used as an indicator towards the end point.

3. **What is starch?**

Starch or amylum is a carbohydrate consisting of a large number of glucose units joined by glycosidic bonds. This polysaccharide is produced by most green plants as an energy store.

4. **Why is starch indicator added towards the end point?**

If the concentration of iodine is more, the indicator Starch forms a stable water insoluble complex with iodine. As a result, the volume of sodium thiosulphate consumed will be less than expected.

5. **What is the principle of this Experiment?**

The available chlorine present in bleaching powder sample is determined iodometricaliy by treating its solution with an excess of potassium iodide solution in the acidic medium.

$OCl^- + 2H^+ + 2I^- \longrightarrow I_2 + H_2O + Cl^-$

6. **Why does Starch produce blue color with iodine?**

Amylose which is the water soluble component of starch forms blue colored complex with iodine.

7. **What is the reaction that occurs between iodine and sodium thiosulphate?**

Iodine reacts with sodium thiosulphate to form sodium iodide and sodium tetrathionate which are colorless product.

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

8. **How bleaching powder can be synthesised?**

   $2Ca(OH)_2 + 2Cl_2 \longrightarrow Ca(OCl)_2 + CaCl_2 + H_2O$

9. **Discuss the uses of bleaching powder?**

It is used

(i) As disinfectant and germicide especially in the sterilization of drinking water.

(ii) For manufacture of chloroform.

(iii) As an oxidising agent in industry.

(iv) As bleaching agent for cotton, linen and wood pulp.

EXPT. NO. 7

Determination of pka of a Given Weak Acid using pH Meter.

1. **What is a weak acid?**
   Weak acid are the weak electrolytes, which ionise incompletely in aqueous solutions.
2. **What is pKa of a weak acid?**
   pKa is a modern method of expressing the strength of weak acids. It is mathematically expressed as
   $pKa = -\log_{10}Ka$

   whereKa is the dissociation constant of the weak acid.
3. **What is meant by pH of a solution?**
   S.P.L. Sorensen defined pH of a solution as the negative logarithm to base 10 of hydrogen ion concentration.
   $pH = -\log_{10}[H^+]$
4. **Why is a glass electrode called an ion selective electrode?**
   The glass electrode is called an ion selective electrode because, it is able to respond to certain specific ions /(H^+ions) only and develop a potential while ignoring the other ions in a solution.
5. **How is the measurement of pH made?**
   The measurement of pH is made by determining the e.m.f of the cell containing glass electrode and the calomel electrode immersed in the test solution. The e.m.f of the cell is expressed by the equation, E = K+0.0591pH, where K is constant.
6. **How are pH and pKa related?**
   According to Henderson-Hasselbalch equation,
   $pH = pKa + \log_{10} [salt] / [acid]$ at half equivalence
   point [salt] = [acid]. Therefore, pH at half equivalence gives the pKa of the weak acid.
7. **How are pKa and strength of a weak acid related?**
   Higher the pKa, lower will be the strength of the weak acid.
8. **What the electrodes used in the measurement of pH for the determination of pKa?**
   In the determination of pKa of a weak acid glass electrode (indicator electrode) and calomel electrode (reference) are used. In this case, glass electrode acts as cathode and calomel electrode acts as aanode.
9. **Why pH increases suddenly after the equivalence point?**
   At the equivalence point, all the weak acid has been neutralized by the base, afterwards the concentration of hydroxyl ions increases resulting in sudden increase of pH.

EXPT. NO. 8

Potentiometric Estimation of FAS Using Standard $K_2Cr_2O_7$ Solution

1. **What is potentiometric titration?**

   The determination of the equivalence point of redox titration on the basis of potential measurement is called a potentiometric titration.

2. **Explain the principle of potentiometric titration?**

   The principle involved in potentiometric titration is the measurement of the emf between two electrodes, an indicator electrode and a reference electrode. In these titrations measurements of emf are made while the titration is in progress. The equivalence point of the reaction is revealed by a sudden change in potential in the plot of emf readings against the volume of titrant.

3. **What are the electrodes used is in potentiometric titration?**

   The indicator electrode used is the platinum electrode (acts as ancathode) and the reference electrode used is the calomel electrode (acts as anode).

4. **What is determining factor in the oxidation - reduction reaction?**
   The determining factor is the ratio of the oxidized and reduced forms.

5. **What is an indicator electrode?**

   The electrode whose potential is dependent upon the concentration of the ion to be determined is termed as the indictor electrode.

6. **What is the reaction that occurring between FAS and potassium dichromate?**

   Acidified potassium dichromate oxidises ferrous sulphate to ferric sulphate and itself gets reduced to chromic sulphate.

   $$6FeSO_4 + 7H_2SO_4 + K_2Cr_2O_7 \rightarrow 3Fe_2(SO_4)_3 + K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O$$

7. **What are the advantages of potentiometric titration?**
   i) Turbuid, fluorescent, opaque or coloured solutions can be titrated.
   ii) Mixture of solutions or very dilute solutions can be titrated
   iii) The results are more accurate because the actual end point is determined graphically.

8. **Why sulphuric acid added during potentiometric titration?**
   Sulphuric acid is added to make the medium acidic, which is required for oxidation.

EXPT. NO. 9

Colorimetric Estimation of Copper

1. What is colorimetry?

Chemical analysis through measurements of absorption of light radiation in the visible region of the Electromagnetic spectrum (400-760nm) with respect to known concentration of the substance is known as colorimetry.

2. What forms the basis for colorimetric determination?

The variation of color of a system with change in concentration of some component forms the basis for the calorimetric determination.

3. What is photo electric colorimeter?

It is an electrical instrument. Which measures the amount of light absorbed using a photocell.

4. What are filters? Why are they used?

The filters consist of either thin films of gelatin containing different dyes or coloured glass. The filters are used in colorimeters for isolating (selecting) any desired spectral region.

5. What is wave length?

The distance between any two successive peaks or troughs of waves is called wave length. It is represented by λ.

6. What is frequency?

It is the number of waves passing through a point per second. It is represented by a symbol υ

7. What is wave number?

It is the reciprocal of wave length.

8. State Beer's law.

The intensity of beam of monochromatic light decreases epxponentially as the concentration of the absorbing substance increase arithmetically.

9. State Lambert's law

When a monochromatic light passes through a transparent medium, the rate of decrease in intensity with the thickness of the medium is proportional to the intensity of light.

OR

The intensity of the emitted light decreases exponentially as the thickness of the absorbing medium increase arithmatically.

10. State Beer-Lambert's law.

The amount of light absorbed is directly proportional to the concentration and path length of the solution.

A Cl

$A = \log I_0/I_t = \varepsilon ct$

ε = Molar extinction constant; c= concentration t = path length

11. What is a calibration curve?

It is the plot of optical density (absorbance) against concentration of solutions. For solutions obeying Beer's law., this is a straight linepassing through the origin.

12. What is meant by transmittance?

It is the ratio of amount of light transmitted (I_1) to the total amount of light absorbed (I_0) **$I_1 I_0$= T** Reciprocal of transmittance I_0 / It is called absorbance or optical density.

$A = \log I_0 / I_1 = \log 1/T = - \log T$

13. Can different Nessler's tubes be used during optical density measurements of solutions?

Different Nessler's tubes cannot be used during optical density measurements of solutions because, absorbance depend on the path length of the solution (We can use different Nessler's tube when they are identical in all respects).

14. Mention a few important criteria for a satisfactory colorimetric analysis.

i) In order to obey Beer-Lambert's law, the solute must not undergo solvation, association, dissociation, hydrolysis or polymerization in the solvent used.

ii) The color produced should be sufficiently stable to permit an accurate reading to be taken.

iii) Clear solution free from traces of precipitate or foreign substances in either blank or standard test solution should be used.

15. Mention a few advantages of photoelectric colorimetric determinations.

i) A colorimetric method will often give more accurate results at low concentrations than the corresponding titrimetric or gravimetric procedure.

ii) A colorimetric method may frequently be applied where no satisfactory gravimetric or titrimetric procedure exists i.e., for certain biological substances.

16. Why different volumes of solution taken in the flask?

Different volumes of solution are taken to prepare standard solutions of different concentration, which are used to plot a calibration curve.

17. What is a blank solution?

A blank solution is identical in all respects to the test solution except for the absence of test solute.

18. Why is ammonia added? Why is that same amount of ammonia is added?

Ammonia is added to get cuprammonium sulphate $[Cu(NH_3)_4]SO_4$ a dark blue complex. Same amount of ammonia is added to nullify the absorbance due to any coloring impurities present in ammonia.

19. Why is estimation of copper done at 620nm wavelength?

The estimation of copper is carried at 620nm wavelength because, the complex shows a maximum absorbance at 620nm.

EXPT. NO. 10

Estimation of Acids in Acid Mixture Conductometrically

1. **State ohm's law.**

   Ohm's law states that the current, I (ampere), flowing in a conductor is directly proportional to the applied electromotive force, E (volt) and inversely proportional to the resistance, R(ohm) of the conductor.

   I= E/R

2. **What is conductance?**

   The reciprocal of resistance is called the conductance.

3. **What is the unit of conductivity?**

   The unit of conductivity is $ohm^{-1}m^{4}$ or Sm^{-1}

4. **Mention the different types of conductivities?**

   A solution may have the following conductivities.

   i) Specific conductivity
   ii) Equivalent conductivity
   iii) Molar conductivity

5. **Which of the above conductivity measured during conductometric titration?**

   The specific conductivity is measured.

6. **What is Specific conductivity?**

   It is the conductivity of the solution between two electrodes of area ICm^2 and kept 1cm apart.

7. **What is equivalent conductivity?**

   It is the conductivity of the solution which contains 1gram equivalent of solute, when placed between two electrodes and 1 cm apart.

   $\lambda = \mathbf{kV}$ V = volume containing 1 gram equivalent of solute

   $\lambda = \dfrac{\mathbf{k \times 1000}}{\mathbf{C}}$ C= Normality of solution

8. **What is molar conductivity?**

   It is the connectivity of a solution which contains 1 gram molecular weight of a substance, when placed between two electrodes 1 cm apart.

9. **What is a cell?**

   A device which produces an electromotive force and delivers an electric current as the result of a chemical reaction is known as a cell.

10. **What is the principle involved in conductometric titration?**

    In conductometric titration, there is sudden change in conductance of solution near the end point. Hence the end point is determined graphically by plotting conductance against titre values. The principle underlying conductometric titration is the replacement of ions of a particular conductance by ions of different conductance during titration.

    $NaOH + HCl \rightarrow NaCl + H_2O$

    The accuracy of the method is greater when the angle of intersection is more acute and more nearly the points of the graph on a straight line.

11. **What are the advantages of conductometric titrations over visual or potentiometric titrations?**

    The method is accurate in dilute as well as more concentrated solutions.

    It can also be employed with coloured solutions.

    Very weak acids such as H_3BO_4 phenol, which cannot be titrated potentiometrically in aqueous solutions can be titrated conductometrically.

EXPT. NO. 11

Determination of Viscosity Co-Efficient of the Given Liquid Using Ostwald's Viscometer

1. **What is viscosity?**

   Viscosity arises due to interal friction between moving layers of molecules. A moving layer exerts a drag of friction on its nearest moving layer backward. This property of liquid by which it retards or opposes motion between the layers is called viscosity.

2. **What is viscosity co- efficient of a liquid?**

   The viscosity co-efficient of a liquid is defined as the tangential force per unit area required to maintain a unit velocity gradient between any two successive layers of a liquid situated unit distance apart.

3. **What is density of a liquid?**

   The density of a liquid is the mass & its unit volume.

4. **The density of a subsance is expressed relative to what?**

   The density of substance is expressed relatively to that of water at 4^0C.

5. **What is specific gravity?**

   Specifi gravity or the relative density is the weight of a given liquid divided by the weight of an equal volume of water at the same temperature.

6. **How are the specific gravity and density are related?**

   Density of liquid = Specific gravity of the liuqid x density of water at that temperature.

7. **Whgat is the SI unit of viscosity co-efficient?**

   The viscosity co-efficident expressed as pascal second (Ps) 1Ps= 1kg m^{-1} $s^{-1.}$

8. **What is the equation used to represent the influence of temperature on viscosity?**

   The influence of temperature on viscosity is best represented by an emperical equation. $\eta = Ae^{B/RT}$ where A and B are constants for a given liquid.

9. **What are the factors that affect the viscosity of a given liquid?**

   i) Increase in molecular weight results in increase in viscosity.

   ii) Branched chain compounds have higher viscosity than straight chain compounds.

   iii) The polar compounds are more viscous than the nonpolar ones. The presence of hydrogen bonds cause the viscosity to increase.

   iv) The viscosity of liquids increases by the presence of lyophilic colloids and suspended imputities.

   v) Temperature has marked influence on the viscosity of a liquid (about 2% per degree)

10. **What is the law based on the viscous flow of liquids through capillary tubes?**

    The law based on the viscous flow of liquids through capillary tubes is poiseuille law. It is expressed as

    $$\eta = \frac{\pi P r^4 t}{8Vl}$$

    η = viscosity co-efficient; p= hydrostatic pressure; r= radius of the tube t= the time required by the liquid to flow through the capillary

    v= volume of the liquid and

    l = length of the capillary.

11. **How does the viscosity vary with termperature?**

    The viscosity of a liquid is usually decreases with the rise in temperature.

12. **Why should the viscometer be dried before the mesaurements are done?**

    The viscometer should be dried to avoid the formation of emulsion, which changes the rate of flow of the liquid.

13. **Why is acetone used for cleaning viscometer?**

Acetone is a volatile organic liquid to dry the viscometer quickly, it is rinsed with acetone.

14. Why is viscometer not rinsed with the given liquid of water?

If the viscometer is rinsed with the given liquid or water before measuring the flow time, the volume taken will be more than a definite know volume.

15. Why do you require laboratory temperature for viscosity determination?

Because, the physical constants like density and viscosity of a liquid vary with temperature.

16. How the viscosity of a is liquid related to its mobility?

Viscosity of a liquid is inversely proportional to its mobility.

17. What is fluidity of a liquid?

Fluidity of a liquid is the reciprocal of viscosity co-efficient. It is a measure of the ease with which the liquid flows.

Fluidity, $\theta = \mathbf{l}/\eta$ = where η viscosity co-efficient.

EXPT. NO. 12

Flame Photometeric Estimation of Sodium and Potassium

1. **What is flame photometry?**
   A photoelectric flame photometer is a device used in inorganic chemical analysis to determine the concentration of certain metal ions, among them sodium, potassium, lithium and calcium. In principle it is a controlled flame with the intensity of the flame color quantified by photoelectric circuitry. test

2. **What are different components of a flame photometer.**
   1. Dual channel 2. Nebulizer 3. Mixing chamber 4. Flame System 5. Filters

3. **Why the analysis of sodium is advantageous in flame photometry?**
   1. Sodium melting point is low.
   2. Since the temperature is not high enough to excite transition metals, the method is selective towards detection of alkali and alkali earth metals.

4. **What is the role of filter in flame photometry?**
   It selects desired wave length spectral light.

5. **What are the limitation of flame photometry?**
   1. The analyte concentration should be low.
   2. Not applicable for high melting metals like transition metals.
   3. Use of different filters for different elements.

6. **Name the fuel and oxidant used in this experiment.**

   Fuel – Butane or LPG
   Oxidant - oxygen