Viva-Voce Questions and Answers

PART-A

DETERMINATION OF PKa OF A GIVEN WEAK ACID

1. What is a weak acid?
Weak acid is a weak electrolyte, which ionizes incompletely in aqueous solution.

2. What are strong acids?
A strong acid is an acid, which ionizes completely in solution.

3. Give example for strong acids?
Strong acids: HCl, HNO_3, and H_2SO_4

4. Give an example for a weak acid?
Acetic acid CH_3COOH

5. 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 Ka, where, Ka is dissociation const.

Higher the pKa value, weaker is the acid & larger the pKa value, stronger is the acid

3. What is meant by pH of a solution?
PH of a solution is the negative logarithm to base 10 of hydrogen ion concentration. **i.e. pH = -log10 (H^+)**

4. What are the electrodes used in the measurement of pH for the determination of pKa?
In the determination of pKa of weak acid, glass electrode (indicator electrode) and calomel electrode (reference electrode) are used. In this case glass electrode acts as an anode and calomel electrode acts as cathode.

5. Why is pH increases suddenly near 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.

6. What are the ions formed by the dissociation of acetic acid?
Dissociation of acetic acid gives acetate (CH_3COO^-) ions and hydrogen ions (H^+)

$$CH_3COOH \longrightarrow CH_3COO^- + H^+$$

7. How are pH & pKa related?
They are related by Henderson- Hasselbalch equation, which is given by

$$pH = pKa + \log \frac{[Salt]}{[Acid]}$$

Where [salt] & [acid] are molar concentration of salt & the acid respectively

8. How pH becomes equal to pKa at half equivalence point?
At half equivalence point molar concentration of salt is equal to molar concentration of the acid i.e. (salt) = (acid)
Therefore log (salt)/ (acid) = log1= 0
Thus pH = pKa + 0 = pKa

9. How are Ka & strength of weak acid related?
Higher the Ka, stronger is the acid.

10. How are pKa & strength of weak acid related?
Higher the pKa, weaker is the acid.

11. Why 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.

[Mrs. Sayeeda sumaiya Banu and Mr. Sreenivasan N.S

POTENTIOMETRIC DETERMINATION OF FERROUS IRON

1. What is a potentiometric titration?
The determination of the equivalence point of redox titration on the basis of potential measurements is called potentiometric titrations.

2. What are the electrodes used in potentiometric titrations?
The indicator (or working) electrode used is the platinum electrode (acts as anode) and the reference (or standard) electrode used is the calomel electrode (acts as cathode)

3. Why sulphuric acid is added to FAS solution during emf measurement?
Reaction between FAS and $K_2Cr_2O_7$ is a redox reaction. Oxidation of Fe^{2+} to Fe^{3+} by $K_2Cr_2O_7$ takes place only in a acidic medium. Hence sulphuric acid is added.

4. Give the principle of Potentiometric titration
The principle 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 titration.

5. What is the reaction occurs between FAS and $K_2Cr_2O_7$ in Potentiometric titration?
Acidified $K_2Cr_2O_7$ oxidizes ferrous sulphate (FAS) to ferric sulphate. $K_2Cr_2O_7$ itself gets reduced to chromic sulphate.

4. Why the beaker solution gradually changes into green during the course of titration?
When FAS, in beaker reacts with $K_2Cr_2O_7$, it reduces $K_2Cr_2O_7$ to $Cr_2(SO_4)_3$ which is a green salt

5. Why the emf rises steeply soon after the equivalence point?
This is because, the potential of the solution before the equivalence point is due to $Fe^{2+} \rightarrow Fe^{3+}$ system only, while at equivalence point, it is due to both Fe^{3+} and $Cr_2O_7^{2-}$ ions. But beyond equivalence point, the potential of the solution is due to $Cr_2O_7^{2-}$ ions only. Therefore, just after the equivalence point, the potential of the solution rises steeply

6. What are the advantages of potentiometric titrations?
i. Turbid, fluorescent, opaque or colored solutions can be titrated.
ii. Mixture of solutions or very dilute solutions can be titrated.
iii. The results are accurate because the actual end point is determined graphically.

COLORIMETRIC DETERMINATION OF COPPER

1. What is colorimetry?
Chemical analysis through measurements of absorption of light radiation in the visible region of the spectrum (400 – 700) with respect to a known concentration of the substance is known as colorimetry.

2. What is wave length?
The distance between any two successive peaks or troughs of a wave is called wave length. It is represented by λ.

3. What is a calibration curve?
It is a plot of optical density (absorbance) against concentration of solutions. For the solutions obeying Beer's law, this is a straight line.

4. Can different Nesslers tube be used during optical density measurements of solutions/
Different Nesslers tubes varying in thickness cannot be used during optical density measurements of solutions. Because absorbance depends on the path length of the solution. If the thickness is same, different Nesslers tubes can be used.

5. Why are the 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.

6. What is a blank solution?
A blank solution is identical in all respects to the test solution except for the absence of test solution.

7. Why is blank solution used in calorimetric estimation?
To nullify the absorbance caused due to the coloring impurities present in the reagents.

8. Why is ammonia added? Why is the same volume of ammonia added to different volumes of copper sulphate?
Ammonia is added to get cuprammonium sulphate, a dark blue complex. Same amount of ammonia is added to nullify the absorbance due to any coloring impurities present in ammonia.

9. Why is estimation of copper done at 620nm wave length?
The estimation of copper is carried at 620nm wavelength because, the complex shows maximum absorbance at 620nm.

10. State Beer's law.
The intensity of a beam of monochromatic light decreases exponentially as the concentration of the absorbing substance increases arithmetically.

11. State Lamberts law.
The intensity of the transmitted light decreases exponentially as the thickness of the absorption medium increases arithmetically.

12. State Beer- Lamberts law.
The amount of light absorbed is directly proportional to the concentration (c) of the solution and directly proportional to the path length (l)

$$A = \epsilon c l$$

Where, ϵ = molar extinction coefficient.

13. What is transmittance?
It is the ratio of the intensity of transmitted light (I_t) to that of the incident light (I_o). $I_t / I_o = T$

14. Why filters are used in colorimetric experiment?
Filters are used for selecting desired spectral region

15. What is wavelength?
The distance between any two successive peaks or troughs of wave is the called wavelength. It is represented by λ. It can be expressed meters

Conductometric estimation of HCl

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

$\propto \frac{emf}{R}$

2. What is conductance?
The reciprocal of resistance is called conductance

3. What is conductivity?
The reciprocal of resistivity is called conductivity.

4. What is the unit of conductance?
The unit of conductance is ohm^{-1} m^{-1} or Sm^{-1}. Or millimho.

5. Mention the different types of conductance?
A solution may have the following conductance.

1. Specific conductance
2. Equivalent conductance.
3. Molar conductance.
4.

6. Which of the above conductance measured during Conductometric titration?
The specific conductance is measured

7. What is specific conductance?
It is the conductance of a solution placed between two electrodes of 1 cm^2 area and kept 1 cm apart.

8. What are the factors that determine the conductance of a solution?
Mobility of ions - higher the mobility, higher is the conductance.
Number of ions - more the no. of ions in the solution, more is the conductance.

9. In this experiment, the conductance first decreases, the steeply increases. Why?
The conductance steeply falls due to the replacement of highly mobile H+ ions of the strong acid by less mobile Na+ ions of the base. The conductance falls till all the H+ ions are replaced. Then, the conductance rises steeply as excess of base is added. i.e., due to highly mobile OH- ions.

10. **What is the principle involved in Conductometric titration?**
In Conductometric titration, there is a sudden change in conductance of a 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 the titration

Determination of viscosity coefficient of the given liquid

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

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

3. what are the factors that influence the viscosity of a liquid?
1. Increase in molecular weight increases velocity.
ii. Branched chain compounds have higher velocity then straight chain compounds.
iii. The polar compounds are more viscous than the non polar ones. The presence of hydrogen bonds causes the velocity increase.
iv. Increase in the temperature decreases the viscosity.

4. Why the viscometer should be dried before adding liquid or water in to it.
To avoid the formation of an emulsion, this changes the rate of flow of the liquid.

5. Why acetone is used to clean the viscometer.
Acetone is volatile organic liquid. To dry the viscometer quickly, it is rinsed with acetone.

6.What is density of liquid?
The density of a liquid is its mass/ its volume.

7. The density of a substance is expressed relative to what?
The density of a substance is expressed relatively to that of water at 4°C.

8. What is SI unit of viscosity co-efficient?
The viscosity co-efficient is expressed as kg/m/s.

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

$\eta = Ae^{B/RT}$

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

10. What is the law base on the viscous flow of liquid through capillary tubes?

The law based in the viscous flow of liquid through capillary tubes Poiseuilles law.

It is expressed as $\eta = \frac{\pi pr^4 t}{8vl}$

Where η = Viscosity co-efficient; p = Hydrostatic pressure; r = Radius of the tubes; t = Time required for the volume; v = of the liquid to flow through the tube of the length, l.

11. How does the viscosity vary with temperature?

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

12. Why viscometer not rinsed with the given liquid or water?

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

13. Why do require laboratory temperature for viscosity determination?

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

14. Why is viscometer dipped in water bath?

Viscometer is dipped in water bath to maintain constant temperature.