

VOLUMETRIC ANALYSIS

1.	Name some oxidizing agents used in Redox Titrations.
Ans:	KMnO ₄ , K ₂ Cr ₂ O ₇
2.	In the titration between KMnO ₄ and Mohr's salt which is the oxidizing agents and which one is the reducing agent.
Ans:	MnO ₄ ⁻ + 8H ⁺ + 5e ⁻ → Mn ²⁺ + 4H ₂ O (Reduction) (OA) Fe ²⁺ → Fe ³⁺ + e ⁻ (Oxidation) (RA)
3.	What is a primary standard?
Ans:	A primary standard is the substance where exact concentration solution can be prepared by directly weighing the sample and dissolving it in given amount of the solution, its concentration value will be occurred.
4.	Give two examples of primary standard solutions.
Ans:	Mohr's salt solution and Oxalic acid solution
5.	What is a secondary standard solution?
Ans:	Whose concentration keeps on changing
6.	Why is KMnO ₄ not a primary standard?
Ans:	KMnO ₄ sample available is usually contaminated with MnO ₂ . So it is not pure. Moreover, KMnO ₄ solution is affected by heat and light and it slowly decomposes to Manganese dioxide (MnO ₂) on standing.
7.	Why is Mohr's salt solution a primary standard solution?
Ans:	It is a double salt having formula FeSO ₄ (NH ₄) ₂ SO ₄ .6H ₂ O. It is pure crystalline form and is very stable salt. It is neither deliquescent nor efflorescent and the concentration of the solution does not change on keeping for a long time.
8.	Can FeSO ₄ .7H ₂ O be considered a primary standard?
Ans:	No because it is an efflorescent salt. It will lose water of crystallization and change in composition.
9.	Is there a need to standardize NaOH solution?
Ans:	Yes. As NaOH Solution is not a primary standard. It is a deliquescent substance and will absorb moisture from atmosphere. So it cannot be weighed accurately.
10.	Calculation of equivalent weight.
Ans:	
11.	How is a standard solution of KMnO ₄ prepared?
Ans:	First a standard solution of Mohr's salt is prepared by direct weighing of the sample. Then the given KMnO ₄ solution is titrated against the standard Mohr's salt solution. Its strength is determined.
12.	Why is dil H ₂ SO ₄ added to the Mohr's salt while preparing its standard solution?
Ans:	It is added to prevent the hydrolysis of the salt.
13.	Why are KMnO ₄ titrations done in acidic medium?
Ans	KMnO ₄ is a good oxidizing agent in both acidic and alkaline medium but titrations are done in acid medium only. Titrations are not done in neutral/alkaline medium because KMnO ₄ gives MnO ₂ in neutral/alkaline medium. MnO ₂ is a brown solid so end point cannot be observed.
14.	Why is moderately concentrated H ₂ SO ₄ used for the titration? Why are conc. HNO ₃ or HCl acid not used for providing the acid medium for titration?
Ans:	Conc. HNO ₃ and Conc. H ₂ SO ₄ are oxidizing agents so these are not used as medium for titration. HCl is not used because it is oxidized to Cl ₂ gas by KMnO ₄ . So the titration will not be quantitative.
15.	What is the indicator used in KMnO ₄ titrations.
Ans:	It is a self indicator. No external indicator is required for KMnO ₄ titrations.
16.	How is the end point detected in the titration of KMnO ₄ and Mohr's salt?
Ans:	KMnO ₄ is used up by the Mohr's salt in the titration when all the Mohr's salt is consumed the extra drop of KMnO ₄ imparts pink colour to the solution due to MnO ₄ ⁻ .
17.	Why should rapid addition of KMnO ₄ be avoided in titration?

Ans:	Rapid addition of KMnO_4 leads to the formation of brown ppt of $\text{MnO}_2 \cdot \text{H}_2\text{O}$ (Hydrated manganese dioxide)
18.	Why should the titration between KMnO_4 and oxalic acid be carried out by heating the oxalic acid from $60^\circ - 70^\circ$?
Ans:	The reaction between oxalic acid and KMnO_4 is too slow to be followed at ordinary temp, So it is necessary to warm the contents to speed up the reaction.
19.	Why should the solution of oxalic acid be heated only upto $60^\circ - 70^\circ$ temp range and not beyond this temp.
Ans:	$\text{COOH} \xrightarrow[\text{COOH}]{\Delta, \text{at high temperature}} \text{CO}_2 + \text{CO} + \text{H}_2\text{O}$ So the titration result at high will not be accurate.
20.	Why should KMnO_4 be stored in a dark place?
Ans:	It slowly decompose when exposed to bright sunlight.
21.	Why can't KMnO_4 solution be filtered through ordinary filter paper?
Ans:	The organic matter in the filter paper decomposes KMnO_4 EASILY. (When we filter a neutral or alkaline KMnO_4 solution. We get a green solution as a filtrate due to reduction of MnO_4^- to MnO_4^{2-} ions.)
22.	What is normal solution?
Ans:	A solution containing one gram equivalent of the solute in 1L of the solution.
23.	What is a molar, molal solution?
Ans:	
24.	Which of the values molal or molar will not change on keeping the solution for a long time?
Ans:	A molal solution will have constat value as it is prepared by measurement of mass not volume.
25.	Why should hot solutions not be poured into the burette?
Ans:	Hot solution will bring about expansion of the glass and introduce errors in volume measurements.
26.	What is the strength of a solution?
Ans:	It is the amount of the substance present per litre of the solution g/litre.
27.	What are concordant readings?
Ans:	Readings which are consecutively same in each set of titration are said to be concordant.
28.	Why are chemical substances not directly weighed in a chemical balance?
Ans:	The chemicals may corrode the pans of the balance.
29.	Why should you never add water to concentrate sulphuric acid but the reverse is to be done for preparing dil. sulphuric acid solution?
Ans:	The reaction between sulphuric acid and water is highly exothermic. On adding a drop of water into large excess of sulphuric acid, enough heat is liberated to convert it to the vapour. So there is scattering of the acids as the water molecule is literally pulled apart by H_2SO_4 . But when a drop of H_2SO_4 is added to excess of waterthe acid ionizes and the ions get hydrated. The reaction is exothermic still and continue to get heated up and has to be cooled by const. stirring.
30.	Why is commercial nitric acid yellow in colour?
Ans:	Due to dissolved NO_2 in it.
31.	What is titrant and titrand?
Ans:	Titrant:- Solution taken in the burette (KMnO_4)is called Titrant. Titrand:- Solution which is to be titrated.
32.	What is an indicator?
Ans:	The substance which denotes the completion of a reaction in a titration by colour change is termed as indicator.
33.	Why do burette and pipettes must be rinsed with the solution for which they are to be used?
Ans;	So that they do not effect the concentration of the solution.
34.	Should a titration flask be also rinsed?
Ans:	No. Rinsing of the flask will increase the volume.
35.	What properties a substance should possess to act as a primary standard?

Ans:	For a substance to be taken a primary standard , it should possess constant chemical composition, sufficiently stability and high purity.
36.	Types of titration:.
Ans:	Acid-base titrations 2.Complexometric titrations 3.Redox titrations 4.Precipitation titrations.
37.	The ferrous ion-permanganate titration is done in cold. Why not in hot?
Ans:	Ferrous is oxidized to Ferric by oxygen of air at higher temperature.
38.	A bottle in which a permanganate solution is stored for a long time develops a brown layer on the glass. What is the chemical nature of this layer?
Ans:	It is of manganese dioxide.
39.	Why the last drop of solution must not blown out of pipette?
Ans:	Since the drop left in the jet end is extra of the volume measured by the pipette.
40.	What is permanganometry?
Ans:	Redox titrations involving KMnO_4 as the OA.
41.	Sometimes a brown ppt is observed in KMnO_4 titration why?
Ans:	Due to insufficient quantity of dil. H_2SO_4 . Brown coloured ppt. MnO_2 .

VIVA QUESTIONS

SALT ANALYSIS

CLASS- XII

1.	Differentiate between qualitative and quantitative analysis.
Ans:	Qualitative : Deals with the identification of the constituents in a substance while the quantitative deals with the determination of the exact amounts of the constituents .
2.	What are radicals?
Ans:	Atom or group of atoms present in a compound which participate in ionic reactions, carrying charge.
3.	What is the condition of precipitation?
Ans:	Ionic product exceeds its solubility products
4.	What are deliquescent salts?
Ans:	Salts which absorb moisture from the atmosphere and dissolve in it. Eg. $MgCl_2$, $FeCl_3$, $ZnCl_2$ etc.
5.	What is common ion effect?
Ans:	When strong electrolyte is added into a solution of weak electrolyte with a common ion then ionization of weak electrolyte is suppressed. This effect is called common ion effect.
6.	Which Substance is used in the wire gauge?
Ans:	Asbestos is used . It provides uniform heat to the beaker.
7.	What is the basis of classification of basic radicals in different groups?
Ans:	There are following two basis for classification: Solubility product, precipitation by same reagent
8.	When neutral $FeCl_3$ is added to salt solution, there is wine red colouration? Which acid radical should be present in the air?
Ans:	This test indicates the presence of acetate radical $3CH_3COONa + FeCl_3 \longrightarrow (CH_3COO)_3Fe + 3NaCl$
9.	Does conc. HCl will give response to Chromyl Chloride test?
Ans:	No, there will be formation of chromic acid. $K_2Cr_2O_7 + 2HCl + H_2O \longrightarrow 2H_2CrO_4 + 2KCl$
10.	Which gas gives brown ring with ferrous Sulphate?
Ans:	Nitric Oxide $FeSO_4 + NO \longrightarrow [Fe(NO)]SO_4$ Nitroso Ferrous Sulphate
11.	Name the acid radicals detected with dil. And conc. H_2SO_4
Ans:	dil. $H_2SO_4 - CO_3^{2-}$, SO_3^{2-} , NO_2^- conc. $H_2SO_4 - NO_3^-$, Cl^- , CH_3COO^-
12.	Why are HNO_3 and H_2SO_4 generally not used for the prep of an original solution?
Ans;	These acts as oxidizing agents and convert H_2S into S in second Group. Nitric acid converts sulphides of Ba, Sr and Pb into insoluble sulphates. Similarly sulphuric acid converts the salts of Ba, Sr and Pb into insoluble sulphates.
13.	Sometimes, a white ppt, is obtained even in the absence of members of 1 st group on the addition of HCl.
Ans:	Sometimes, a white ppt or milkiness is formed when the solution prepared in conc. HCl is diluted, even when no member of first group is present. This may be due to formation of the oxychlorides of antimony , Bi and tin. $BiCl_3 + H_2O \longrightarrow BiOCl \downarrow + 2HCl$. The ppt disappears if little conc. HCl is added. In such a case H_2S can be passed through milky solution.
14.	Why does $FeSO_4$ which is green in colour becomes yellow after sometimes?
Ans:	Ferrous salts are prone to arial oxidation by exposure to air. So Fe^{2+} changes to Fe^{3+} state which is generally yellow.
15.	What type of bonds are present in $CuSO_4$?
Ans:	The bond between Cu^{2+} and SO_4^{2-} ions is an ionic bond. The bond between S and O atoms in SO_4^{2-} are covalent.
16.	Why do Lead salts turn black on keeping for a long time in the lab?

Ans:	Due to formation of PbS. (black)
17	Give eg. Which produce crackling sound on heating.
Ans:	Ba(NO ₃) ₂ , KBr, Pb(NO ₃) ₂ etc.
18.	Why is conc. HCl used for making a paste with the salt before performing flame test?
Ans:	The given salt has to be converted to the chloride salt as only chlorides are volatile and thermally ionizable.
19.	Can conc. H ₂ SO ₄ be used for making paste in flame test?
Ans:	No. All sulphates of gr. V are insoluble precipitates. E.g. BaSO ₄ , CaSO ₄ , SrSO ₄
20.	Mg doesn't impart colour to the flame even though it belongs to Gr.2 in the periodic table along with Ca, Sr and Ba.
Ans:	Because IE of Mg is very high
21.	Why is dil. H ₂ SO ₄ acid used for preliminary test for detecting acid radicals?
Ans:	H ₂ SO ₄ has a higher boiling point while that of HCl is 110°C. In cold any acid can be used. But when heating is done then HCl gas may evolve along with the other gases.
22.	What information do you get when addition of dil. H ₂ SO ₄ for testing acid radicals results in formation of a white ppt?
Ans:	The cations present in the salt may be Pb ²⁺ or Ba ²⁺ , Sr ²⁺ , Ca ²⁺ which have formed insoluble sulphates.
23.	While performing the conc. H ₂ SO ₄ test for preliminary test of acid radicals, why should the solution not to be heated to boiling?
Ans:	Conc. H ₂ SO ₄ itself will decomposes to give SO ₂ gas which may interfere with detection of other gases evolved by the group radicals.
24.	Addition of Cu turnings done to test the presence of NO ₃ ⁻ ions in conc. Acid group. Does the appearance of a blue solution confirm the presence of NO ₃ ⁻ ions due to addition of Cu turnings to the acid solution of salt?
Ans:	No, the appearance of blue colouration in the solution alone does not prove the presence of NO ₃ ⁻ ion. The solution will turn blue in the absence of NO ₃ ⁻ ion also due to reaction of Cu with H ₂ SO ₄ . $Cu + 2H_2SO_4 \rightarrow CuSO_4 + SO_2 + 2H_2O$. In presence of NO ₃ ⁻ the solution turns blue due to formation of Cu(II) nitrate. $Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$. So the solution must be blue and there should be evolution of pale brown gas too.
25.	Can we use Ba(NO ₃) ₂ instead of BaCl ₂ for testing sulphate radical?
Ans:	Yes. We can use Ba(NO ₃) ₂ reagent.
26.	What is Chromyl Chloride test?
Ans:	Used for Cl ⁻ ion. The salt is heated with solid K ₂ Cr ₂ O ₇ and conc. H ₂ SO ₄ the red vapour of chromyl chloride (CrO ₂ Cl ₂) thus evolved are passed through NaOH Solution. The yellow solution is acidified with acetic acid and then lead acetate is added. Yellow ppt. of PbCrO ₄ . (Lead Chromate)
27.	Can water be taken instead of NaOH in Chromyl Chlorides test for passing CrO ₂ Cl ₂ gas?
Ans:	Yes. Water can be taken and CrO ₂ Cl ₂ will give H ₂ CrO ₄ solution. This will also give yellow ppt. with lead acetate solution due to formation of lead chromate.
28.	Why should the test tube be dry in which Chromyl Chloride test is performed?
Ans:	Chromyl Chloride readily reacts with H ₂ O to form chromic acid. $CrO_2Cl_2 + 2H_2O \rightarrow 2HCl + H_2CrO_4$
29.	Why should freshly prepared FeSO ₄ be used in the ring test for nitrate?
Ans:	Ferrous salts are prone to oxidation so the salt of Ferrous Sulphate gets converted to ferric Sulphate and Ferric ion will readily hydrolyse to give red precipitate of Ferric Hydroxide. So a freshly prepared Ferrous Sulphate solution is required.
30.	Why is the original solution prepared in water or HCl for identification of basic radicals?
Ans:	The scheme of analysis of basic radicals is based on test of ions from solution. So the solid salt must be made to dissolve in either water or HCl as metal chlorides.
31.	Why Pb ²⁺ placed in both group I and group II in the scheme of basic radical analysis?
Ans:	The gr-reagent is dil. HCl $Pb^2 + 2HCl \rightarrow PbCl_2 + 2H^+$ PbCl ₂ dissolves in excess of HCl.

	$\text{PbCl}_2 + 2\text{HCl} \rightarrow \text{H}_2[\text{PbCl}_4]$ Hydrochloro plumbous acid (soluble)
32.	Name the gr. Reagents for various gr. In the scheme of basic radical analysis.
Ans:	<p>Gr. I - dil. HCl</p> <p>II - H_2S in presence of dil HCl</p> <p>III - NH_4OH in presence of NH_4Cl</p> <p>IV - H_2S in presence of NH_4Cl and NH_4OH</p> <p>V - $(\text{NH}_4)_2\text{CO}_3$ in presence of NH_4Cl and NH_4OH</p> <p>VI - No specific group reagent.</p>
33.	What is the role of HCl in the ppt ⁿ of group II basic radicals by H_2S ?
Ans:	$\text{HCl} \rightarrow \text{H}^+ + \text{Cl}^-$, $\text{H}_2\text{S} \rightleftharpoons 2\text{H}^+ + \text{S}^{2-}$ The addition of HCl suppresses the ionization of H_2S due to the presence of H^+ (common ion). The conc. Of S^{2-} ion is sufficient to precipitate the sulphides group II as the solubility product of sulphids group II is low.
34.	Why is conc. HNO_3 added before proceeding with the test for group (III) cations?
Ans:	Conc. HNO_3 is added to convert Fe^{2+} to Fe^{3+} by oxidation This is done because ferrous salts are usually contaminated with Fe^{3+} ions due to part oxn by air and is incompletely precipitated by NH_4OH in group III. So it is completely converted to Fe^{3+} and precipitated as $\text{Fe}(\text{OH})_3$.
35.	Why is NH_4Cl added before addition of NH_4OH in precipitation of gr. III cations?
Ans:	$\text{NH}_4\text{Cl} \rightarrow \text{NH}_4^+ + \text{Cl}^-$ The addition of $\text{NH}_4\text{OH} \rightleftharpoons \text{NH}_4^+ + \text{OH}^-$ NH_4Cl suppress the ionisation of NH_4OH due to presence of NH_4^+ (common ion). The equilibrium is shifted to the left and the concentration of OH^- is low. This OH^- is sufficient to cause precipitation of gr.III cations Al^{3+} , Fe^{3+} as hydroxides. If NH_4OH is added first before addition of NH_4Cl then there would be more ionization of NH_4OH & $[\text{OH}^-]$ will be relatively high. It may lead to the precipitation of gr. IV or V cations or even Mg^{2+} as hydroxides.
36.	Can NaCl and NaOH be used in the scheme of basic radical analysis in place of NH_4Cl and NH_4OH ?
Ans:	No. NaCl and NaOH be used in the scheme of basic radical analysis in place of NH_4Cl and NH_4OH as both are strong electrolytes. There will be no common ion effect influencing the ionization of compounds. $\text{NaCl} \rightarrow \text{Na}^+ + \text{Cl}^-$ $\text{NaOH} \rightarrow \text{Na}^+ + \text{OH}^-$ } strong electrolytes Conc. of OH^- will be high and lead to precipitation all the basic radicals of gr III, IV or V and VI
37.	Why is excess NH_4OH added in IV gr before passing H_2S gas?
Ans:	The precipitation of gr IV cations takes place as sulphides. However the conc. of S^{2-} ions required for group VI cations is more than that required for gr. II Cations as the KSP of gr. IV Sulphides is high. $\text{NH}_4\text{OH} \rightleftharpoons \text{NH}_4^+ + \text{OH}^-$ (1) $\text{H}_2\text{S} \rightleftharpoons 2\text{H}^+ + \text{S}^{2-}$ (2) The OH^- ions of step 1 remove the H^+ ions of step (2) thereby shifting the equilibrium (2) to the right the $[\text{S}^{2-}] \uparrow$ which is required for precipitation of gr IV cations.
38.	Can Na_2CO_3 be used as gr. V reagent in place of $(\text{NH}_4)_2\text{CO}_3$?
Ans:	No, Na_2CO_3 cannot be used as a V gr. Reagent because it is a strong electrolyte and will be ionised completely $\text{Na}_2\text{CO}_3 \rightarrow 2\text{Na}^+ + \text{CO}_3^{2-}$. The conc. of Resulting in CO_3^{2-} ions will be high and may lead to the precipitation of gr.V radicals. BaCO_3 , SrCO_3 , and CaCO_3 along with VI gr. (MgCO_3).
39.	In the precipitataion of gr. V radical as carbonates $(\text{NH}_4)_2\text{CO}_3$ is needed as the reagent. NH_4Cl is also needed to supress the ionization of $(\text{NH}_4)_2\text{CO}_3$ so that CO_3^{2-} ions is sufficient to precipitate only gr V cations and not group VI (Mg^{2+}) and Mg CO_3 . Why is NH_4OH also added in gr V?
Ans:	$(\text{NH}_4)_2\text{CO}_3$ always contains some NH_4HCO_3 along with it. NH_4OH is added to convert NH_4HCO_3 to $(\text{NH}_4)_2\text{CO}_3$

40.	Why are Na, K or NH_4^+ ions not precipitated in any groups?
Ans:	The hydroxides sulphides, carbonates and sulphates of these cations are soluble.
41.	Explain why Ba^{2+} , Sr^{2+} and Ca^{2+} are analysed in the same sequence.
Ans:	Both BaSO_4 & SrSO_4 are insoluble in water. Oxalate of Ba^{2+} and Sr^{2+} are also insoluble like CaC_2O_4 . Only BaCrO_4 dissolves in acetic acid.
42.	When NH_4OH is added to CdSO_4 the solution remains colourless. Why?
Ans:	Colourless complex is formed $\text{CdSO}_4 + 4\text{NH}_4\text{OH} \longrightarrow [\text{Cd}(\text{NH}_3)_4]\text{SO}_4 + 4\text{H}_2\text{O}$

CHROMATOGRAPHY

1.	What is chromatography?
Ans:	It is a technique used for separation, purification and identification of mixture of substances.
2.	What is the principle of Chromatography?
Ans:	It is based on the principle of different rates of adsorption of components from a moving phase into fixed phase under the influence of the solvent. Based on selective distribution of the various constituents of a mixture between 2 phases.
3.	What is R_f value?
Ans:	Retention factor or 'ratio of front's'. It is measuring as the ratio of the distance travelled by the component to the distance travelled by the solvent from origin.
4.	What does R_f value depend upon?
Ans:	R_f value is influenced by a. Nature of the paper b. Nature of solvent c. Height of paper d. Temperature
5.	What is a chromatogram?
Ans:	The filter paper on which the components have been separated is called chromatogram.
6.	What is resolution?
Ans:	It is the degree of separation of the components after development on the chromatogram.
7.	What type of solvents are usually used in Chromatography?
Ans:	For an effective separation, the solvents which are generally employed are of low viscosity. The rate of flow of the solvent is inversely proportional to its viscosity.
8.	What happens when the filter paper strip touches the walls of the jar during development?
Ans:	An uneven flow of solvent takes places and so the spots are not separated.
9.	How liquid rises up through the Whatman filter paper ?
Ans:	Liquid rises up through the filter paper by capillary action.
10.	What characteristics are essential for the solvent to be used in paper chromatography?
Ans:	Organic liquid of low viscosity are used as solvent in paper Chromatography . It is because the rate of rise of solvent on the paper is inversely related to the viscosity of the solvent.
11.	What are common uses of Chromatography in life science?
Ans:	Separation of amino acids from the mixture Separation of components of chlorophyll Separation of carbohydrates present in the mix Separation of nucleic acids
12.	Eluent
Ans	The mobile phase is called as eluent.