

**CHAPTER 1: PHARMACEUTICAL ANALYSIS****(a) Pharmaceutical analysis- Definition and scope**

- i) Different techniques of analysis
- ii) Methods of expressing concentration
- iii) Primary and secondary standards.
- iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, Sulphuric acid, potassium permanganate and ceric ammonium sulphate

**(b)Errors:** Sources of errors, types of errors, methods of minimizing errors, Accuracy, precision and significant figures

**(c)Pharmacopoeia,** Sources of impurities in medicinal agents, limit tests

**Questions:**

- 1) Write a note on definition and scope for Pharmaceutical Analysis.
- 2) Define Pharmaceutical Analysis and Describe different techniques involved in Analysis. **OR** Write a brief note on different techniques of analysis. **OR** Write a detailed note on classification of analytical method. **OR** Write a brief note on different techniques of analysis.
- 3) Explain different methods of expressing Concentration of Solution.
- 4) What is primary standard compound? Explain ideal requirements of primary standard compound. **OR** Define Primary and secondary standards with example.
- 5) Explain primary and secondary standards with example. Write a note on Preparation and standardization of molar and normal solutions of hydrochloric acid and sulphuric acid.
- 6) Describe preparation and standardization of 0.1 M sodium thiosulphate solution. **OR** Describe preparation and standardization of Sodium hydroxide, hydrochloric acid, Sulphuric acid, potassium permanganate and ceric ammonium sulphate. **(ANY ONE)** [Also includes in your Practicals].
- 7) Define error. Classify the error and methods of their minimization. **OR** Define Errors and explain its types and How to minimize it. **OR** Explain different types of error. How will you minimize the errors? **OR** Explain error minimization techniques. **OR** Explain different types of error. How will you minimize the errors?
- 8) Classify Errors and explain accuracy and precision in detail.

- 9) Define validation. Enlist analytical validation parameter and explain it in detail.  
**OR** Explain about Accuracy, precision and significant figures of validation.
- 10) Prepare the following four set of data (Mention standard Value)
- Accuracy and no Precision.
  - Precision and no Accuracy.
  - No precision and No accuracy.
  - Accuracy and precision.
- 11) Write note on Pharmacopoeia. Discuss the principle involved in the assay of magnesium sulphate IP'96. **OR** magnesium stearate.
- 12) Discuss briefly various sources of impurities in medicinal agents. **OR** Discuss various sources of impurities.
- 13) Describe sources of impurities in Medicinal agents and Discuss limit test of Chloride. [**ANY ONE LIMIT TEST OF Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, Fe<sup>2+</sup>**]
- 14) Define terms: (i) Primary standard compound (ii) Standardization (iii) Pharmacopoeia (iv) Normality (v) Molality/ Molarity. **OR** Define: Normality, Molality, Mole fraction, Titrant, Stoichiometric end point, Co Precipitation Pharmacopoeia.

**CHAPTER 2:**

**Acid base titration:** Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves

**Non-Aqueous titration:** Solvents, Acidimetry and alkalimetry titration and Estimation of Sodium benzoate and Ephedrine HCl

**Questions:**

1. What is Acid base titration? Describe theories of Acid base titration. OR Explain in brief various acid base theories.
2. Explain in detail theories of acid base indicator. OR Explain in detail theories acid- base indicators. OR Enlist end point detection method in acid base titration and explain Resonance theory.
3. Comment: Why phenolphthalein is colorless at below pH 8.3 and above pH 12.
4. Explain end point detection method in acid base titration.
5. Explain titration curve for the salt of weak base & strong acid. [ANY ONE FROM TYPES OF CURVE]. **OR** Classify Acid base titrations and Explain [ANY ONE] theory involved in titrations of strong, weak, and very weak acids and bases.
6. Write a short note on Neutralization curves. **OR** Explain the neutralization curve of acid base titration with suitable example.
7. Describe Law of Mass action in detail.
8. Discuss Applications of acid base titration.
9. Define buffer solution. Explain in detail Henderson-Hassel Bach equation for finding pH of buffer solution.
10. What is hydrolysis? Derive equation for finding pH of aqueous solution of salt of strong acid and weak base.
11. What is the pH of 10 ml 0.1 M HCl and 40 ml of 0.2 M H<sub>2</sub>SO<sub>4</sub>.
12. Calculate pH of solution resulting by mixing 25ml 0.2 M CH<sub>3</sub>COOH and 40 ml 0.1 M NaOH. pK<sub>a</sub> of CH<sub>3</sub>COOH is 4.75.
13. What would be the pH of 0.01M solution of NH<sub>4</sub>Cl in water at 25°C.
14. Write a note on Non-aqueous titration.
15. Explain basic principle of non-aqueous titration. Write the name of titrants and indicators used in non-aqueous titration.

16. Write a brief note on types of non-aqueous solvents and levelling and differentiating effect of solvent. **OR** Write brief note on levelling and differentiating effect of solvent.
17. What is non-aqueous titration? Give merits, demerits and application of non-aqueous titration.
18. Comment: Water is differentiating solvent for HCl and CH<sub>3</sub>COOH. **OR** Acetic acid is added in preparation of perchloric acid. **OR** Acetic acid is a levelling solvent as well as differentiating solvent.
19. Explain the estimation of sodium benzoate by non-aqueous titration. **OR** Write a note on Estimation of Sodium benzoate and Ephedrine HCl [ANY ONE] by non-aqueous titration. [Estimation of Sodium benzoate Includes in your Practicals].
20. Write a note on solvent, titrant and indicator used for weak acid & weak base in non-aqueous titration.

**CHAPTER 3:**

**Precipitation titrations:** Mohr's method, Volhard's, Modified Volhard's, Fajan's method, estimation of sodium chloride.

**Complexometric titration:** Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.

**Gravimetry:** Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate. Basic Principles, methods and application of diazotisation titration.

**Questions:**

1. Enlist End Point Detection methods in Precipitation titration & Describe Volhard's method in detail.
2. Enlist the end point detection methods in precipitation titration. Explain Mohr's method in detail. OR Explain in detail Mohr's method.
3. Explain in detail Volhard's method of precipitation. **OR** Write a note on Volhard's method of Precipitation titration.
4. Explain in detail Mohr's method/Fujan's method. **OR** Explain estimation of sodium chloride by any one Precipitation titration As Mohr's method, Fajan's method. [Also includes in your Practicals].
5. Comment: Mohr's titration is performed in slightly alkaline condition. OR Give comment: Mohr's titration is carried out in acidic media.
6. Comment: Nitrobenzene is used in Volhard's method.
7. Write a note on factors affecting purity of precipitation.
  
8. What is Complexometric titration? Explain different types of Complexometric titration.
9. Explain different types of EDTA titrations. What are the ideal requirements of metal ion indicators?
10. Write a short note on pM indicator. **OR** Write a note on metallochromic indicator.
11. Explain Masking and Demasking in Complexometry.
12. Write a short note on (I) Masking & Demasking reagents (II) pM indicator
13. Define Ligand and Chelate. Give an account of different types of EDTA titrations.

14. Explain estimation of Magnesium sulphate (Direct Titration)/ Calcium gluconate (Replacement Titration). [Also includes in your Practicals].
15. Explain ligand and sequestering agent. Write note on Replacement titration.
  
16. What is gravimetric analysis? Discuss steps involved in gravimetric analysis.  
**OR** Explain steps involved in Gravimetric Analysis.
17. Explain co-precipitation and post-precipitation. **OR** Define term: Co Precipitation **OR** Purity of the precipitates Methods. (Co-precipitation and post-precipitation).
18. Explain- how to estimate barium sulphate by gravimetry. **OR** Explain Estimation of Barium Sulphate ( $\text{BaSO}_4$ ).
19. Write Pharmacopoeial application of gravimetric analysis.
20. Explain theory of Von-Weimarn's ratio for relative supersaturation. **OR** Theory of Von Weimarn's ratio for relative super saturation to control the precipitation in gravimetric analysis.
21. What is the solubility of 0.1 N AgCl in water and 0.1 M  $\text{AgNO}_3$  solution. Water constant Conc. of  $1.0 \times 10^{-7}$  M.
22. The  $K_{sp}$  of  $\text{PbI}_2$  is  $1.4 \times 10^{-8}$ . Calculate molar solubility of  $\text{PbI}_2$ .
23. Comment: Electrolyte solution is used for wash precipitate.
  
24. Explain Diazotization titration in detail. **OR** Discuss in detail about Diazotization titration. **OR** Explain basic Principles, methods and application of diazotisation titration.
25. Explain sodium nitrite titration. (which is Diazotization titration)

**CHAPTER 4:****Redox titrations:**

(a) Concepts of oxidation and reduction

(b) Types of redox titrations (Principles and applications)

Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with Potassium iodate

**Questions:**

1. Define oxidizing agent and reducing agent with example and explain Redox indicator in detail. **OR** What is redox titration? Explain redox indicators.
2. Write a detailed note on Redox titration with its types.
3. Enlist different types of redox titrations. Describe iodine methods in detail. **OR** Enlist types of redox titration and explain iodine titration in detail.
4. Enlist different End Point detection method used in redox titration. Discuss them.
5. Give difference between Iodimetry and Iodometry.
6. Enlist redox titration in which starch act as an indicator and explain any one in detail.
7. Comment: Starch indicator should be added near the end point in iodine titration. **OR** [Starch indicator should be freshly prepared.] **OR** [Comment: KI is added in preparation of std. solution of iodine.]
8. Comment: Equivalent wt. of  $\text{KMnO}_4$  changes with the media.

**CHAPTER 5:****Electrochemical methods of analysis**

**Conductometry-** Introduction, Conductivity cell, Conductometric titrations, applications.

**Potentiometry** - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.

**Polarography** - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications.

1. Write a note on Conductometric titrations.
2. Discuss Conductivity cell in detail.
3. Describe factors affecting on conductance. (3 times)
4. Briefly explain the applications of conductometry.
  
5. Write a note on Potentiometric titrations.
6. Classify Potentiometric electrodes and discuss SCE in detail.
7. Enlist different reference electrode used in Potentiometry. Explain Saturated Calomel Electrode. **OR** Define Reference electrode. Enlist types of it and write a note on Saturated Calomel electrode (SCE).
8. Explain methods to determine End Point in Potentiometric titrations.
9. Enlist various electrodes used in potentiometry. Explain NHE in detail.
  
10. Write note on Principle and Ilkovic equation involved in Polarography.
11. Write a note on dropping mercury electrode (DME). **OR** Discuss working, Construction of DME with figure. **OR** Describe Dropping Mercury Electrode. **OR** Write a note on dropping mercury electrode (DME)/Rotating platinum electrode. **OR** Write a note on dropping mercury electrode (DME).
12. Write a short note on Application of Polarography.
13. Define: Polarography, Limiting current, Diffusion current, Migration current, Residual current.