

## PART - A

Answer any **FIVE** of the following: (5x2=10)

- 1) Give the geometry of  $[\text{BF}_4]^-$  using VSEPR theory and justify the geometry.
- 2) How does electro negativity of central atom affect bond angle?
- 3) Urea, a nonelectrolyte in water, acts as an acid in liquid  $\text{NH}_3$  and base in anhydrous  $\text{H}_2\text{SO}_4$ . Justify.
- 4) Among  $\text{Al}^{+3}$ ,  $\text{Au}^+$ ,  $\text{F}^-$  and  $\text{I}^-$ , which of them prefer to react with each other and why?
- 5) What are amphiboles? Give an example.
- 6) What is the structure of  $\text{B}_5\text{H}_9$  by Wade's rule?
- 7) Explain the higher reactivity of interhalogens than their corresponding halogens.
- 8) How Xenon fluorides are excellent fluorinators than other fluorine compounds?

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## PART - B

Answer any **FIVE** of the following (5x10=50)

9. a) Explain the structure of ZnS and calculate the number of  $\text{Zn}^{+2}$  and  $\text{S}^{-2}$  ions in a unit cell of it. (5)
- b) What is limiting radius ratio rule? Give radius ratio for an ion to occupy octahedral site. (5)
- 10.a) Construct molecular orbital diagram for  $\text{N}_2$  and compare its bond order with  $\text{N}_2^{\oplus}$  and  $\text{N}_2^{\ominus}$ . (5)
- b) Set up a Born Haber cycle for the formation of Neon Chloride and Indicate whether the compound is stable?  
 $\Delta H_{IE} = 2080$ ,  $\Delta H_D = 226$ ,  $\Delta H_{EA} = -351$ ,  $\Delta H_{LE} = -840$  ( $\text{KJ mol}^{-1}$ ) (5)
- 11.a) What is HSAB principle? With examples, discuss the applications of HSAB concept. (5)
- b) Explain the relative order of Lewis acid character of  $\text{BX}_3$  Molecules (5)
- 12.a) Explain the importance of molten salts as solvents. (5)
- b) Explain the following with an example: (5)
  - i) Lux-Flood acid and bases
  - ii) Super acids
- 13.a) Explain the classification of silicates. (5)
- b) How are N-and B-substituted borazines synthesized? Give an account of their reactivity. (5)



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SEMESTER I- P.G Examination -M.Sc. Analytical Chemistry

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November -2024

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ORGANIC CHEMISTRY

Time: 2 ½ Hours

Max. Marks: 60

## PART-A

Answer any **FIVE** of the following

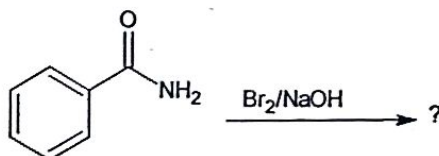
(5x2=10)

- Write down the structures of tautomers of ethylacetate.
- Account for the following order of decreasing basicity.



- Give the order of stability of the following carbocations  
Benzyl, allyl, propyl and methyl

- Predict the product and mention the method of determining this reaction mechanism



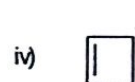
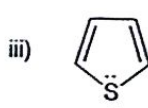
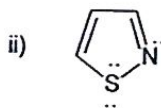
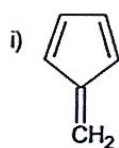
- What is meant by asymmetric synthesis? Given an example
- Differentiate between configuration and conformation isomers
- Write equations to illustrate that the hydroxyl groups of carbohydrates can react to form esters and ethers.
- Write an equation to illustrate the three-step Stork enamine reaction.

## PART-B

Answer any **FIVE** of the following

(5x10=50)

- Write briefly on the following
    - Hyperconjugation
    - Nature of bonding in inclusion compounds
  - Write a note on crown ethers and cryptands
- State Huckel's rule and classify the following compounds into aromatic, non-aromatic or anti-aromatic with proper justifications



(5)

- Discuss the inductive and resonance effects on the strengths of carboxylic acids

(5)

Contd...2

11. a) What are singlet and triplet carbenes? What happens when they are added to olefins? Comment on the stereochemistry of the reactions (5)  
b) Comment on the stability of carbanions and carbenes (5)
12. a) Explain the generation, structure and reactivities of nitrenes (5)  
b) How are the following techniques useful in determining the mechanism of a reaction (5)  
i) Cross-over experiments ii) Kinetic evidences
13. a) Explain the optical activity in biphenyl and allenes (5)  
b) Discuss Prelog's rule and its applications (5)
14. a) Explain the various methods used for resolution of racemic mixtures. (5)  
b) Discuss the effect of conformation on the reactivity of substituted cyclohexanols with appropriate examples. (5)
15. a) Given any two synthetic applications of the following  
i) Darzen condensation  
ii) Chichibabin reaction (5)  
b) Discuss the mechanism of Sharpless asymmetric epoxidation reaction (5)
16. a) Discuss the Synthesis of amino sugars and deoxy sugars (5)  
b) Explain Duff reaction with mechanism (5)

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Semester I – P.G. Examination - M.Sc. Analytical Chemistry

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November –2024

PHYSICAL CHEMISTRY

Time: 2 ½ Hours

Max. Marks: 60

**PART - A**

Answer any **FIVE** of the following: (5x2=10)

1. Write the expression of Duhem-Margulus equation. Give its significance.
2. The free energy change for a process at 25°C is -85.77 kJ and at 35 °C is -83.68 kJ. Calculate the change in enthalpy for the process at 303 K.
3. What is a pseudo-first-order rate constant? How do its dimensions differ from those of a second-order rate constant?
4. Give any two comparisons of hydrogen-halogen reaction
5. How does chemisorption differ from physisorption?
6. What is the effect of temperature on enzyme catalysed reaction?
7. What is the modification done for all DHLL theory?
8. Mention the Number of phases within a Bimodal curve?

**PART - B**

Answer any **FIVE** of the following (5x10=50)

9. a) One mole of solid gold is raised from 25 °C to 100 °C at constant pressure.  $C_p$  (J/K mol) =  $23.7 + 0.00519T$ . Calculate  $\Delta S$  for the transformation. (5)
- b) Explain the variation of Free energy with temperature and pressure by deriving suitable mathematical expressions. (5)
10. a) Derive any two fundamental equations of thermodynamics (5)
- b) Formulate any two Maxwell's relations. (5)
11. a) Discuss the kinetics of parallel reaction with example (5)
- b) Discuss the Hammett relationship and mention its application. (5)
12. a) Derive the equation for primary salt effect. (5)
- b) Derive the linear free energy relationship (5)
13. a) Discuss the kinetics of protolytic mechanism of acid-base catalysis. (5)
- b) Write a note on semiconductor catalysis. (5)
14. a) Discuss the kinetics of unimolecular surface reaction. (5)
- b) Derive Michealis-Menten equation for enzyme catalysis. (5)
15. a) Draw and discuss the phase diagram for a three-component system by taking a suitable example. (5)
- b) Derive DHLL Equation and any one modification (5)
16. a) Discuss the Bjerrum theory of Ion Association (5)
- b) Derive Debye-Huckel-Onsagar equation. (5)

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**St Aloysius (Deemed to be University), Mangaluru**

**SEMESTER I – P.G. Examination – M.Sc. Analytical Chemistry**

**November -2024**

**PRINCIPLES OF ANALYTICAL CHEMISTRY AND SEPARATION TECHNIQUES**

Time: 2 ½ Hours

Max. Marks: 60

**PART - A**

Answer any **FIVE** of the following: **(5 x 2 = 10)**

1. Describe a statistical test or method to compare the standard deviations of two datasets.
2. What is meant by the term "super-saturation" in the context of precipitation reactions?
3. In complexometric titrations, why is it crucial to consider the selectivity of the titration method, especially when analyzing mixtures of metal ions?
4. Mention the types of finger prints.
5. Name two essential components of an HPLC instrument.
6. What is Eddy diffusion?
7. Define the normal error curve (bell curve) and its significance in statistical analysis. How does it relate to the distribution of random errors?
8. What is kinetic marking in EDTA titration?

**PART - B**

Answer any **FIVE** of the following **(5 x 10 = 50)**

9. a) In a set of measurements the following concentrations of Fe (ppm) were reported: 20.2, 20.4, 20.3, 20.1, 19.9, 20.0, and 19.8. Calculate i) Average Deviation ii) Standard Deviation iii) Relative Standard Deviation iv) Coefficient of variation. **(5)**  
b) Compare and contrast the means and standard deviations of two samples. **(5)**
10. a) Write a note on methods of sampling solids. **(5)**  
b) What are organic precipitants? Explain the advantages and disadvantages. **(5)**
11. a) Write a note on forensic toxicology **(5)**  
b) Explain how to plot and interpret a potentiometric titration curve for a redox reaction. How can you determine the end point from the curve? **(5)**
12. a) Describe the procedure for standardization of a potassium permanganate solution using a primary standard. **(5)**  
b) What are chelating agents, and why are they commonly used in complexometric titrations? Provide an example of a chelating agent. **(5)**

Contd...2

13. a) How does LC-MS enhance the specificity and selectivity of compound identification compared to HPLC alone? (5)  
b) Explain the role of temperature in gas chromatography and the application of gas chromatography. (5)
14. a) Write a note on Von-Deemter's plot. (5)  
b) What are the different types of detectors used in HPLC and how do they work? What are the advantages and disadvantages of each type? (5)
15. a. What are the criteria for precipitation and its completeness. (5)  
b. Write a note on sampling hazards and the precautions. (5)
16. a. What is a determinate error? Explain the cause and the consequences. (5)  
b. Explain the theory and principle of size exclusion chromatography. (5)

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**St Aloysius (Deemed to be University)**

**Mangaluru**

**SEMESTER I- PG Examination – M.Sc. Analytical Chemistry**

**November -2024**

**RESEARCH METHODOLOGY**

**Time: 2 ½ hours**

**Max. Marks: 60**

**PART – A**

**Answer any FIVE of the following:**

**(5 × 2 = 10)**

1. How do you generate a statement for a problem?
2. Scopus is important tool to identify good publication. Give two comments on the statement.
3. Give an account on emergency procedure to be followed during chemical accidents.
4. How explosives are disposed in laboratory?
5. Mention the importance of publication ethics
6. List out two rights and obligations of research participants.
7. Define incineration. List the items which must be incinerated in labs.
8. What is the rationale for protecting the IPR?

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**PART – B**

**Answer any FIVE of the following**

**(5x10=50)**

9. a) Discuss the primary and secondary sources of literature review. (5)  
b) Describe the objectives and characteristics of research. (5)
10. a) Write the meaning of h index, impact factor and SciFinder. (5)  
b) Explain briefly how digital web resources help in easy access to journals (5)
11. a) Write a note on first aid and laboratory ventilation requirements for a laboratory. (5)  
b) Explain the process of recovery, recycling and reuse of waste chemicals. (5)
12. a) Give a set of guidelines of using protective apparels, and procedure while handling highly sensitive chemicals. (5)  
b) Explain the process of verification and segregation of laboratory wastes. (5)
13. a) Give elaboration on ethics versus moral philosophy concepts. (5)  
b) Write a note on intellectual honesty and research integrity. (5)
14. a) How is falsification different from fabrication of scientific data? Explain. (5)  
b) Write any four forms of IPR with suitable example. (5)
15. a) Differentiate between plagiarism, falsification and fabrication (5)  
b) Discuss the concept and characteristics of IPR. (5)
16. a) Define obsolete chemical waste. List the categories of hazardous chemical waste (5)  
b) Write a note on storage and labeling of hazardous chemical waste (5)

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