PS1GPHC500/PS1HPHC500 Reg. No.: | | | | | | | | |

St Aloysius (Deemed to be University)

Mangaluru

School of Physical Sciences (PG Programme)

M.Sc. Chemistry/Analytical Chemistry –Semester I-PG Examination

October/November-2025

Inorganic Chemistry

Time: $2^1/_2$ Hours **Max Marks: 60**

SECTION – A

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

1. What are the coordination numbers of metal ions in the crystals of CsCl and ZnS?
2. State and explain Pauli's Exclusion Principle.
3. Discuss the merits of Bronsted-Lowry acid and base concept.
4. Compare Brønsted and Lewis superacids with suitable examples.
5. What is meant by a three-centre two-electron (3c–2e) bond? Give an example from higher boranes.
6. Predict whether boron and silicon will form acidic, basic or amphoteric oxides and justify your answer.
7. Which is more stable: chloric acid or perchloric acid?
8. List any four properties of Noble gases.

SECTION - B

Answer any TEN of the following. **(10x5=50)**

9. Explain the concept of hybridization in Valence Bond Theory. How does hybridization affect the bonding in molecules?
10. Discuss why bond strength in a N_2 molecule is greater than that in F_2 molecule using MO Theory.
11. Analyze how the presence of hydrogen bonds affects the boiling and melting points of molecules.
12. Discuss Pearson's principle of HSAB and any two applications of it.
13. Arrange perchloric acid,Chloric acid,Chlorous acid and hypochlorous acid in the order of increasing acidic strength and justify.
14. Write a note on the reactions in liq NH_3, liq SO_2 as non-aqueous solvents.
15. What are Pyroxenes and amphiboles?Give their structure.
16. Analyze the bonding in B_2H_6 using molecular orbital theory and discuss how electron counting explains its structure.
17. Differentiate between borazine and benzene with respect to their chemical properties.
18. Compare and contrast the electron configurations of nitrogen and phosphorus, highlighting their similarities and differences.
19. Write a note on Linear Polyphospazenes and their applications.
20. Explain the general physical and chemical properties of interhalogens.

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St Aloysius (Deemed to be University), Mangaluru

School of Physical Sciences (PG Programme)

M.Sc. Chemistry/ Analytical Chemistry - Semester I –PG Examination

October/November 2025

Research Methodology

Time: $2^1/_2$ Hours **Max Marks: 60**

SECTION – A

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

1. What is conceptual research?
2. Define a research problem and its significance in the research process.
3. How do peer-reviewed journal articles differ from other sources of information, such as websites or magazines?
4. What is a corrosive chemical waste? Give example.
5. What should personnel do immediately in the event of a gas leak when working with high-pressure levels?
6. Mention two factors contributing to unethical conduct.
7. What types of inventions are eligible for patent protection
8. Provide an example of a research obligation towards participants.

SECTION - B

Answer any TEN of the following. **(10x5=50)**

9. Differentiate between two types of e-journals.
10. Explain the concept of induction and the steps involved in this research process.
11. Identify and explain two advantages of using specialized search engines like SciFinder for chemical research.
12. Write a detailed note on research gap
13. Write a note on lab related energencies.
14. Can you describe the procedures for handling, transporting and transferring flammable or explosive substances safely?
15. List out the materials that should never be disposed of through the sanitary sewer system?
16. Explain the concept of "incompatibility" when segregating laboratory waste. Provide specific examples of incompatible waste materials and the risks associated with mixing them.
17. Write a note on prevention of publication misconduct
18. Define geographical indications (GIs) and discuss their role in identifying and protecting products associated with specific regions
19. What are the characteristics of Intellectual property rights (IPRs)
20. Explain scientific conduct in research

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St Aloysius (Deemed to be University), Mangaluru

School of Physical Sciences (PG Programme)

M.Sc. Chemistry/ Analytical Chemistry –Semester I –PG Examination

October/November 2025

Organic Chemistry

Time: $2^1/_2$ Hours **Max Marks: 60**

SECTION – A

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

1. Define inclusion compounds and give an example involving cyclodextrins.
2. Which among CH_3COOH, CCl_3COOH and CF_3COOH is stronger acid? Justify your answer.
3. How do you study the reaction mechanism by Isotopic labeling techniques?
4. Write a note an stereospecific reactions of carbene
5. Describe the advantages of using Newman projections when studying the conformational behavior of alkanes.
6. How does the Sharpless asymmetric epoxidation differ from traditional epoxidation methods?
7. What are chitins? Give its structure
8. Explain with example the mechanism of Claisen Schmidt reaction.

SECTION - B

Answer any TEN of the following. **(10x5=50)**

9. Discuss formation and reactions of sulphur ylides.
10. How to assign the nomenclature for the conformations of biphenyls and allenes?
11. Compare the conformations of cyclic systems observed in cyclopentane and cycloheptane with proper representations.
12. Explain the mechanism of benzoin reaction
13. Discuss the synthesis of acetal and ketal sugars
14. Compare and contrast the aromatic properties of benzenoid and non-benzenoid compounds. Provide examples of each type and discuss their aromaticity.
15. Explain the mechanism of Duff rearrangement reaction.
16. Explain how the configuration of a molecule can be determined using the Cahn-Ingold-Prelog priority rules.
17. Explain the concept of resolution of racemic mixtures. Detail about any 5 methods.
18. Explain the key step in the Wittig reaction mechanism that leads to the formation of an alkene.
19. Describe the chemical synthesis of deoxysugar and amino sugars.
20. Detail the mechanism and importance of Crams rule in predicting the stereospecific product.

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St Aloysius (Deemed to be University), Mangaluru

School of Physical Sciences (PG Programme)

M.Sc. Chemistry/ Analytical Chemistry –Semester I-PG Examination

October/November-2025

Physical Chemistry

Time: $2^1/_2$ Hours **Max Marks: 60**

SECTION – A

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

1. Define entropy in the context of thermodynamics.
2. Define cryoscopy.
3. What is the integrated rate expecession for 2^{nd} order reaction?
4. What is a substituent constant?
5. Compare BET adsorption isotherm and the Langmuir adsorption isotherm.
6. Distinguish enzyme catalysis with heterogeneous catalysis.
7. What is the significance of conductance minima in the conductometric titration of weak electrolytes?
8. What is a plait point in three component phase diagram?

SECTION - B

Answer any TEN of the following. **(10x5=50)**

9. Derive the Duhem-Margules equation.
10. What are the challenges of applying the third law of thermodynamics to experimental determination of absolute entropies?
11. How do you calculate molal Ebullioscopic constant using Raoult's law?
12. Explain the features and construction of the potential energy surfaces.
13. Explain the kinetics of a branched chain reaction.
14. For a consecutive reaction of the type A + B + C explain how the rate constants k_1 and k_2 affect the concentration of the intermediate.
15. List any five industrial applications of catalysis.
16. Differentiate between homogeneous and heterogeneous catalysis with examples.
17. Prove that prototropic mechanism is general acid catalysed irrespective of the type of intermediates formed.
18. Describe the Debye-Huckel limiting law (DHLL) and explain its relationship to the behavior of electrolyte solutions at infinite dilution.
19. Derive DHO equation and Validate the same.
20. Based on the three component system, discuss two and three partially miscible component systems.

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St Aloysius (Deemed to be University)

Mangaluru

School of Physical Sciences (PG Programme)

M.Sc. Chemistry/Analytical Chemistry - Semester I –PG Examination

October/November 2025

Principles of Analytical Chemistry and Separation Techniques

Time: $2^1/_2$ Hours **Max Marks: 60**

SECTION – A

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

1. Define the normal error curve (bell curve) and its significance in statistical analysis. How does it relate to the distribution of random errors?
2. Define median.
3. What is the primary goal of precipitation in gravimetric analysis?
4. How is an overall stability constant different from a stepwise stability constant in complexation chemistry?
5. In what type of titration would you prefer to use potentiometric endpoint detection over visual indicators, and why?
6. A sample of pure As_2O_3 weighing 0.2068g is dissoved in NaOH and the solution is acidified with HCl and titrated with 42.46ml of a permanganate solution. Calculate the normality of the permanganate. MnO_4 is reduced to Mn^{2+}, and As(III) is oxidised to As(V).
7. Name one application of gel filtration chromatography in biochemistry.
8. Name two primary classifications of chromatographic methods based on the nature of the stationary phase.

SECTION - B

Answer any TEN of the following. **(10x5=50)**

9. Calculate average deviation and standard deviation for 0.184, 0.178, 0.169,0.172, 0.170, 0.185.
10. Outline the principles of sampling and the steps involved.
11. What are the criteria for precipitation and its completeness?
12. Write a note on Q-test giving suitable examples.
13. Describe the direct titration method employing EDTA. Include a step-by-step procedure and an example application.
14. Discuss on the different types of indicators in redox titrations
15. Write a note on the chemical methods to determine the finger prints.
16. Give an account of classification of poisons.

Contd...2

17. Explain the principle of gel permeation chromatography.
18. What are the different types of pumps used in HPLC and how do they work? What are the advantages and disadvantages of each type?
19. Explain how GC-MS can be used for the qualitative and quantitative analysis of compounds in complex mixtures.
20. Discuss the impact of column length and diameter on the separation efficiency in gas chromatography. How do these parameters influence resolution and analysis time?

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