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PS1HPHC600

Reg. No.:

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

**Mangaluru**

**School of Physical Sciences (PG Programme)**

**M.Sc. Chemistry/ M.Sc. Analytical Chemistry**

**Semester III – PG Examination**

**October/November - 2025**

**ORGANOMETALLIC, BIOINORGANIC AND COORDINATION CHEMISTRY**

Time: 2<sup>1</sup>/<sub>2</sub> Hours

Max Marks: 60

**SECTION – A**

Answer any **FIVE** of the following.

(5x2=10)

1.  $d^8$  - square planar complexes are stable although they do not obey the 18-electron rule. Explain.
2. Illustrate the use of hepto notations in organometallic compounds.
3. Give reaction for isomerization of olefins using organometallic compound.
4. What is the role of iodide in Monsanto acetic acid process?
5. Differentiate between active transport and passive transport.
6. What is transferrin? Mention its function.
7. How geometry of transition metal complexes effects on the rate of substitution reaction.
8. What are complimentary reactions? Give example.

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**SECTION - B**

Answer any **TEN** of the following.

(10x5=50)

9. What is Wilkinson's catalyst? Illustrate its application in the hydrogenation of olefins.
10. Explain the mechanism of polymerization of propene using Ziegler-Natta catalyst. The catalyst generally given stereo regular polymer. Why?
11. Explain bonding and reactions in cyclobutadiene based co-ordination complexes.
12. What are Fischer and Schrock carbenes? Give an account of these synthesis and reactivity.
13. Explain synthesis and bonding in ferrocene.
14. Describe the catalytic cycle of hydroformylation reaction.
15. Write the role of hemoglobin in acid base balance and carbon dioxide transport.
16. Write any four applications of nitrogen fixation.
17. Compare and contrast the structural differences between Hemocyanin and Hemerythrin, and explain how these differences relate to their oxygen-binding mechanisms.
18. Design two-step syntheses of cis-and trans-[PtCl<sub>2</sub>(NO<sub>2</sub>)(NH<sub>3</sub>)]<sup>-</sup> starting from [PtCl<sub>4</sub>]<sup>2-</sup>.
19. Compare and contrast inner sphere and outer sphere reactions in terms of their mechanisms, reaction conditions, and examples. What distinguishes one from the other?
20. Write the reactions involved in dissociative and associate reaction mechanisms and create corresponding reaction profiles.

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**October/November - 2025**

**MOLECULAR SPECTROSCOPY**

Time: 2<sup>1</sup>/<sub>2</sub> Hours

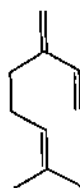
Max Marks: 60

**SECTION - A**

Answer any **FIVE** of the following.

(5x2=10)

1. What is the significance of referencing in NMR spectroscopy?
2. What information about molecular conformation and dihedral angles can coupling constants provide in NMR spectroscopy?
3. How can the Karplus relationship be useful in determining molecular conformation?
4. Determine the  $\lambda_{\max}$  of the following organic compound:



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5. What are overtone bands?
6. State and explain Beer-Lambert law.
7. Write one fragmentation pathway typical for phenols, observed in mass spectrum.
8. Write a note on the peak that shows maximum intensity in a mass spectra.

**SECTION - B**

Answer any **TEN** of the following.

(10x5=50)

9. Examine the role of relaxation techniques in NMR spectroscopy. How can these techniques enhance the analysis of complex spectra?
10. How does the spin-spin coupling mechanism work in NMR spectroscopy?
11. Explain the concept of shielding in NMR spectra and how it can be used to confirm the presence of certain functional groups.
12. Elucidate the structure of an organic compound that exhibited the following spectral data: IR: 1690 PMR: 2.5 (s, 3H), 3.8 (s, 3H), 6.9 (d, 2H, J = 8 Hz) 7.8 (d, 2H, J = 8Hz)<sup>13</sup>CMR : 26, 56, 114, 129, 130, 165, 197 Provide stepwise explanation.
13. Write a note on Simultaneous determination as one of the advantages using UV-Visible spectroscopy.
14. Differentiate between the Butane and 1- Butene using IR spectrum.
15. Calculate the wave number of stretching vibration of C=C bond. Given: Force constant,  $k=10 \times 10^5$  dynes  $\text{cm}^{-1}$
16. Using suitable examples for each, differentiate between a aliphatic and aromatic alcohol, using IR spectroscopy.
17. Benzoyl chloride exhibits strong peaks at  $m/z$  140, 105, and 77. Discuss the fragmentation pattern responsible for these ions.
18. Benzamide shows strong peaks at  $m/z$  121 and 105. Describe the reasons for these fragmentations.
19. Explain the principle of mass spectrometry.
20. Describe the basic fragmentation types observed in mass spectrometry.

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