M. SC. CHEMISTRY EXAMINATION, 2025

(3rd Semester)

PAPER : XII-I

[Inorganic Chemistry (Special)]

Time : *Two Hours* *Full Marks* : 40

(20 marks for each part)

Use a separate answer script for each part

UNIT—I–3121 **CO–1**

1. Answer *any* **four** of the following :

(a) What are hydrolytic metallo-enzymes? With the help of schematic diagram highlight the role of the metal ion in one such enzyme. 1+1½

(b) What are the essential differences in cis-Platin and Rh(II)-carboxylates acting as DNA targeting agents? 2½

(c) Mention essential features that enabled cis-Platin to act as an effective anticancer agent. With two examples discuss drug design beyond cis-Platin. 1+1½

(d) With suitable model studies, explain the methyl transfer reaction mediated by Vitamin B_{12}. 2½

(e) Discuss the role of Vitamin B_{12} as a coenzyme in the reduction of ribonucleotide to 2′-deoxyribonucleotide in biological systems. 2½

2. Answer *any* **two** of the following : 5×2=10

(a) Draw the structure of the active site in cytochrome C oxidase. Why does it exhibit unusual magnetic properties and EPR spectrum? Discuss its mechanistic pathway for oxygen reduction. 1+2+2

(b) Mention the unique role of anion (carbonate/bicarbonate) in transferrin. Mention different parts of Ferritin. Why is it used as an example for bio-mineralization? 2+2+1

(c) Mention the unique role of the metal ion present in chlorophyll. What do you mean by photophosphorylation? How does the Oxygen Evolving Complex (OEC) work in the Kok cycle? 2+1+2

(d) What is ferryl complex? Mention the structural difference found in Peroxidase and Myoglobin. Mention their behaviour towards molecular oxygen. 1+2+2

UNIT—I–3122

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Answer *any* **five** questions : 2×5=10

1. *(a)* Categorize polymorphs with respect to their stability over certain temperature and pressure range. Draw the structure of the molecule which has highest numbers of polymorphs reported so far.

(b) Define P-type and T-type photochromic materials with examples. What do you mean by Z_{50} and $t_{1/2}$ of a photochromic material?

(c) Define electrochromic materials with examples. Explain the mechanism of electrochromism in WO_3 mentioning redox reaction.

(d) Depict and explain superhydrophilic, hydrophilic, hydrophobic and superhydrophobic materials in the context of contact angles.

(e) What is shape memory material? Briefly explain shape memory effect in NiTinol.

(f) "A 'centrosymmetric' crystal cannot exhibit piezoelectric behaviour" — explain with pictorial depiction.

(g) Define thermochromism and its mechanism of colour switching by taking an example of inorganic complex.

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2. *(a)* Write any four differences between homogeneous catalysis and heterogeneous catalysis.

(b) What is a photosensitizer and how does it help in photocatalysis?

(c) Write a rate expression for an adsorption reaction when cumene (C) adsorbs during its decomposition.

(d) Write down the intermediates (schematic diagram) for the following reaction :

$$N_2 + H_2 \xrightarrow{\text{Catalyst}} NH_3$$

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