

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1706

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Unique Paper Code : 2172014801

Name of the Paper : Advanced Chemistry – II

Name of the Course : **B.Sc. (Hons) Chemistry**

Semester : VIII

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **three** sections in this paper.
3. Attempt any **two** questions from each section.
4. In total, you must answer **six** out of **nine** questions.
5. **All** questions carry equal marks.
6. Attempt all parts of a question, and all questions of a section together.

SECTION – A

1. (a) Discuss the role of biomineralization in the formation of bones, teeth, and shells.
(b) Explain the role of biocatalysts in metabolism of carbon.
(c) Describe the biological significance of nickel ions in living systems.
(5,5,5)
2. (a) Describe the composition and function of dentin in natural teeth.
(b) Discuss the antimicrobial role of silver nanoparticles in biomedical applications.
(c) Differentiate between hydroxyapatite and tricalcium phosphate in bone repair.
(5,5,5)
3. (a) Discuss the biomedical applications of stainless steel as an implant material.
(b) Compare natural bone with synthetic calcium phosphate ceramics.
(c) Give the role of metal ions in medicines.
(5,5,5)

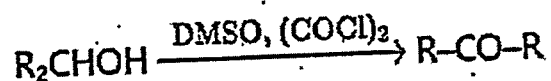
P.T.O.

SECTION - B

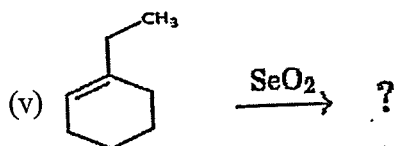
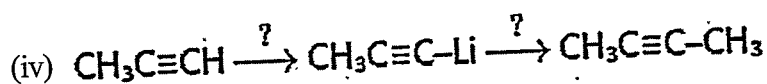
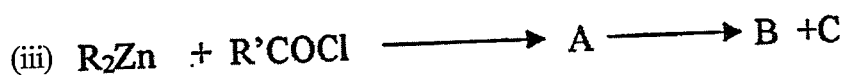
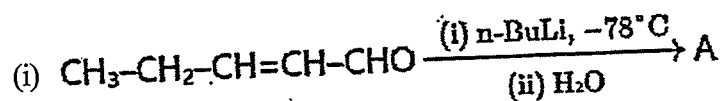
1. (a) How is iodomethyl zinc chloride prepared? Give its reaction with propene with mechanism and name of the reaction.
- (b) Discuss the role of Collin's reagent and PCC in oxidation.
- (c) Write the full form and structure of DIBAL-H. Complete the following reaction and write its mechanism.



2. (a) Discuss with mechanism the polyhydroxylation of trans-crotonic acid in presence of KMnO_4 with stereochemistry involved.
- (b) Give the name and mechanism of the following reaction.



- (c) Complete the following reactions :



(5,5,5)

3. Write short notes on the following (Attempt **any three**)

- (a) Oxidation by thallium nitrate
- (b) Hydroboration-oxidation
- (c) PTC and crown ether
- (d) Organo aluminium compounds

(5,5,5)

SECTION – C

1. (a) Derive the Stirling's approximation. Write its significance in statistical mechanics. Calculate $\ln 100!$ using Stirling's approximation.
(b) Explain the concept of Microcanonical and Canonical ensemble. Discuss their main features and assumptions. To study an isolated system which ensemble would you choose and what will be its characteristic thermodynamic function?
(c) Why is the partition function also known as the store house of information. Give examples to justify it.
(5,5,5)
2. (a) Derive the condition under which Maxwell-Boltzmann statistics becomes valid for a quantum system (Fermi-Dirac and Bose Einstein Statistics).
(b) For a system whose internal energy is zero and partition function is 10 at 300 K. Calculate Gibbs free energy. Helmholtz free energy and entropy of the system in a canonical ensemble.
(c) What are the key features of a random walk problem in 1-Dimension? Which real life problem does it mimic? If a particle starts from the origin and takes N steps, does it ever return to origin? Under what condition will returning to origin become impossible?
(5,5,5)

P.T.O.

3. (a) A polydisperse sample of polymethyl methacrylate (PMMA) is prepared by mixing three monodisperse samples in the following proportions:

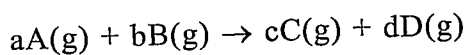
$$1g = 10,000 \text{ g/mol}$$

$$2g = 50,000 \text{ g/mol}$$

$$2g = 100,000 \text{ g/mol}$$

Using this information calculate the number average molecular weight, weight average molecular weight and polydispersity index of the mixture.

- (b) Why is the Conventional Transition State Theory (CTST) also known as the Activated Complex Theory (ACT)? Derive an expression of rate constant in terms of partition function for a given general reaction :



- (c) Calculate the ratio of translation partition functions for same volume of two gases A & B at 300 K and 900 K. If the temperature is kept constant and volume increased from 2 L to 8 L, how do this ratio change? (5,5,5)