

CSM—19/24
PART—II/PAPER—VII
CHEMISTRY
PAPER—II

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Time : 3 Hours

Full Marks : 250

The question paper contains 18 (Eighteen) questions in GROUP—A, (12) and GROUP—B, (06) together.

GROUP—A

Candidates to attempt 10 (ten) questions within word limit of 250.

Each question carries 15 marks.

1. What is the role of photochemical rearrangements such as Photo-Fries and di-pie methane rearrangements in organic synthesis? Explain their mechanisms with suitable examples.
2. Illustrate with examples the specific use of Lead tetraacetate as acetoxyating, methylating and oxidizing reagent.
3. Describe the Sandmeyer reaction and its mechanism.
4. Describe the general methods used to study the mechanisms of organic reactions, highlighting both kinetic and non-kinetic approaches. How is the use of isotopes helpful in understanding reaction mechanism? Provide suitable examples with reactions.
5. Discuss the mechanism of Wolff rearrangement. How has the reaction been utilized in Arndt-Eistert homologation of acids?
6. Discuss the mechanism and significance of Norrish Type—I and Type—II reactions in photochemistry. Provide relevant examples to support the explanation.

7. What are the conditions for aromaticity? What is Hückel's rule? Name five compounds that obey this rule. Show the aromaticity in annulenes. Why cyclodecapentaene [10]-annulene does not exhibit aromaticity?
8. How can the mass spectrum be used to find the molecular formula of the compounds? What are metastable ions or peaks? Illustrate the mass spectra of Neopentane and Dodecane.
9. What are Chugaev Elimination and Cope Rearrangement reaction? Write their mechanisms.
10. Explain the significance of energy diagrams in understanding the electrophillic and nucleophillic reactions. Illustrate the reaction mechanisms with suitable energy diagrams and organic reaction examples.
11. Define number-average molecular weight and weight-average molecular weight. How the polystyrene is prepared and how its molecular weight is calculated?
12. Explain the importance of FMO approach in predicting pericyclic reaction outcomes and using the same, predict whether {2+2} cycloaddition is allowed thermally or photochemically.

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GROUP—B

Candidates to attempt 05 (five) questions within word limit of 300.

Each question carries 20 marks.

13. What are the key features of Diels-Alder reactions? Explain why it is thermally allowed. Write the complete mechanism of it between 1,3-butadiene and ethane.
14. What are *E1* and *E2* reactions? What are their characteristics and by which factors their reaction rates are influenced?
15. Explain the differences between singlet and triplet states in photochemistry. How do these states influence photochemical reactions?

16. Define free radicals. How are they generated? Show all methods. Enumerate their stability.
17. State the Woodward-Hoffmann rule for cycloaddition reactions. How do symmetry considerations determine whether a reaction is allowed or forbidden? Predict the product of the following electrolytic reactions using WH rules and justify your answer :
- (i) Hexa-2,4-diene $\rightarrow$? (Thermal conditions)
- (ii) Octa-2,4,6-triene $\rightarrow$? (Photochemical conditions)
18. Define and discuss the mechanism of Cannizzaro reaction mentioning crossed and intermolecular reaction. How has it been established that a direct transfer of hydride ion takes place from one aldehyde to the other? Give some of its applications.

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