

# MIZORAM PUBLIC SERVICE COMMISSION

## GENERAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF JR. GRADE OF MIZORAM FOREST SERVICE (ASST. CONSERVATOR OF FORESTS) UNDER ENVIRONMENT, FOREST & CLIMATE CHANGE DEPARTMENT, GOVERNMENT OF MIZORAM, 2023

### CHEMISTRY

Time Allowed : 3 hours

Full Marks : 100

*The figures in the margin indicate full marks for the questions.*

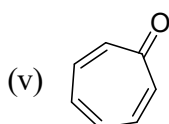
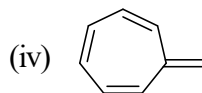
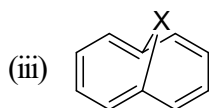
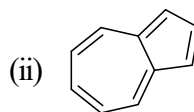
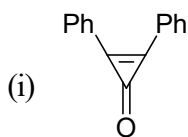
*Answer any 10 (ten) questions  
taking 5 (five) questions from each section.*

#### SECTION - A

- (a) What are the significance of principal and azimuthal quantum numbers? (5)
  - (b) Write the molecular orbital energy level diagram of  $N_2$  molecule and explain its difference from the MO diagram of  $O_2$ . (5)
- (a) What do you mean by stoichiometric defect? Make a comparison of Schottky and Frenkel defects. (1+4=5)
  - (b) Give an account on Maxwell's distribution of molecular velocities. Explain how velocities change with temperature. (5)
- (a) Derive an expression for entropy change of an ideal gas associated with temperature and volume. (5)
  - (b) Draw and discuss the phase diagram for the water system. (5)
- (a) Give an account of the Debye-Huckel theory of strong electrolytes and explain the asymmetry effect. (5)
  - (b) Discuss the effect of temperature on the rate of reaction. (5)
- (a) Discuss the kinetics of hydrogen-chlorine reaction and comment on the quantum yield. (5)
  - (b) Derive an expression for Langmuir's adsorption isotherm. (5)
- (a) How does crystal field theory differ from valence bond theory? How does CFT account for the fact that  $[CoF_6]^{3-}$  is paramagnetic but  $[Co(NH_3)_6]^{3+}$  is diamagnetic? (2+3=5)
  - (b) By taking a suitable example, discuss the bonding in the metal olefin complex. (5)
- (a) What is meant by lanthanide contraction? What are its causes? (5)
  - (b) What do you mean by the solvent-system concept of acid and base? Explain the neutralization reaction in liquid ammonia by using this concept. (5)

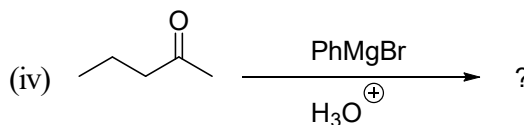
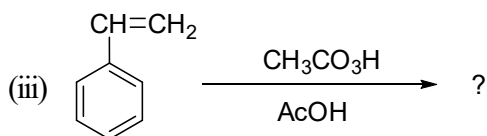
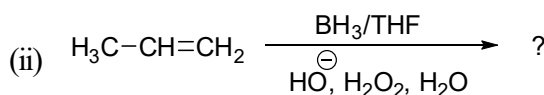
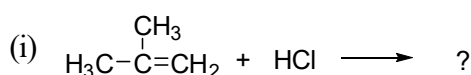
**SECTION – B**

8. (a) Designate each of the following as Aromatic or Antiaromatic: (5×1=5)

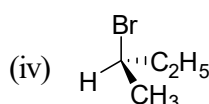
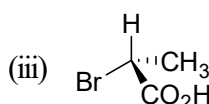
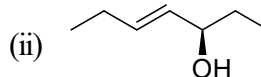
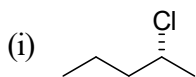


(b) Explain the mechanism of Hoffmann elimination pathway taking suitable examples. (5)

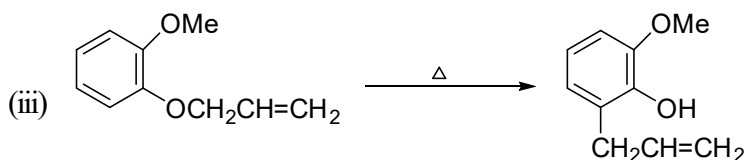
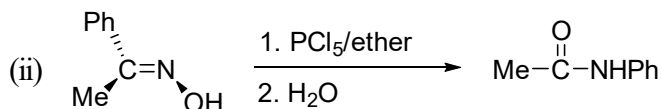
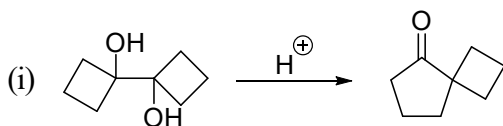
9. (a) Write the major product of each of the given reactions: (4×1.5=6)



(b) Assign R or S configuration of the following compounds: (4×1=4)

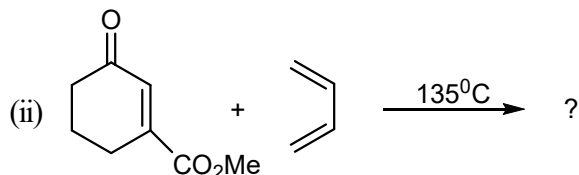
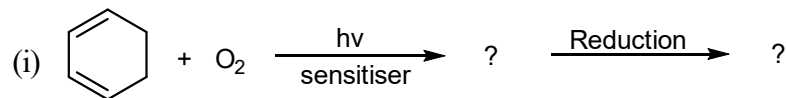


10. Propose suitable mechanisms for the following reactions. (Any two): (2×5=10)

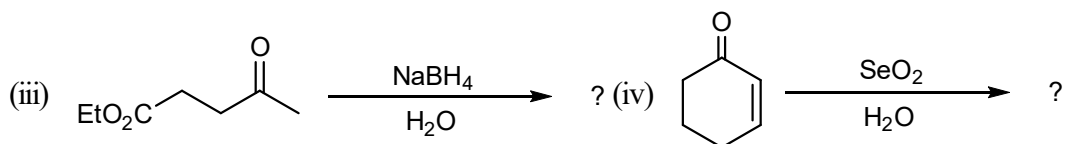
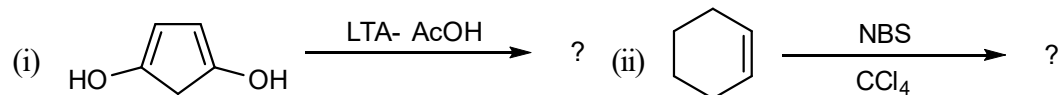


11. (a) Based on Woodward-Hoffmann rule explain the electrocyclic interconversion of Cyclobutene – Butadiene system. (5)

(b) Complete the following reactions (mechanism not required): (3+2=5)

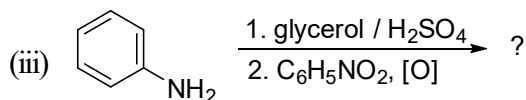
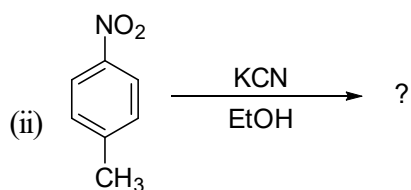
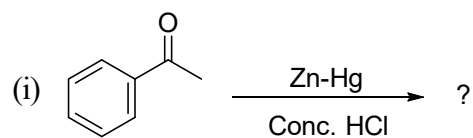


12. (a) Complete the following reactions: (4×1.5=6)

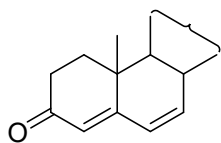


(b) Equal number of polymer molecules with  $M_1 = 10,000$  and  $M_2 = 100,000$  are mixed. Calculate  $\bar{M}_n$  and  $\bar{M}_m$ . (4)

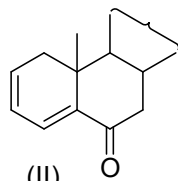
13. Predict the products with suitable mechanisms for the following reactions (Any two): (2×5=10)



14. (a) The following polyene show  $\lambda_{\max}$  at 284 nm ( $\epsilon = 28000$ ) and 315 nm ( $\epsilon = 7000$ ) in ethanol. Find out which is which? (5)



(I)



(II)

- (b) An organic compound ( $C_2H_4O$ ) shows  $^1H_{NMR}$  signals as:  $\delta = 2.14$ , singlet and  $\delta = 9.78$ , quartet. Identify the compound. (3)
- (c) Explain Mc-Lafferty rearrangement taking suitable examples. (2)

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