

- N.B. :** (1) All questions are compulsory
 (2) Figures to the right indicate full marks.

1. (A) Answer any **two** of the following :-

- (a) Draw Frost Musulin diagrams for benzene and cyclooctatetraene. Show the distribution of electrons in the MOs and comment on their aromaticity. 4
- (b) What is the structure of azulene (C₁₀H₈) ? Explain its aromaticity and high dipole moment. 4
- (c) Answer the following :- 4
- (i) What are homoaromatic compounds ? Give an example.
- (ii) Comment on the aromaticity of [14] annulene.
- (d) Draw the π MOs of a diene and a dienophile showing electron distribution. Label the FMOs and show their interaction in Diels-Alder reaction. 4

(B) Answer any **one** of the following :-

- (a) Draw the π MOs of ethene and butadiene by LCAO method. Explain the effect of conjugation on the UV spectra of ethene and butadiene. 4
- (b) Draw a π MO diagram to show the relative energies of the MOs of formaldehyde and ethene. Explain their reactivity with nucleophiles on the basis of their FMOs. 4

2. (A) Answer any **two** of the following :-

- (a) What is an E₁cB reaction ? Give one example with mechanism. 4
- (b) Explain the use of the following techniques in proving the benzyne mechanism of aromatic S_N. 4
- (i) Product analysis
- (ii) Detection and trapping of intermediates.
- (c) Explain the following :- 4
- (i) Trifluoroacetic acid is a stronger acid than acetic acid
- (ii) Salicylic acid is more acidic than p-hydroxybenzoic acid
- (d) Arrange the following in increasing order of basicity and explain : 4
- aniline, ethylamine, diphenylamine, diethylamine.

(B) Answer any **one** of the following :-

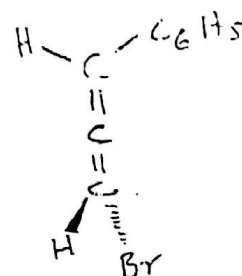
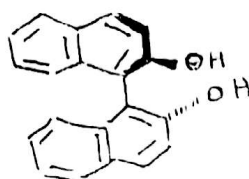
- (a) What is the principle of microscopic reversibility ? Explain its significance in the kinetic vs thermodynamic control of organic reactions with the help of a potential energy diagram. 4
- (b) Answer the following : 4
- (i) Give equations specifying reaction conditions to represent an organic reaction that can undergo thermodynamic and kinetic control (no mechanism).
- (ii) Give a complete equation to represent the pyrolysis of acetates.

3. (A) Answer any **two** of the following :-

- (a) Explain the chirality of spiranes. Write the structures of a pair of enantiomeric spiranes with their configurational descriptors. 4
- (b) Answer the following : 4
- (i) Write the structure of a molecule with a pseudoasymmetric centre and assign a configurational descriptor to the pseudoasymmetric centre.
- (ii) What is the principal axis of symmetry in a molecule? Draw and label the principal axis of symmetry in naphthalene.
- (c) Explain the addition and symmetry criteria for identification of enantiotopic and diastereotopic faces in a molecule with suitable examples. 4
- (d) Explain enantiomerism in the following with suitable examples. 4
- (i) Quarternary phosphonium compounds.
- (ii) Silanes

(B) Answer any **one** of the following :-

- (a) Answer the following : 4
- (i) Assign the configurational descriptors to the following:



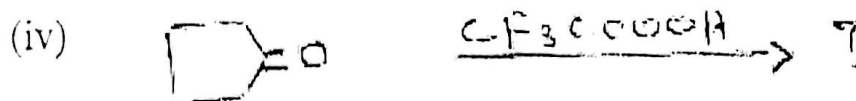
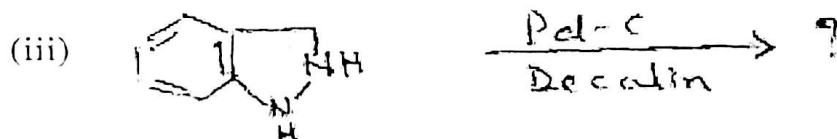
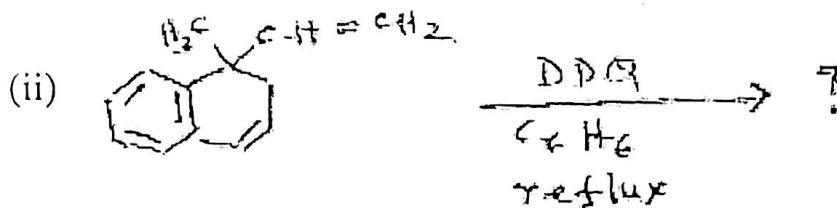
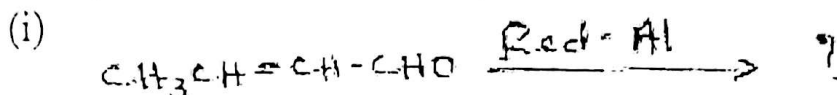
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(ii) Write the structure of a molecule with a pair of diastereotopic ligands and assign stereochemical descriptors to these ligands.

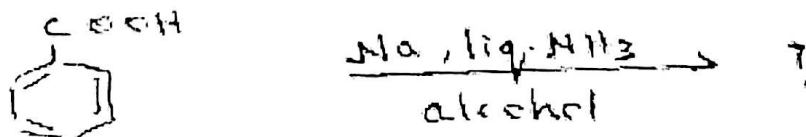
(b) Explain the principle of planar chirality with reference to ansa compounds. Write the structure of a chiral ansa compound with its stereochemical descriptor. 4

4. (A) Attempt any two of the following :-

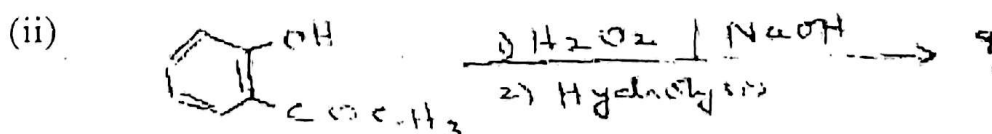
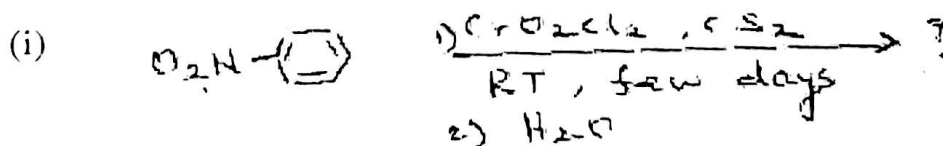
(a) Predict the products in the following reactions : 4



(b) Complete the following reaction name it and give its mechanism. 4



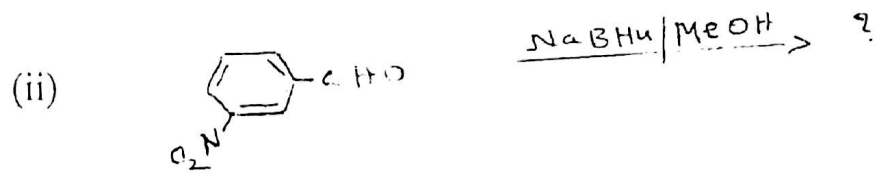
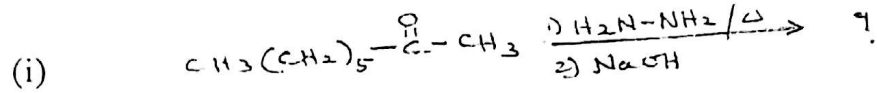
(c) Complete the following reactions and name them : 4



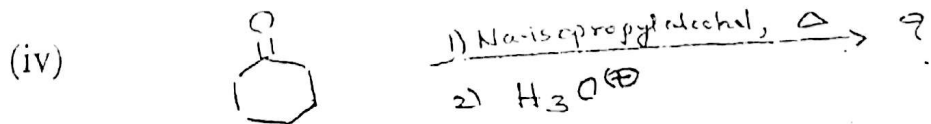
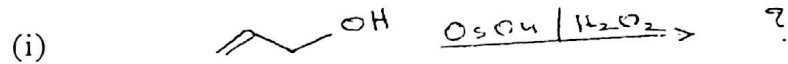
- (d) Write a complete equation to represent HIO_4 oxidation of butane-2,3-diol and explain the mechanism of the reaction. 4

(B) Attempt any **one** of the following :-

- (a) Complete the following reactions and give the mechanism of any **one**. 4

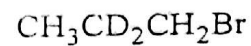
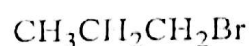


- (b) Complete the following equations. 4



5. Answer any **four** of the following :-

- (A) Explain the structure and aromaticity of ferrocene. 3
 (B) Comment on the aromaticity of thiophene and pyridine. 3
 (C) Elimination of HBr from compound A occurred 6.7 times faster than from compound B. Explain the type of kinetic isotope effect displayed and how the mechanism (E_1 or E_2) is proved. 3



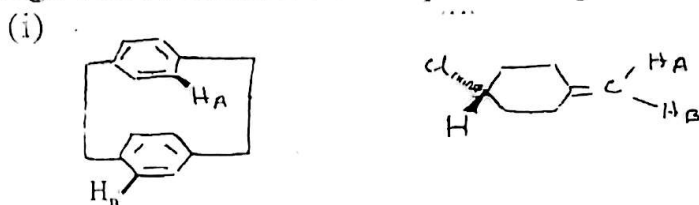
A

B

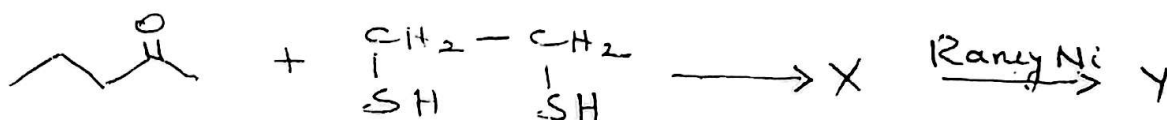
- (D) What is general acid catalysis? Explain its mechanism with a suitable example. 3

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- (E) Write the structure of erythro 2, 3-dichlorobutanal and assign 3
configurational descriptors [R/S] to the chiral centres in the molecule.
- (F) Identify the topic relationship between H_A and H_B in the following 3
and assign stereochemical descriptor if required.



- (G) What is Raney nickel? Predict the products X and Y in the following 3
reaction.



- (H) Illustrate the use of the following in organic synthesis with one example 3
each.
- (i) Collin's reagent
 - (ii) K-selectride
 - (iii) Jones reagent.
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