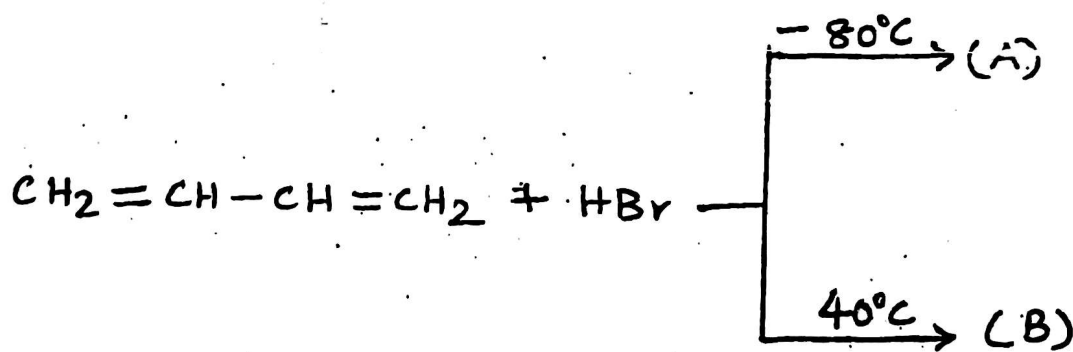


- N.B. :** (1) All questions are compulsory.  
 (2) Figures to right indicate full marks.

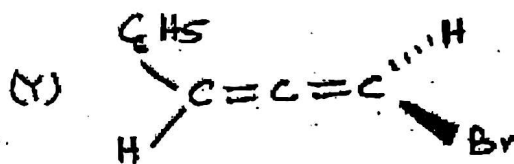
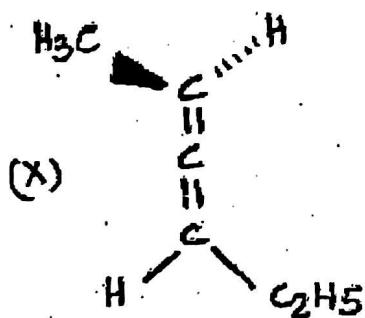
1. (A) Answer any two of the following :—
- (a) Draw Frost Musulin diagrams for benzene and cyclooctatetraene. Show the distribution of electrons in the MOs and comment on their aromaticity. 4
  - (b) Explain the following :— 4
    - (i) Aromaticity of [10] annulene.
    - (ii) Use of  $^1\text{H-NMR}$  to prove the aromaticity of compound.
  - (c) Draw the  $\pi$  MO diagram of diene and dienophile showing electron distribution. Label the FMOs and show their interaction in Diels Alder reaction. 4
  - (d) Ethene absorbs at  $\sim 165$  nm while butadiene absorbs at  $\sim 214$  nm in uv spectroscopy. Explain using MO diagrams of ethene and butadiene. 4
- (B) Answer any one of the following :—
- (a) Explain the aromaticity of :- 4
    - (i) Ferrocene
    - (ii) Furan
  - (b) Draw the MO diagram for the allyl cation and allyl anion. Show the interaction of their FMOs. Predict the product of the reaction between the two ions. 4
2. (A) Answer any two of the following :—
- (a) Predict the products (A) and (B) and justify their formation. 4



- (b) Explain the use of the following techniques in determining the mechanism of a reaction : 4
  - (i) Product Analysis
  - (ii) Stereochemical outcome.

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- (c) Explain :— 4
- (i) Although phenol has a pKa value of 9.95, its 2, 4, 6-trinitro substituted derivative has a pKa of 1.02.
- (ii) The pKa value of pyridine is 5.21 while that of pyrrole is -0.27.
- (d) Explain the difference between specific and general acid catalysis with examples. 4
- (B) Answer any one of the following :—
- (a) Explain with the help of energy profile diagrams : 4
- (i) Hammond's postulate
- (ii) Transition State Theory
- (b) Explain the mechanism and stereochemistry of the E<sub>2</sub> elimination reaction. 4
3. (A) Answer any two of the following :—
- (a) Explain with suitable examples : 4
- (i) Atropisomerism
- (ii) Optical activity of ansa compounds
- (b) Answer the following :— 4
- (i) What is the principal axis of symmetry in a molecule? Draw and label the principal axis of symmetry in ethylene.
- (ii) Explain the syn anti system of nomenclature with an example.
- (c) Explain optical activity in molecules with a tricoordinate chiral centre. 4
- (d) Answer the following :— 4
- (i) What is a pseudoasymmetric centre? Write the structure of a molecule with a pseudoasymmetric centre and label it.
- (ii) Assign configurational descriptors to the following molecules :



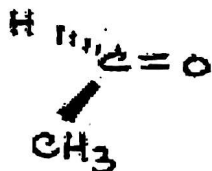
- (B) Answer any one of the following :—
- (a) What are enantiotopic ligands? Explain how they are identified by substitution and symmetry criteria? Give examples to illustrate. 4

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(b) Answer the following :—

4

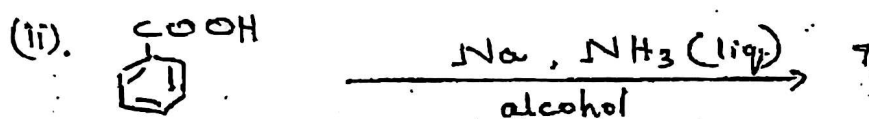
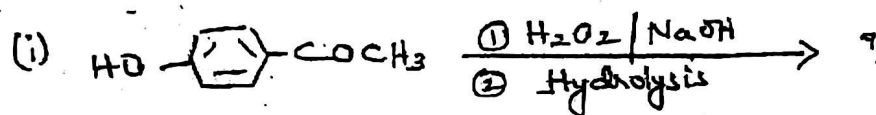
- (i) Define molecular chirality. Explain any one theory of axial chirality with a suitable example.  
 (ii) Identify the Re and Si faces in the following molecule :



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

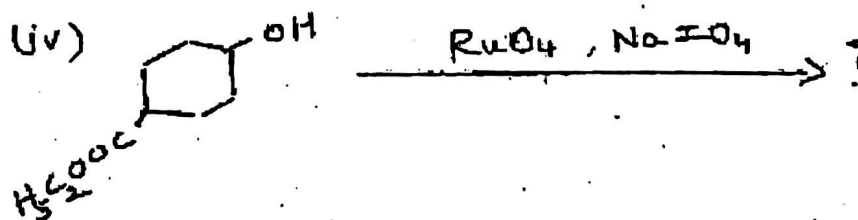
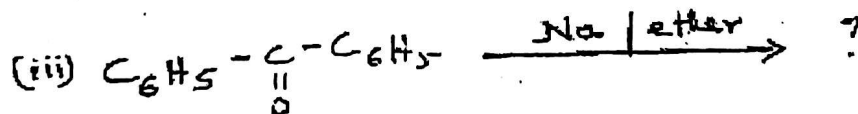
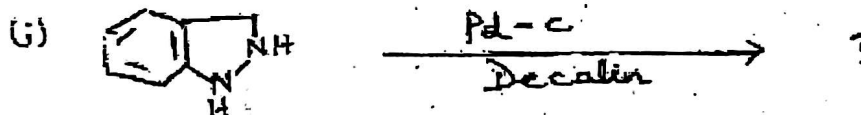
(a) Complete the following reactions and name them :—

4



(b) Predict the products in the following reactions :—

4

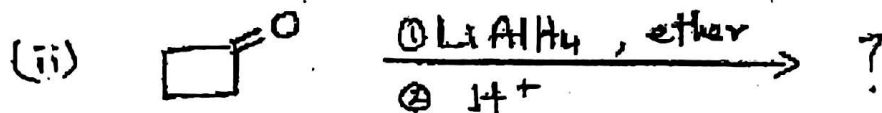
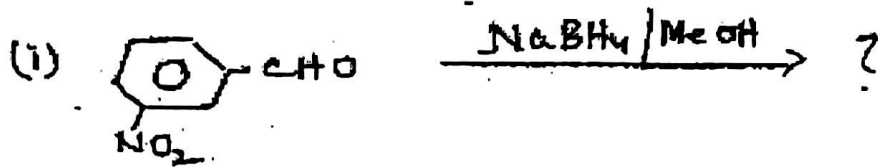


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- (c) Give the mechanism of Wolff-Kishner reduction on octan-2-one. What is Huang-Minlon modification of the reaction ? 4
- (d) What is Oppenauer oxidation ? Give its mechanism and one application. 4

(B) Attempt any one of the following :—

- (a) Complete the following reactions and give mechanism of any one :— 4



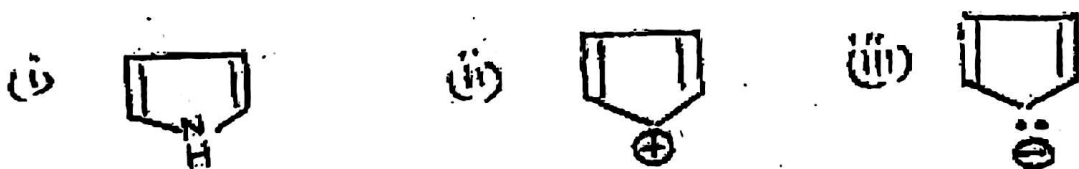
- (b) Illustrate the uses of the following in organic synthesis with one example each. 4

- $\text{CrO}_2\text{Cl}_2$
- $\text{HIO}_4$
- DDQ
- Mg metal in neutral medium.

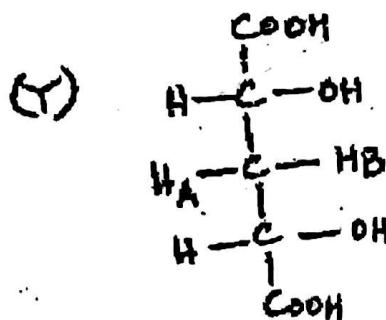
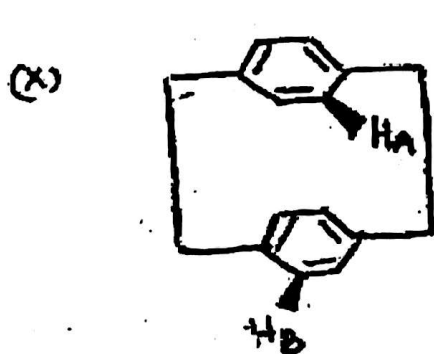
5. Attempt any four of the following :—

12

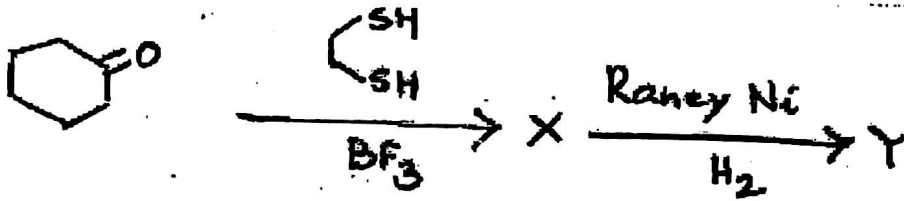
- What are homoaromatic compounds ? Give an example.
- Which of the following compounds are aromatic and why ?



- Explain the mechanism of  $\text{E}_{1\text{C}}\text{B}$  reaction.
- Explain secondary kinetic isotopic effect with a suitable example.
- Explain the optical activity of cyclophanes.
- Assign appropriate stereochemical descriptors to  $\text{H}_\text{A}$  and  $\text{H}_\text{B}$ .



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



(H) Complete the following reactions :-

