

D-GT-M-DIB

## CHEMISTRY

### Paper—II

Time Allowed : Three Hours

Maximum Marks : 200

### INSTRUCTIONS

*Candidates should attempt Question Nos. 1 and 5 which are compulsory, and any **THREE** of the remaining questions, selecting at least **ONE** question from each Section.*

*All questions carry equal marks.*

*Marks for each part/sub-part of a question are indicated against each.*

*Answers must be written in **ENGLISH** only. Assume suitable data, if considered necessary, and indicate the same clearly.*

*Unless otherwise indicated, symbols and notations have their usual meanings.*

#### **Important Note :—**

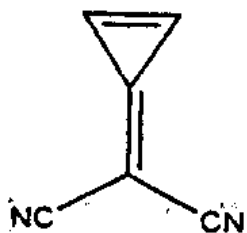
*All parts/sub-parts of a question must be answered contiguously. That is, where a question is being attempted, all its constituent parts/sub-parts must be attempted before moving on to the next question.*

*Pages left blank, if any, in the answer-book(s) must be clearly struck out. Answers that follow pages left blank may not be given credit.*

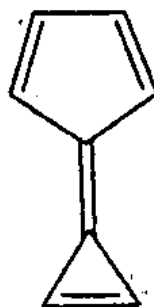
## SECTION—A

1. (a) Which of the following compounds are aromatic or non-aromatic? Give reason. -5×2

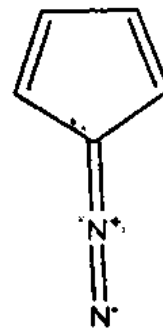
(i)



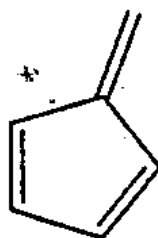
(ii)



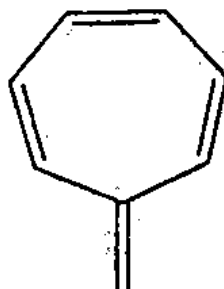
(iii)



(iv)



(v)



- (b) What is a carbene and how is it formed? How can you distinguish between the two types of carbenes by a chemical method? Show by a reaction, choosing an appropriate example.

5+5

- (c) How does the following affect SN1 and SN2 reaction? Explain by one suitable example in each case.

2×5

- (i) Structure of alkyl halide

(ii) Relative reactivity of halogen

(iii) Nucleophile

(iv) Solvent

(v) Rearrangement.

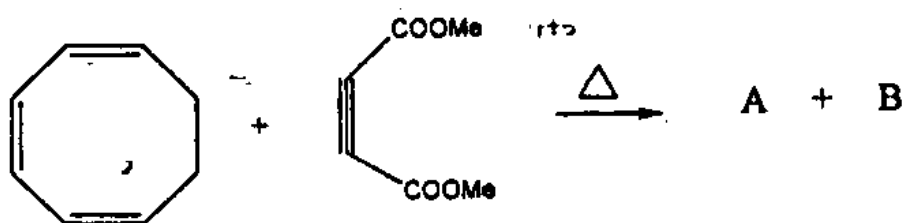
(d) How can you distinguish between E1 and E2 reaction on the basis of kinetic isotope effect ?

10

2. (a) What is a pericyclic reaction ? Explain thermal addition of butadiene with ethylene showing molecular orbitals. 10

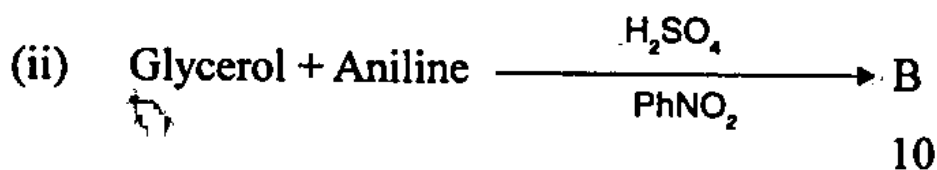
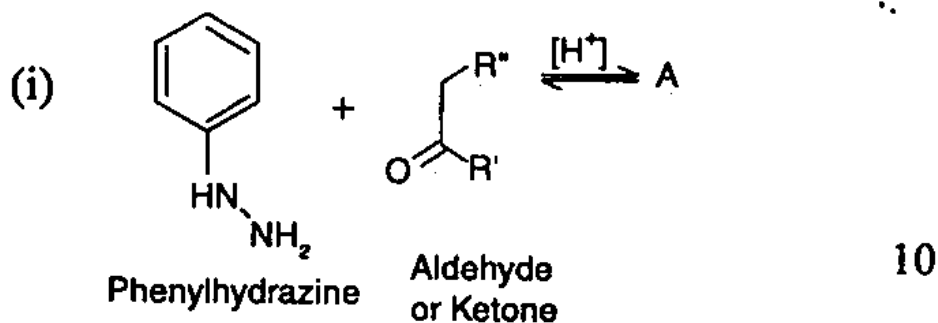
(b) What happens when p-cresol reacts with chloroform in presence of NaOH ? Explain the formation of products with mechanism. 10

(c) Complete the reaction with mechanism. 10

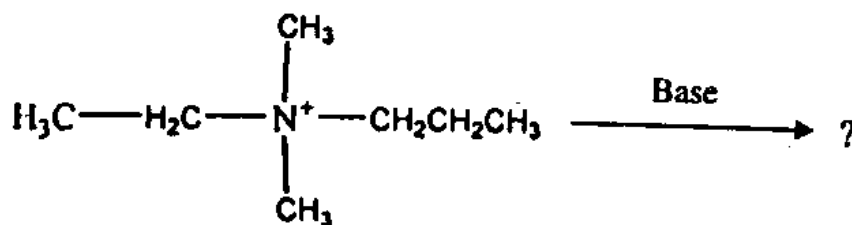


(d) Acid catalyzed dehydration of neopentyl alcohol yields 2-methyl-2-butene as the major product. Outline a mechanism showing all steps of formation. 10

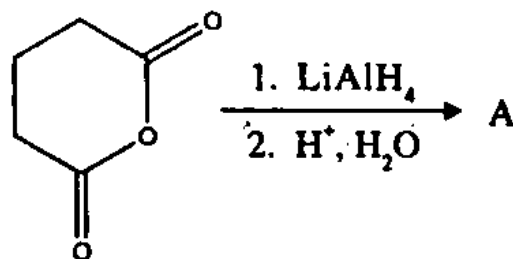
3. (a) Write mechanistic steps involved in the Dieckmann reaction. 10
- (b) Give the products, mechanism for their formation and name the reaction :



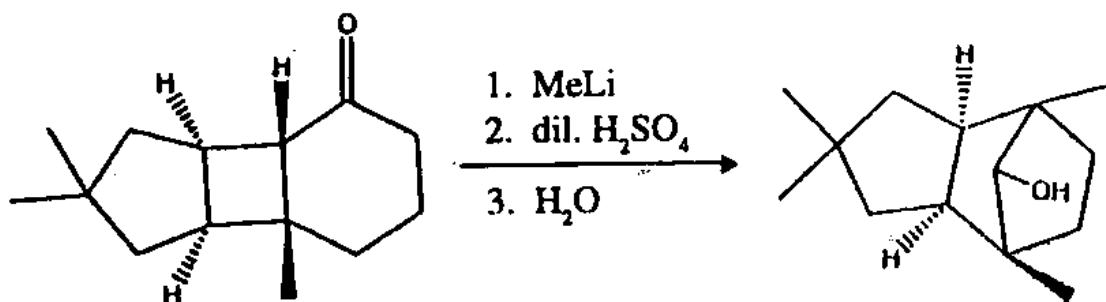
- (c) Give the product. Explain its formation and non-formation of the other by giving proper mechanism and reasoning. 10



4. (a) Give the product (A) and give mechanism for the formation of product : 5

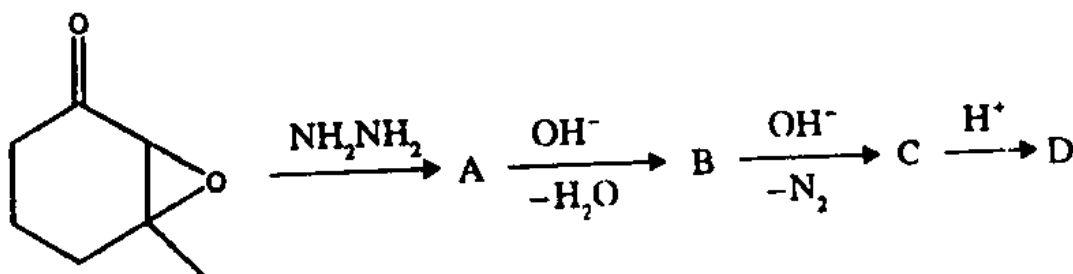


- (b) Write the mechanistic steps involved in the formation of the given product : 10

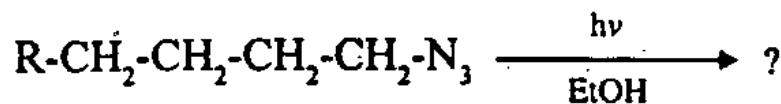


- (c) Butenone, on addition of HCN gives two different products. On the basis of the mechanism involved, draw an energy profile diagram showing formation of both kinetic and thermodynamic product. Also, predict the more stable product. 10

- (d) Identify A-D and give mechanism for their formation. 10



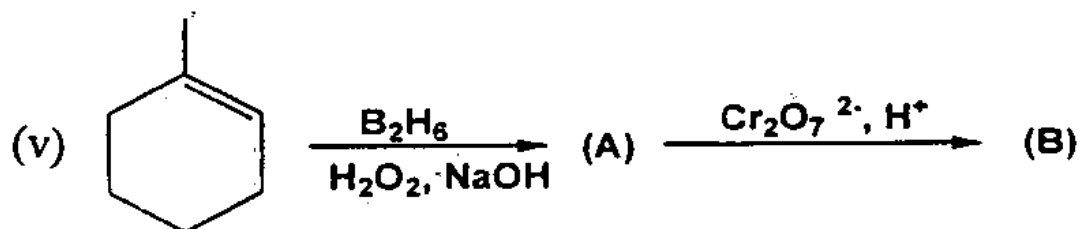
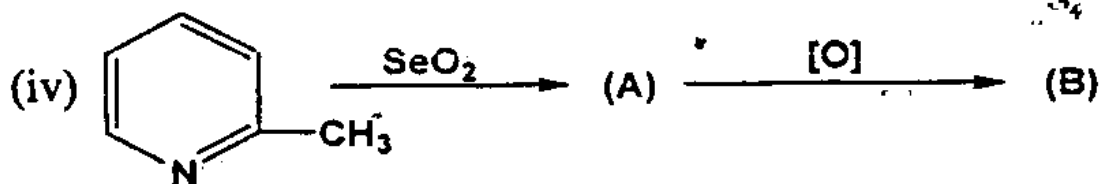
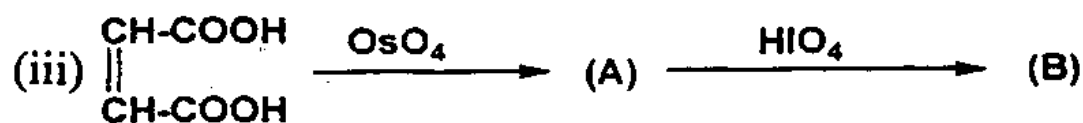
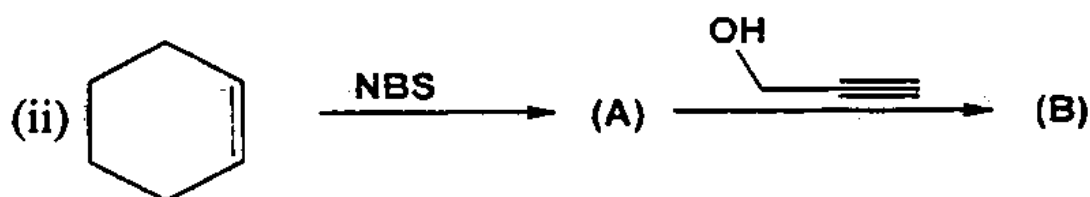
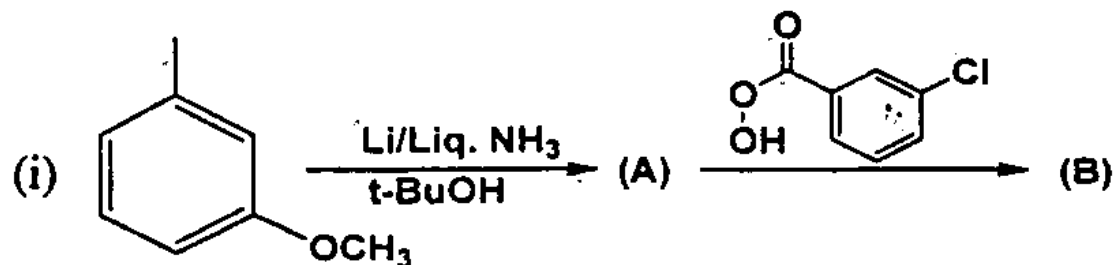
- (e) Identify the product(s) in the following reaction.  
What is the intermediate involved ? 5



### SECTION--B

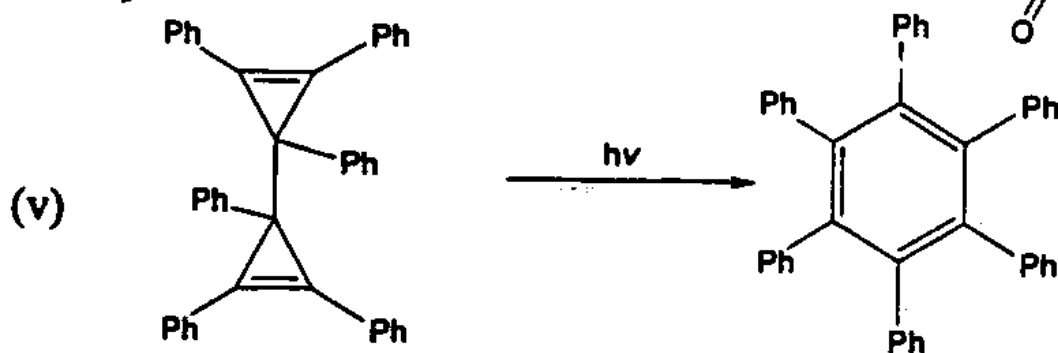
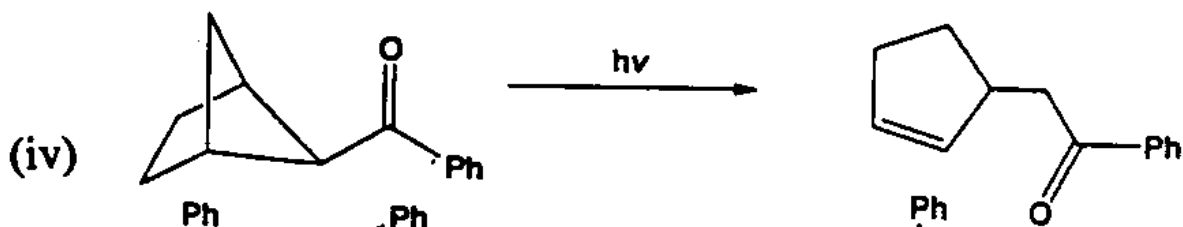
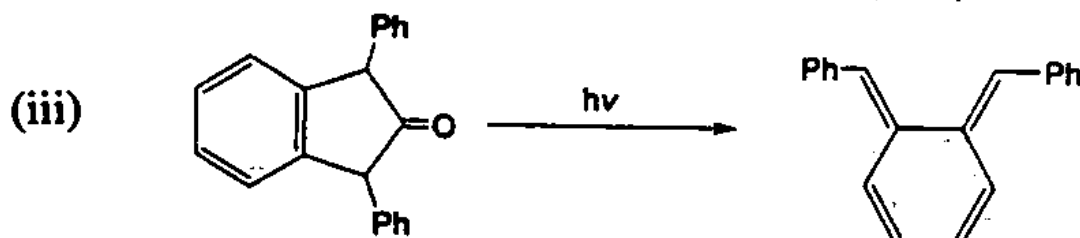
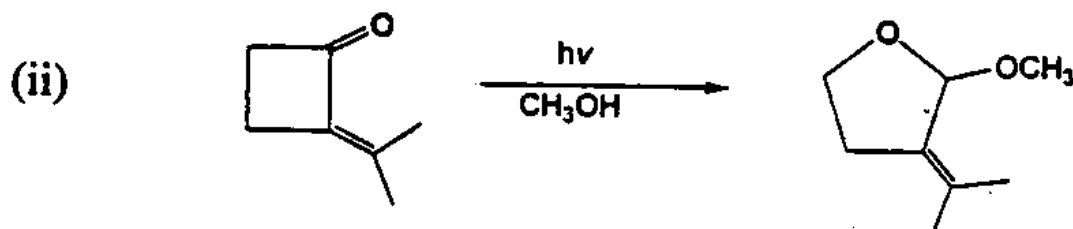
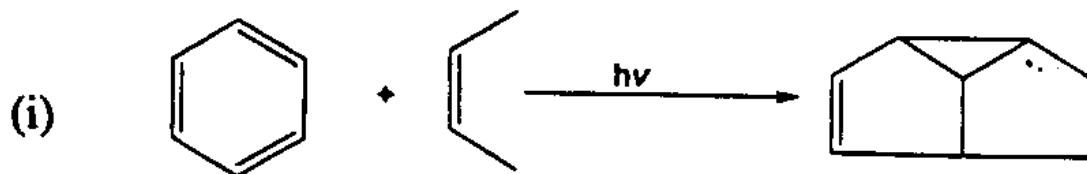
5. (a) Give the formation of nylon 6 and nylon 6, 6 with the help of chemical reaction. 10
- (b) Describe the light scattering method for determination of weight average molecular weight of polymers. 10
- (c) Show the mechanistic steps for the free radical formation of polystyrene. Show the formation of Styrene-acrylonitrile co-polymer. 10
- (d) What are phosphorazines ? Draw the structures of the following phosphonitrilic chlorides :
- (i)  $(\text{NCl}_2)_3$
- (ii)  $(\text{NCl}_2)_4$  10

6. (a) Predict the products of the following reactions showing suitably stereochemistry wherever necessary. 5×5



- (b) Show the mechanistic steps for the formation of products by the reaction of  $\text{OsO}_4$  and cis-2 butene. Indicate and comment upon the stereochemistry of the final products. 10+5

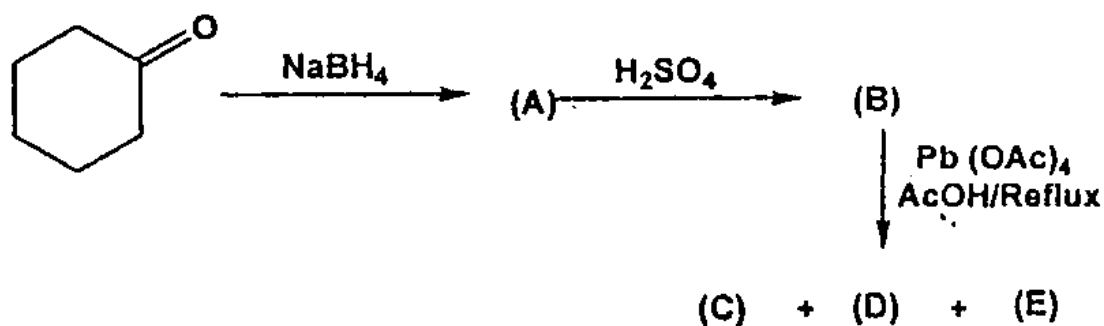
7. (a) Outline the suitable mechanism for the following transformations : 4×5=20





(b) Predict the structures of A, B, C, D and E :

10



(c) Write down the possible electronic transitions as applied to fluorescence and phosphorescence.

5

(d) The low resolution NMR spectrum of a compound having molecular formula  $\text{C}_4\text{H}_4\text{O}_2$  shows two peaks of equal intensity. Draw the structure.

5

8. Answer the following :—

(a) Reaction of an organic compound (A) with a mixture of conc.  $\text{H}_2\text{SO}_4$  and conc.  $\text{HNO}_3$  gave two isomeric compounds (B) major and (C) minor. The compound (B) exhibited the following spectral characteristics :

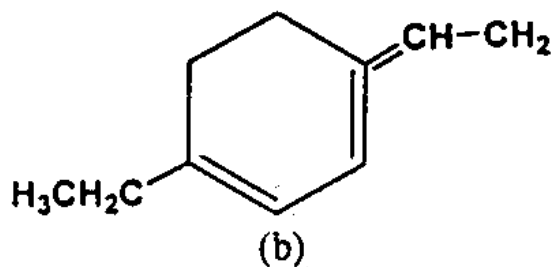
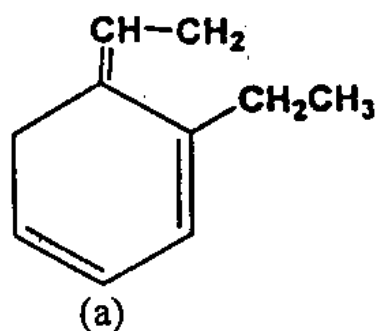
Molecular formula :  $\text{C}_7\text{H}_7\text{NO}_3$

IR : 3040, 1610, 1510, 1350 and 1030  $\text{cm}^{-1}$

$^1\text{H-NMR}$  :  $\delta$  (ppm) 8.1 (2H, d,  $J = 8$  Hz),  
 6.8 (2H, d,  $J = 8$  Hz) and  
 3.9 (3H, s)

Deduce the structure of (A), (B) and (C) with proper explanation. 15

- (b) Explain typical fragmentations for the mass spectrum of 1-phenylethanol. 5
- (c) Explain, how the UV-vis spectrum can be used to distinguish the following isomeric compounds. 5



- (d) An organic compound (A) with molecular formula  $\text{C}_3\text{H}_7\text{NO}$  gives absorption peaks in the regions 3413 (m), 3030-2899 (m), 1667 (s), 1634 (s) and  $1460\text{ cm}^{-1}$  (s) in IR spectrum. Give its probable structure. 5

(e) Amines absorb at higher wavelength as compared to alcohols, why ? 5

(f) Which of the following system will show ESR spectrum ?

(i) H (ii) Na<sup>+</sup>

(iii) N<sub>2</sub> (iv) NO

(v) Cu<sup>+</sup> (vi) Cu<sup>+2</sup>

(vii) CH<sub>3</sub> (viii) CO<sub>2</sub> 5