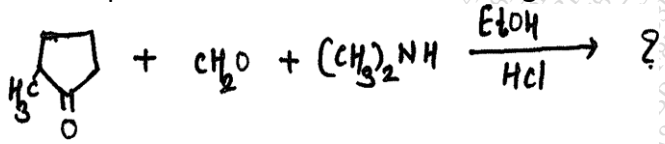
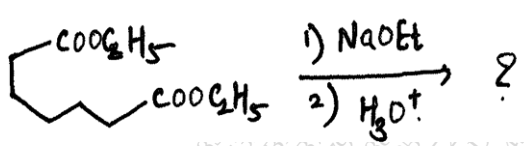
[Time: - 2½ Hours] **[Marks: 60]**

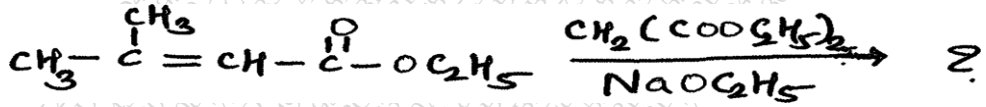
N.B: 1. **All** questions are **compulsory**.
2. **Figures** to the **right** indicate **full** marks.

1. (A) Attempt **any two** of the following:-
   a) Discuss Robinson annulation with mechanism. 04
   b) Predict the products and name the following reactions: 04

i) 

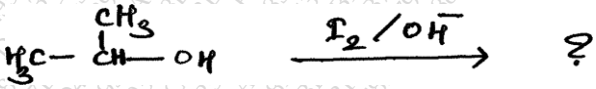
ii) 

   c) Using a suitable example, explain the mechanism of α – bromination of carboxylic acids. 04
   d) Complete the following reaction, name it and explain its mechanism: 04

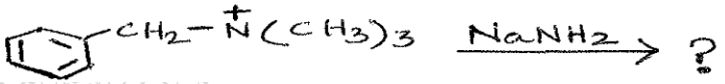


(B) Attempt **any one** of the following:
   a) Predict the product and give the mechanism for the following reaction: 04

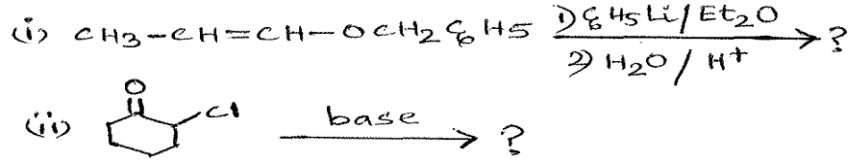
   b) Complete the following reaction and give the mechanism involved: 04



2. (A) Answer **any two** of the following:
   a) Complete the following reaction and explain its mechanism: 04



b) Complete the following reactions and name them: 04



c) What is Neber rearrangement? Explain its mechanism. 04

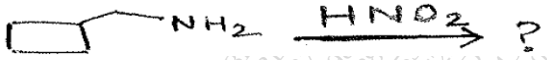
d) Give the mechanism for the following conversions: 04

i. Alkyl sulfoxide to α – acyloxythioether;

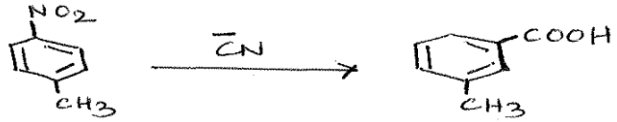
ii. 2 – methyl-2-phenylbutanoyl chloride to 3-methyl-3-phenyl pentanoic acid.

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

a) Complete the following reaction and give its mechanism: 04



b) Write the mechanism for the following conversion and name the reaction: 04



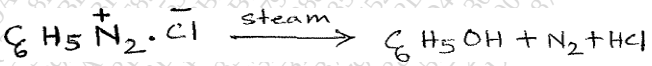
3. (A) Answer **any two** of the following:-

a) Discuss the stereochemistry of aliphatic nucleophilic substitution reaction at sp^3 carbon involving NGP. 04

b) Answer the following:- 04

i. Give an example of S_{NCA} reaction.

ii. Give the mechanism of the following reaction:



c) Calculate the λ_{max} values for the following molecules: 04

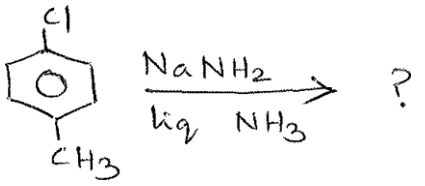
d) Answer the following:- 04

i. Biphenyl exhibits a very intense absorption band at 252 nm but the 2, 2' - dimethyl derivative shows absorption at λ_{max} = 262 nm. Explain.

ii. Using IR spectroscopy, elucidate whether the 'N' atom in a molecule belongs to an amide, nitrile or amine functional group?

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

a) Complete the following reaction, label the products and give the mechanism: 04



b) Answer the following: 04

i. Calculate the vibrational degrees of freedom for:
(X) Methane (Y) Benzene

ii. Explain fundamental, overtone and combination bands.

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

a) Give the fragmentation patterns of: 04

i. o - Nitroaniline

ii. Butanal

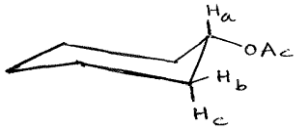
b) Write a note on: 04

i. Long range coupling

ii. Karplus equation

c) On the basis of NMR spectroscopy, how will you distinguish between: 04

i. o - Nirtrophenol and p- nitrophenol

ii 

d) Significant spectral features of an organic compound are given below: 04

i. Molecular formula $C_{10}H_{13}NO_2$

ii. IR, cm^{-1} = 3402 (s), 3318 (s), 3025 (w), 1695 (s), 1602 (s), 1580 (m)

iii. ^1H NMR, δppm: 7.9 (2H, d); 6.7 (2H, d); 4.75 (1H, septet), 4.2 (2H, br), 1.25 (6H,d)

Assign suitable structure to the compound.

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

a) An organic compound gave the following spectral data: 04

IR cm^{-1} : 3333-2300 (multiple bands), 1715 (strong)

^1H NMR (δ) : 2.12 (3 H, s), 2.50-2.70 (4H, m), 11.00 (1H, bs, D_2O exchangeable).

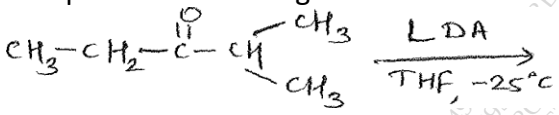
If the molecular formula of the compound is $C_5H_8O_3$, what is the possible structure of the compound?

b) How many different types of protons are present in: 04

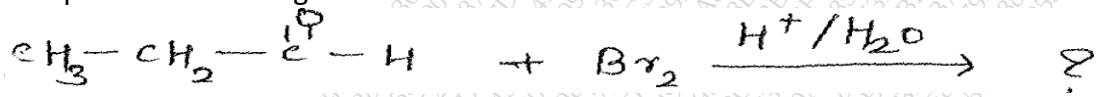
i. 2- methyl propene
ii. t- butanol
iii. Acetone
iv. 1, 2 - dibromoethane

5. Attempt **any four** of the following:- 12

A. Complete the following reaction:



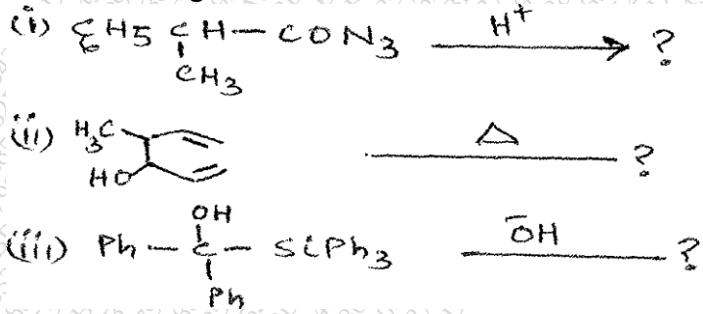
B. Complete the following reaction with suitable mechanism:



C. Give complete equations to represent the following rearrangements:

i. Dienone-phenol
ii. Schmidt

D. Complete the following reactions:



E. Explain:

i. Hypsochromic effect
ii. Finger print region

F. Explain:

i. Vicarious substitution
ii. Ambident nucleophile

G. Explain the following in mass spectrometry:

i. Nitrogen Rule
ii. Retro-Diels-Alder reaction

H. Write a note on magnetic anisotropy.

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