[Time: 2 ½ Hours] **[Marks: 60]**

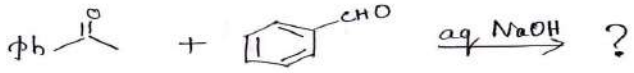
Please check whether you have the right question paper.

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

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

a What is Knoevenagel condensation reaction? Explain its mechanism with a suitable example. 4

b Complete the following reaction and explain its mechanism. 4



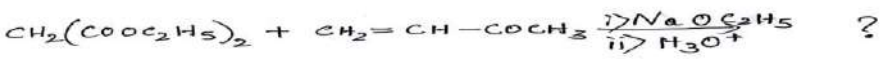
c Explain how solvent polarity affects the rate of alkylation of enolates. 4

d What are enamines? Explain with suitable examples alkylation of enamines. 4

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

a Discuss the mechanism of Mannich reaction with a suitable example. 4

b Complete the following reaction, name the reaction, and give its mechanism. 4

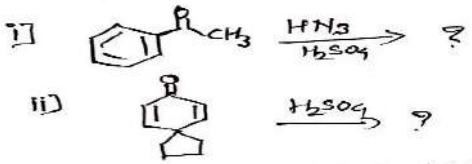


Q.2) (A) Answer **any two** questions out of the following

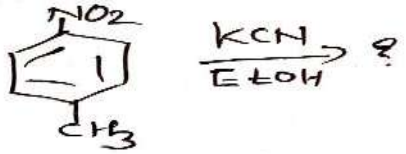
a What is Baylis-Hilman reaction? Explain its mechanism 4

b What is Curtius rearrangement? Explain its mechanism 4

c Predict the product of the following reactions and give the name of the reactions. 4



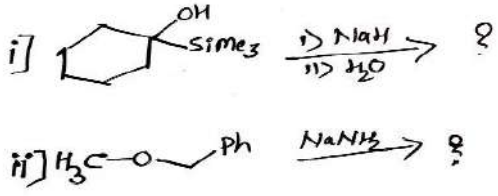
d Complete the following reaction and give its mechanism. 4



(B) Answer **any one** question out of the following

a What is Passerini reaction? Explain its mechanism 4

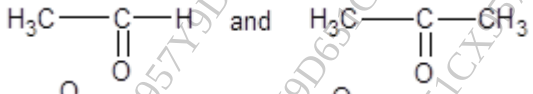
b Predict the product and name the following reactions 4

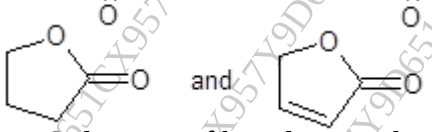


Q.3) (A) Answer any two of the following:

a Draw the π − MO diagrams of diene (1,3-dutadiene) and dienophile (ethylene) showing electron distribution. Label FMOs, show their interaction. 4

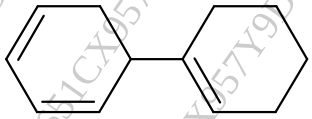
b How are the following compounds distinguished using IR spectroscopy? 4

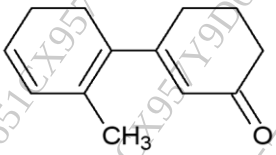
(i) 

(ii) 

c Draw the MO diagram of butadiene and 1,3,5-hexatriene. Using this diagram explain λ-max of 1,3 butadiene is 217 nm while that of 1,3,5-hexatriene is 254 nm. 4

d Calculate the λmax of the following compounds: 4

i) 

ii) 

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

a With the help of suitable example, explain how following factors affect the vibrational frequency. 4
1) Ring size
2) Hydrogen bonding

b Explain donor acceptor interaction in nucleophilic addition reaction on formaldehyde using FMO method. 4

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

a Write the fragmentation pattern of the following molecules in mass spectroscopy 4
i) 2-Methylbut-2-ene
ii)2-Methylpentane

b Explain the following terms in NMR spectroscopy. 4
i) Karplus equation
ii) Coupling Constant.

c An organic compound with molecular formula $C_6H_{14}O$.IR spectrum gives broad band at 3600 cm-1,PMR spectrum gives δ 0.8 ppm (t) 6H,δ 1.0 ppm (s) 3H . δ 1.5 ppm (q) 4H,δ 1.6 ppm (s) 1H 4
Deduce the structure of the molecule and justify your answer.

d Explain the following terms in Mass spectroscopy with suitable example. 4
i) McLafferty rearrangement
ii) Nitrogen rule

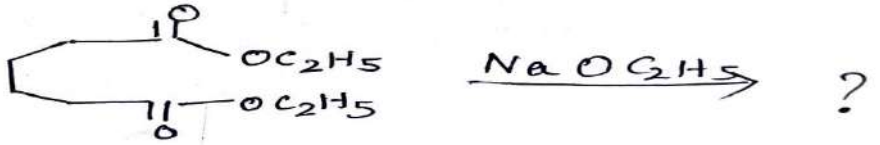
(B) Answer any one of the following:

a Write the number of signals and splitting pattern observed in the NMR spectra of following molecules: 4
i) Butan-2-ol ii) Methylbenzoate
ii) iii) Toluene iv) 2-Methylbutanoic acid

b An organic compound with molecular formula C_6H_7N shows the following spectral data : 4
IR = 1180 cm^{-1},1500cm^{-1}, 3000cm^{-1}, 675cm^{-1} ,730 cm^{-1}
^{1}HNMR = δ 7.5 ppm (m) , δ5.8 ppm (s),
Deduce the structure of the molecule and justify your answer.

Q.5) Answer **any four** of the following;

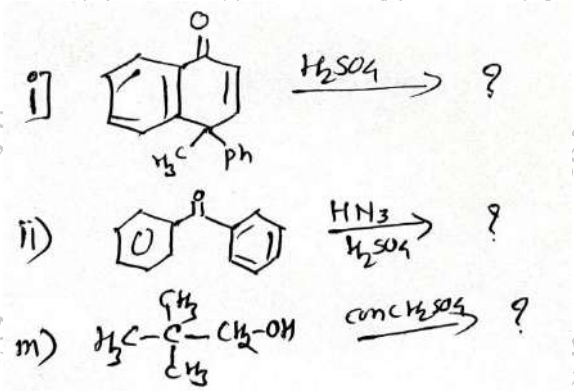
a Complete the following reaction and name the reaction: 3



b Explain in detail the reaction mechanism between acetone and excess of iodine in NaOH. 3

c Explain Tiffeneau- Demjanov rearrangement with a suitable example. 3

d Complete the following reactions. 3



e Define hard and soft nucleophiles. Give one example of each. Comment on the relative energies of their LUMO's 3

f Why benzene shows absorption maxima at 255nm (ε_{max} = 230) whereas aniline shows absorption maxima at 280nm (ε_{max} = 1430)? Justify your answer. 3

g Explain the terms Base peak and Isotopic peaks in Mass spectroscopy. 3

h Explain the term proton coupled and decoupled spectra in 13C NMR spectroscopy. 3

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