

B.Sc. 4th Semester (Honours) Examination, 2019

Subject : Chemistry

Paper : CC-10

Time: 2 Hours

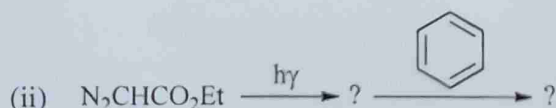
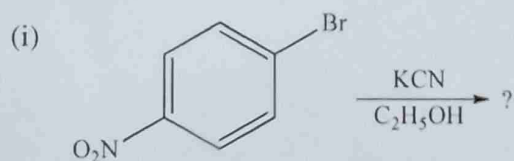
Full Marks: 40

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*

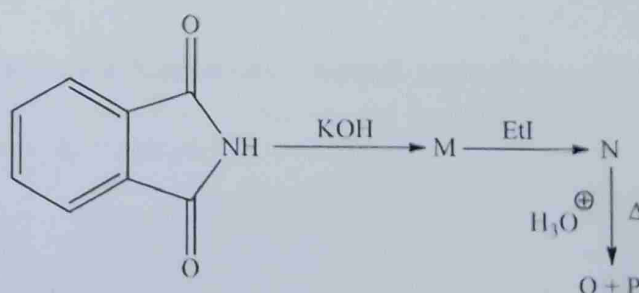
1. Answer any five questions from the following:

2×5=10

- (a) Define synthon and synthetic equivalent with one example for each.
- (b) What are the products you expect on reduction of nitrobenzene with
- Zn-dust, ammonium chloride, methanol
 - Zn-dust, methanol, sodium hydroxide?
- (c) Explain the terms bathochromic shift and hypsochromic shift in U.V. spectroscopy.
- (d) Give the products:



- (e) Define magnetically equivalent protons and chemically equivalent protons in light of NMR spectroscopy with one example for each.
- (f) Identify M, N, O and P.



- (g) Name the factors that affect chemical shift positions of protons in different organic compound in ^1H NMR spectrum.

- (h) Explain why cyclobutane ring formation is difficult as compared to either cyclopropane or cyclopentane ring formation.

5×2=10

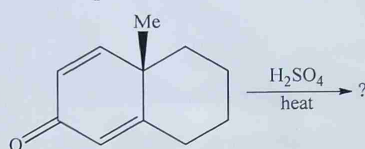
2. Answer *any two* questions from the following:

- (a) (i) Predict the product(s) when an unsymmetrical ketone, having enolisable α -Hs, in an acid medium, is made to react with a secondary amine. Explain your prediction.

1+2=3

- (ii) Draw the product of the following reaction and mention the steps involved:

2

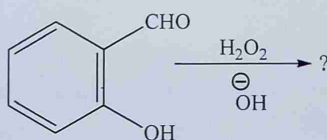
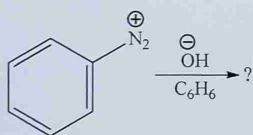


- (b) (i) What happens when cyclohexanone is treated initially with hydroxylamine hydrochloride and subsequently with phosphorus pentoxide? Predict the product(s) with mechanism.

1+2=3

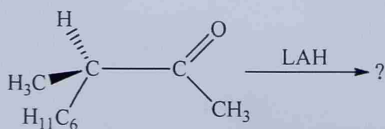
- (ii) Predict the product in each of the following reactions:

1+1=2



- (c) (i) Predict the major product formed in the following reaction and explain its formation using Felkin-Anh model.

3



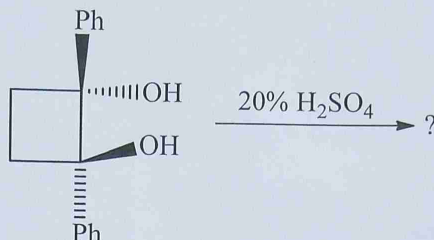
- (ii) Why is excess of diazomethane used in Arndt-Eistert synthesis?

2

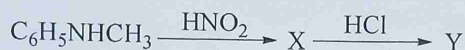
(3)

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- (d) (i) Identify the product(s) formed in the following reaction given below. Justify your prediction with proper mechanism. 1+2=3

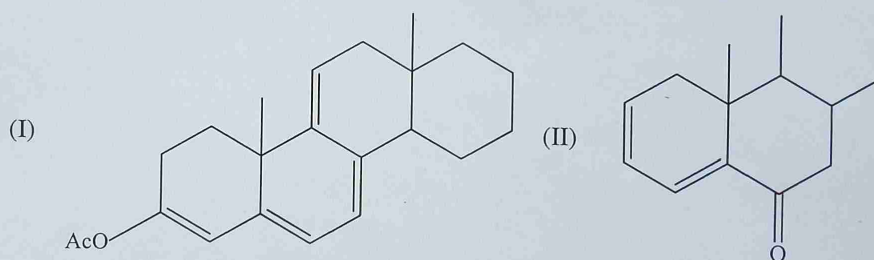


- (ii) Complete the following: 1+1=2



3. Answer any two questions from the following: 10×2=20

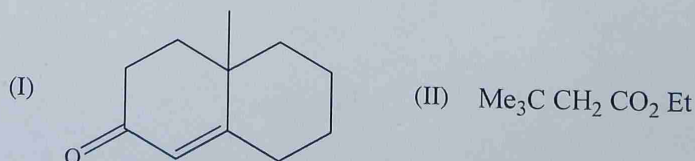
- (a) (i) Predict the λ_{max} for the following compounds using Woodward's rule: 2+2=4



- (ii) The molar extinction coefficient (ϵ) value for acetyl acetone in water is much less compared to the (ϵ) value measured in isooctane though their λ_{max} value in water (274 nm) and in isooctane (272 nm) are comparable. [$\epsilon_{\text{water}} \sim 2000$; $\epsilon_{\text{isooctane}} \sim 12000$] 3

- (iii) How can you distinguish the following pairs of molecules by UV spectroscopy? (I) 1,3-Butadiene and Butanone, (II) *p*-nitrophenol and *m*-nitrophenol (in faintly basic medium) 1½+1½=3

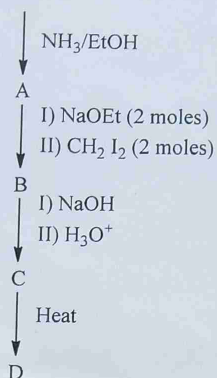
- (b) (i) Using retrosynthetic analysis, suggest a possible synthetic route for the following target molecules. [Both backward and forward routes are to be shown with required reagents and conditions.] 3+3=6



(ii) Identify the products given below:

Acetone (1 mole) + Ethylcyanoacetate (2 moles)

4



- (c) (i) Is it possible to distinguish an aromatic compound from an anti-aromatic one using ^1H NMR spectroscopy? Explain. 1½
- (ii) How many ^1H NMR signals do you expect in the spectrum of *o*-dinitro benzene? Draw their pattern and assign their position in the spectrum with respect to the structure. ½+1+½+½=2½
- (iii) Identify the compound (x) having molecular formula $\text{C}_4\text{H}_8\text{O}_2$ from the spectroscopic data given below. You have to relate each data with your predicted structure.

UV : 206 nm

IR : 1736 cm^{-1} $2+1+1+2=6$

^1H NMR(δ) : 0.95 (3H, t, $J = 7.0$ Hz),
 1.67 (2H, sextet, $J = 7$ Hz),
 4.12 (2H, t, $J = 7$ Hz),
 8.07 (1H, S)

- (d) (i) Carbon tetrachloride is gradually added into neat ethyl alcohol. Comment on the changes that may be observed in the IR absorption of O–H stretching frequency. 2
- (ii) Distinguish between the members of the following pairs using IR spectroscopy: $2+2=4$
- (I) Vinyl acetate and methyl acrylate
- (II) Cyclohexanone and 2-ethyl cyclopentanone
- (iii) Does the O – H absorption peak in IR spectrum shift if 'H' is replaced by 'D'? Justify your view. 2
- (iv) Can IR spectroscopy be a handy tool to study the progress of the following reaction? Justify your answer. ½+1½=2

