



WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 4th Semester Examination, 2022

CEMACOR10T-CHEMISTRY (CC10)

ORGANIC CHEMISTRY-IV

Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.*

Answer any four questions taking one from each unit

Unit-I

1. (a) How would you chemically distinguish the following pair of compounds? 2
 (i) Benzyl cyanide and benzyl isocyanide
 (ii) N-methylaniline and N, N-dimethylaniline.
 (b) Explain the products [A] and [B] with proper mechanism of the reaction. 2

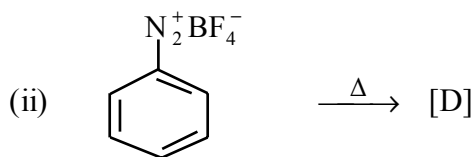
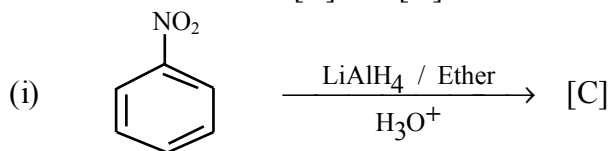
$$\text{CH}_3\text{CH}_2\text{NO}_2 \xrightarrow[\text{NaOH}]{\text{aqueous}} [\text{A}] \xrightarrow[\text{room temperature}]{50\% \text{ H}_2\text{SO}_4} [\text{B}]$$

 (c) How can you prepare N-methylaniline from aniline? 2

2. (a) Suggest the product(s) and give the mechanism for the following reaction: 2

$$\text{Et}_2\text{NH} \xrightarrow[\Delta]{\text{HCHO} / \text{HCOOH}} \text{Product(s)}$$

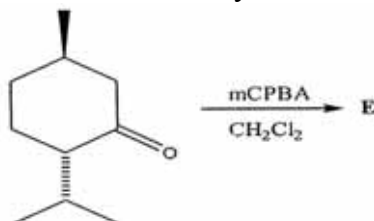
 (b) Give the structures of [C] and [D]: 2



- (c) How can you convert aniline to 1,3,5-tribromobenzene? 2

Unit-II

3. (a) Draw the structure of **E** with the proper configuration of the stereogenic centres and give plausible mechanistic steps. Discuss the effect of stereoelectronic factors for the determination of regio and stereoselectivity. 4



(b) Carry out the following conversions:

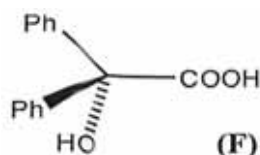
2+2

(i) Phthalic anhydride \longrightarrow anthranilic acid

4. (a) Outline two methods for the preparation of phenyl acetate. Rationalise the products in the reaction of phenyl acetate and anhydrous AlCl_3 (Friedel-Crafts conditions) with plausible mechanism. Explain the role of solvents and temperature in the control of product ratio. 4

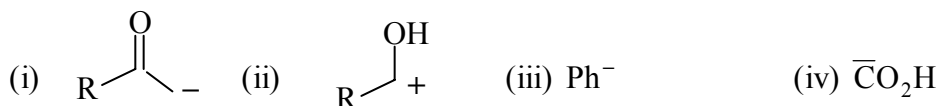
(b) Convert benzoyl chloride to phenylacetic acid in one-step. Suggest plausible mechanism with a comment on the intermediate. 2

(c) Convert benzoin to the α -hydroxyacid (**F**) in two steps and suggest plausible mechanism for step two only. 2

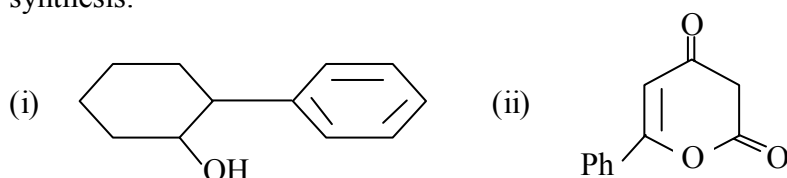


Unit-III

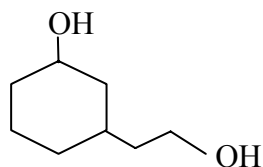
5. (a) Give the synthetic equivalent for the following species: 2



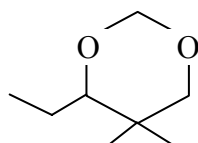
(b) Show the retrosynthetic analysis of the following compounds and then carry out the synthesis: $1\frac{1}{2}+1\frac{1}{2}$



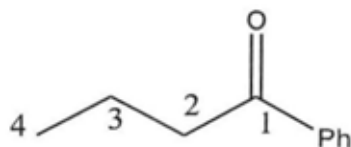
(c) Plan a retrosynthesis followed by the synthesis of the following by FGI approach. 3



(d) Propose a synthesis of the following compound: 2

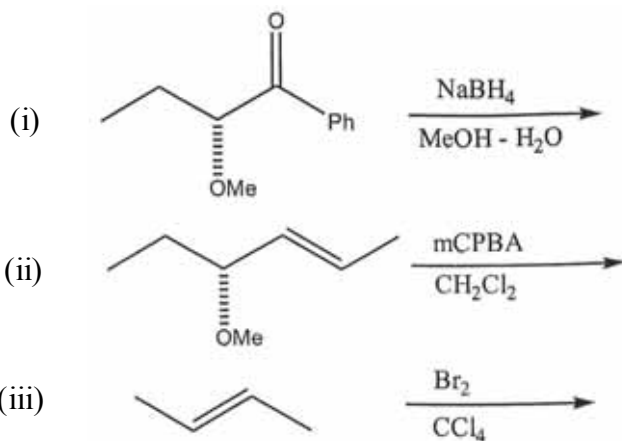


6. (a) Depict the disconnections, as indicated for the retrosynthesis of the following ketone and then draw the synthons and the corresponding synthetic equivalents. Also, classify all the synthons as logical / illogical and donor / acceptor terminology. 4

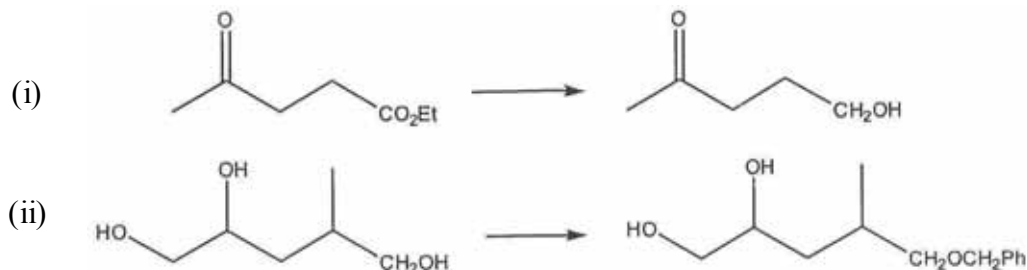


- (i) FGI followed by C – C disconnection
 (ii) 1,2 C – C disconnection
 (iii) 2,3 C – C disconnection
 (iv) 3,4 C – C disconnection.

- (b) Predict the product(s) in the reactions given below and comment whether these are stereoselective or stereospecific reactions. 3

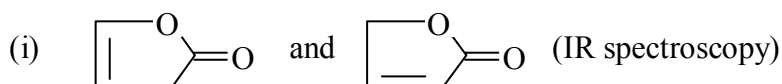


- (c) Carry out the following conversions using protection / deprotection strategy. 3



Unit-IV

7. (a) Sketch and label the possible bending vibrational modes in CH_2Cl_2 . 2
 (b) What are the radiation sources of IR spectrometer and UV spectrometer? 2
 (c) What are the significance of the terms: (i) absorbance and (ii) vacuum UV? 2
 (d) Describe Fermi coupling. Which region in IR spectrum is known as fingerprint region? Describe its significance. 2
 (e) Distinguish the following pair of compounds using spectroscopy: 3



(ii) *cis* and *trans* stilbene (UV spectroscopy)

(iii) $\text{CH}_3 - \text{CH}_2 - \text{C} \equiv \text{CH}$ and $\text{H}_3\text{C} - \text{C} \equiv \text{C} - \text{CH}_3$ (^1H NMR)

- (f) Aromatic protons are more deshielded than ethylenic protons, although both the types of protons are attached to sp^2 hybridised C-atom. — Explain. 2

- (g) An organic compound having molecular formula $C_8H_7NO_3$ shows a strong IR bond at 1690 cm^{-1} and three signals at
- δ 8.5 (doublet)
 δ 7.9 (doublet)
 δ 2.5 (singlet)
- in its ^1H NMR spectra. Establish the structure of the compound. 3
8. (a) In IR spectroscopy ethylacetoacetate shows the peaks at 1715 cm^{-1} , 1690 cm^{-1} , 2900 cm^{-1} and 3500 cm^{-1} . How will you explain it? 2
- (b) Define the following terms: 2
- (i) Hypochromic effect, (ii) Hypsochromic effect
- (c) How would you distinguish 4-nitro-N,N-dimethylaniline and acidified 4-nitro-N,N-dimethylaniline by UV spectroscopy? 2
- (d) Predict and label the chemical shifts in δ_{ppm} and the splitting pattern of the nonequivalent Hs of butanone. Express the difference of chemical shift value in Hz between the upfield and downfield Hs in butanone. 3
- (e) The compound (X) is obtained as major product after the mononitration of toluene. Compound X on reduction with Sn and concentrated HCl gives compound Y. Compare the ^1H -NMR spectra of X and Y. 2
- (f) What are the two probable products (enone) in the aldol condensation of acetone? How would you distinguish them by UV, IR and ^1H -NMR spectroscopy? 3
- (g) Why is tetramethylsilane (TMS) preferred as an internal standard in ^1H -NMR experiment? 2

N.B. : *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

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