

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

M.A./M.Sc. FIRST SEMESTER EXAMINATION, DECEMBER 2018

FIRST YEAR [BATCH 2018-20]

APPLIED CHEMISTRY

Date : 17/12/2018

Time : 11 am – 1 pm

Paper : II

Full Marks : 50

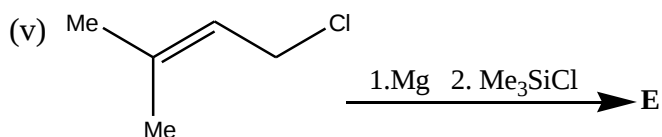
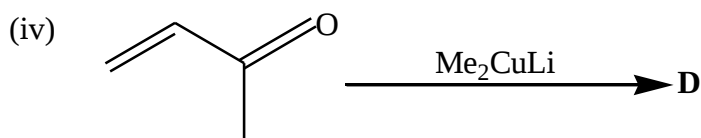
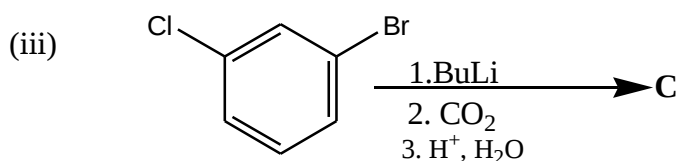
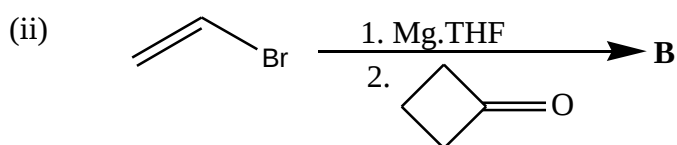
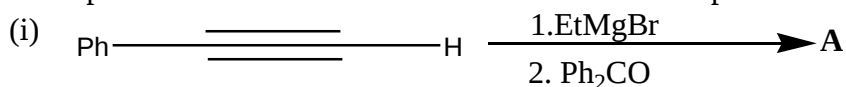
(Use a separate Answer Book for each Unit)

Unit-I

Answer any one from Question Nos. 1 & 2:

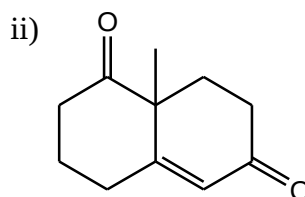
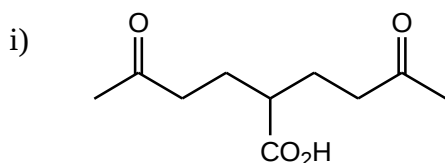
[4×2.5+3]

1. a) What products would be formed in these reactions? Explain the formation of the products.



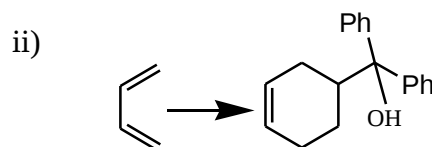
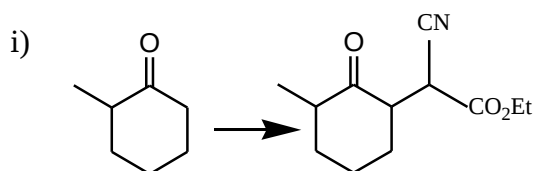
b) Give Retrosynthetic analysis and efficient synthesis of the following compounds from easily available starting materials.

3×2



c) Carry out the following conversions:

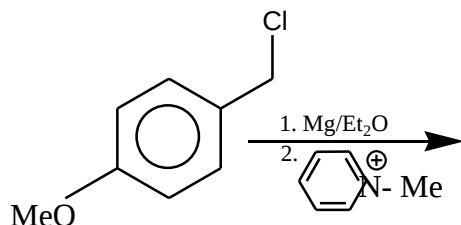
3×2



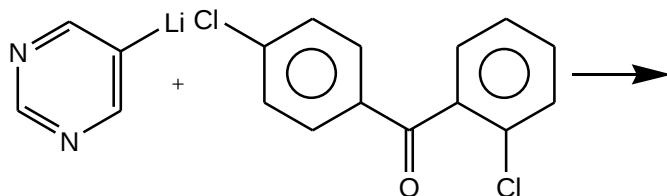
2. a) Predict the products in the following reactions and explain their formation.

[4×2.5+3]

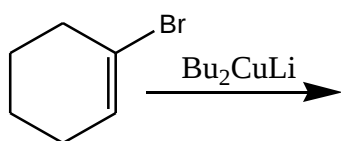
(i)



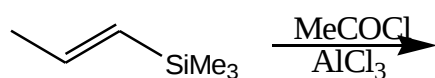
(ii)



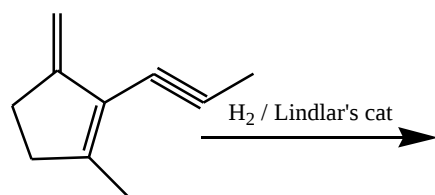
(iii)



(iv)



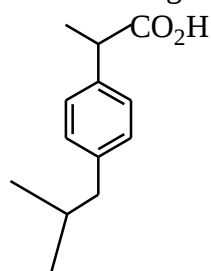
(v)



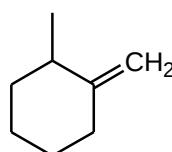
b) Give Retrosynthetic analysis and efficient synthesis of the following compounds from easily available starting materials.

3×2

i)

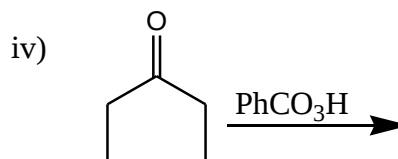
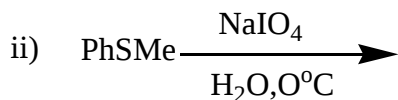
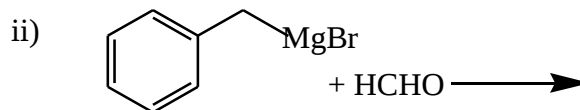
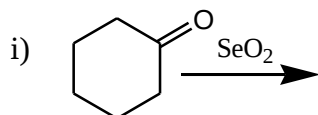


ii)



c) Predict the product(s) of the following reactions:

4×1.5

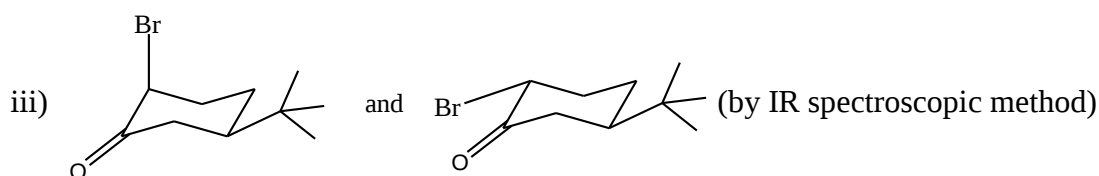
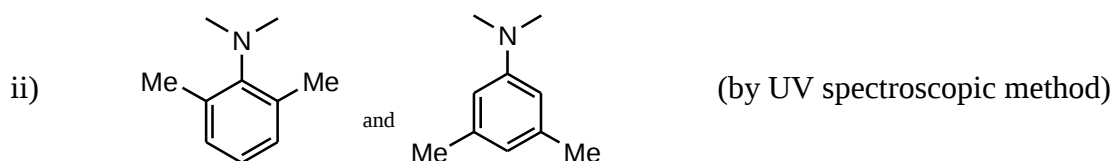
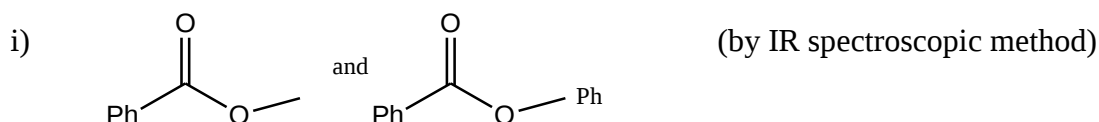


Unit-II

Answer **any one** from **Question Nos. 3 & 4**:

3. a) How would you distinguish between the following compounds by spectroscopic method:

3×2



b) Ethylene fails to absorb at 1600 cm^{-1} in its IR spectrum-explain the observation.

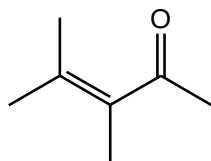
1

c) The UV spectrum of α,β -unsaturated ketone shows absorption bands at 230 and 321 nm in isooctane. Assign them in terms of electronic transition. How does the absorption band change their position with the change of solvent from isooctane to water?

3

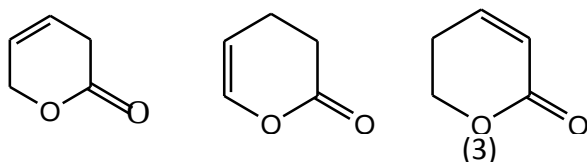
d) Calculate the value for λ_{max} for the molecule.

2

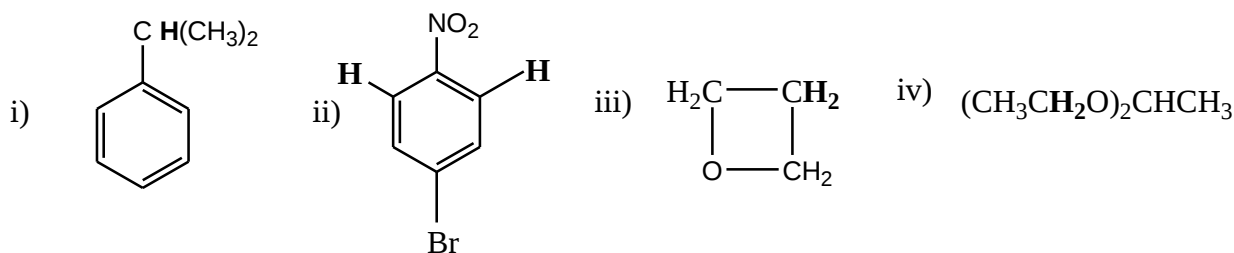


e) Arrange the following compounds in order of increasing stretching carbonyl frequency with proper explanation.

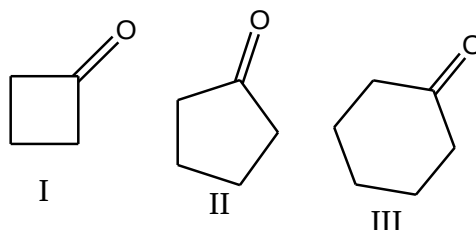
3



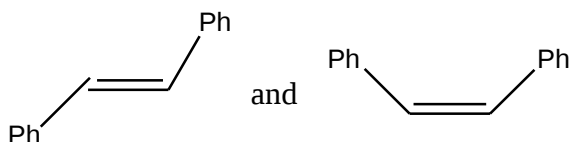
- f) What splitting pattern in the ^1H NMR spectrum would you expect for the hydrogen atom(s) (**bold**) in the compounds shown below? Your choices are: **s**(singlet) **d**(doublet) **t**(triplet) **q**(quartet) **m**(multiplet). Write down the appropriate letter against each structure. 2



- g) The molecular formula of a compound is $\text{C}_5\text{H}_{12}\text{O}_2$ and it shows the following ^1H NMR pattern : 4.1(s,6H), 1.8 (s,6H). Suggest the molecular structure of the compound. 3
- h) Explain why, in the following case, chemical shift is slightly different from the normal range **Chloroform** (CHCl_3): H on sp^3 carbon; 0-5 ppm but here at 7.27 ppm. 3
- i) A compound has a mass of 194.19 amu, determined by mass spectrometry, and contains C,N,H,O. What is a molecular formula for this molecule? 2
4. a) Discuss the effect of dilution by CCl_4 on IR absorption position of O-H stretching frequency of EtOH. 2
- b) Arrange the following molecules with increasing order to increasing C=O stretching frequency with proper reason: 2

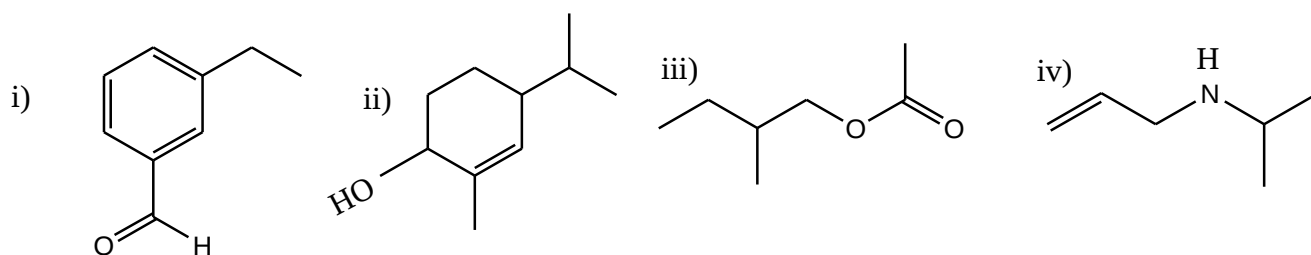


- c) Explain the following observation: 3×2
- i) Acetic acid in solution has IR absorption frequency at 1718 cm^{-1} (C=O stretching) where in vapour phase at 1786 cm^{-1} (C=O stretching)
- ii) 1,3-butadiene shows the UV absorption maxima at 217nm (ϵ 21000) while 1,3,5-hexatriene exhibits maxima 258 nm (ϵ 35000).
- ii) The UV absorption spectrum of o-nitrophenol has λ_{max} 350 nm in a 0.1 M HCl but in 0.1 NaOH its shifted to λ_{max} 715 nm.
- d) Saturated acyclic ketones usually three absorption bands in their UV spectra at around 160 nm, 190 nm and 280 nm. Assign them in terms of electronic transition and also predict with proper reason which one will be recorded as most intense absorption. 2
- e) Define chromophore and auxochrome in UV spectroscopy. 2
- f) How would you distinguish between the following pair using UV spectroscopy. 1



- g) For each of the following structure indicate how many peaks would be found in the pattern decoupled ^{13}C spectrum.

2



- h) Explain why, in the following case, chemical shift is slightly different from the normal range: Nitrobenzene ($\text{C}_6\text{H}_5\text{NO}_2$): H on sp^2 , aromatic carbon normally 7-8 ppm but here 8.5 ppm.

3

- i) At what frequency would be chemical shift of chloroform (CHCl_3 , $\delta = 7.28$ ppm) occur relative to TMS on a spectrum recorded on a 500 MHz spectrometer?

2

- j) 2-hexanone has molecular weight of 100 amu and it shows two intense peaks at m/z 58 and 43. Predict the fragments and the fragmentation pattern.

3

_____ × _____