

No. of Printed Pages : 5

RCH-002

M. Phil./Ph. D. IN CHEMISTRY
(MPHILCHEM/PHDCHEM)

Term-End Examination

December, 2019

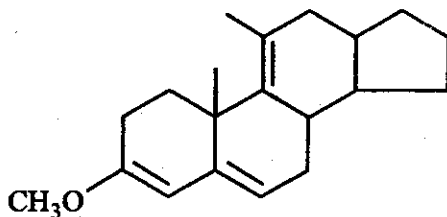
RCH-002 : ANALYTICAL TECHNIQUES IN
CHEMISTRY—I

Time : 3 Hours

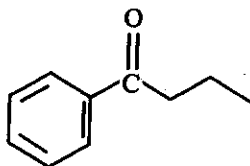
Maximum Marks : 100

Note : Answer all questions.

1. Explain the basic principle of fluorescence spectroscopy and give its applications. 10
2. (a) Predict the λ_{\max} for the following molecule : 5

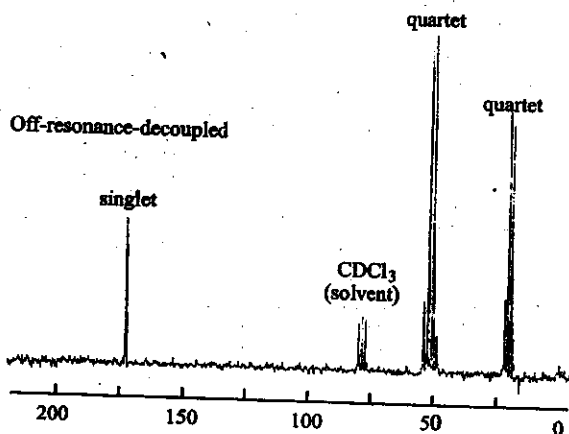
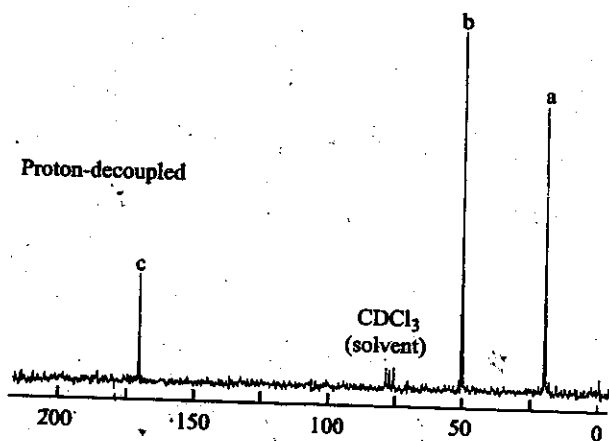


- (b) Predict the major fragments giving their m/z values observed in the mass spectrum of the following compounds ($M^+ = 148$): 5

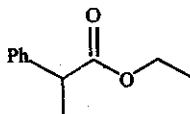


3. Briefly discuss various desorption methods used in ionization of compounds in mass spectrometry. Write the advantages and limitations of these methods. 10
4. Briefly discuss the factors affecting intensity and shape of IR signals. 10
5. (a) Assuming the force constant values are approximately the same for C - C, C - N, C - O and C - F bonds, predict the relative positions of their stretching vibrations in IR spectra. Justify your answer. 5
- (b) Explain with a suitable example the term diamagnetic anisotropy pertaining to NMR spectroscopy. 5

6. A compound with the formula $C_3H_6O_2$ gives the following proton-decoupled and off-resonance decoupled spectra. Determine the structure of the compound : 10



7. (a) Draw the expected ^1H -NMR spectrum for the following compound : 5



- (b) Predict the appearance of the ^{19}F and ^{29}Si -NMR spectra of SiF_4 and explain them. 5
8. Draw and explain the ^1H -NMR spectra of 1, 1, 2-trichloroethane and *p*-disubstituted benzene (sym). 10
9. (a) Predict a structure which matches with the data provided : 5

$\text{C}_5\text{H}_{10}\text{O}$ $\delta = 1.10$ (doublet), 2.10 (singlet)

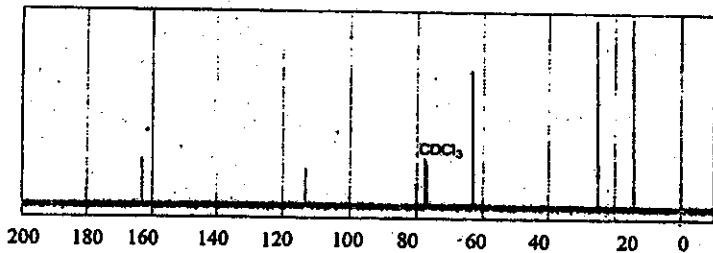
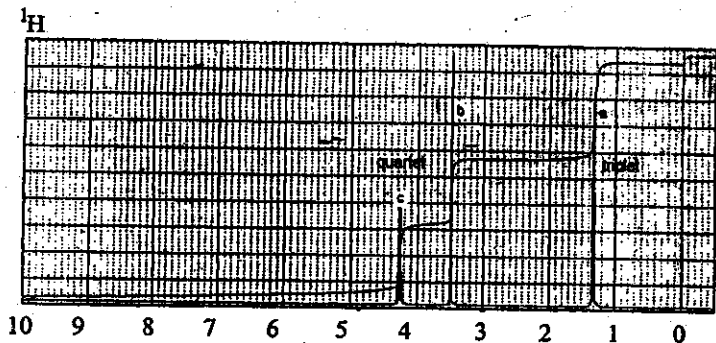
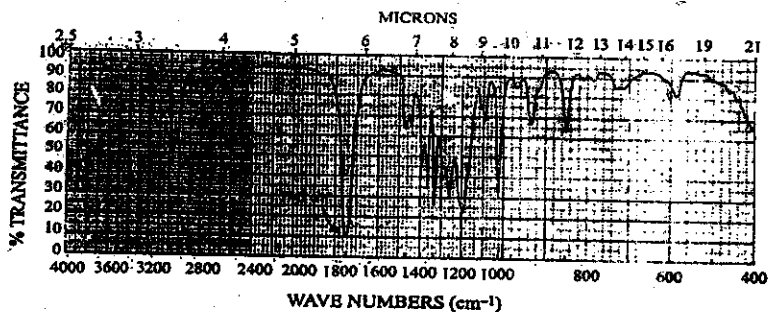
2.50 (septet)

Integration 6 : 3 : 1

IR = 1700 cm^{-1} (strong)

- (b) A compound $\text{C}_3\text{H}_8\text{O}$ in its IR spectrum shows a band at 3300 cm^{-1} . Its ^1H -NMR spectrum shows 4 sets of signals at δ 0.92 (t, 3H); δ 1.58 (sextet, 2H); δ 3.55 (2H, t) and δ 3.85 (s, 1H). Assign a structure to the compound. 5

10. The following are the IR, ^1H -NMR and ^{13}C NMR spectral data for a compound with the molecular formula $\text{C}_5\text{H}_7\text{NO}_2$. Predict its structure with justifications: 10



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