# 2018

## M.Sc. 4th Semester Examination

## CHEMISTRY

**PAPER—CEM-403**

**Subject Code—24**

*Full Marks* : 40

*Time* : 2 Hours

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

*Illustrate the answers wherever necessary.*

### (*Organic*)

### Group-A

Answer any *four* questions.                    2×4

1. A compound of molecular formula $C_6H_8$ show only two types of signals in the $^1H$ NMR spectra. Identify the compound.

2. Compound of molecular formula $C_7H_7NO_2$ shows the following absorption in the $^1H$ NMR spectra. Identify the compound. $\delta$ 8.1 (d, J = 5.8 Hz, 2H), 7.3 (d, J = 5.8 Hz, 2H), 2.45 (s, 3H).

**3.** Isomeric esters D and E have the composition $C_{11}H_{12}O_4$. Spectral data are summarized below : Deduce the structure of D and E and rationalized your answer.

Compound D : $\delta$ 8.49 (t, J = 2 Hz, 1H), 8.05 (d, J = 2 Hz, 2H), 3.94 (s, 6H), 2.46 (s, 3H) ;

Compound E : $\delta$ 8.52 (d, J = 2 Hz, 1H), 8.00 (dd, $J_1$ = 8 Hz, $J_2$ = 2 Hz, 1H), 7.28 (d, J = 8 Hz, 1H), 3.91 (s, 6H), 2.63 (s, 3H).

**4.** A organic compound having molecular formuia $(C_7H_{12}O_2)$ exhibit following $^1H$ NMR data- $\delta$ (ppm) : 7.10 (dt, $J_1$ = 16 Hz, $J_2$ = 7.2 Hz, 1H) ; 5.90 (dt, $J_1$ = 16 Hz, $J_2$ = 2 Hz, 1H) ; 4.1 (q, J = 7.2 Hz, 2H) ; 2.10 (m, 2H) ; 1.25 (t, J = 7.2 Hz, 3H) ; 0.90 (t, J = 7.2 Hz, 3H).

(a) 

(b) 

(c) 

(d) 

(Continued)
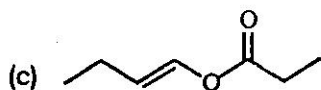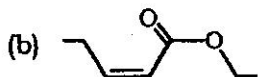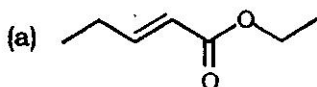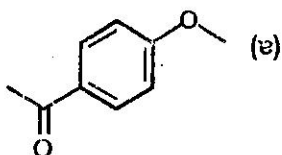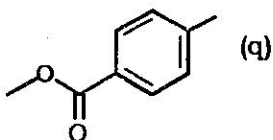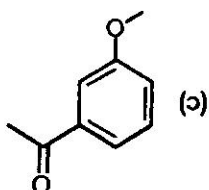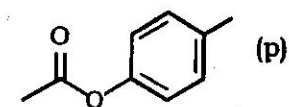
5. A organic compound having molecular formula ($C_9H_{10}O_2$) exhibit following spectral data- *FTIR (cm$^{-1}$)* = 1690 ; $^1H$ NMR – $\delta$ (ppm) ; 7.8 (d, J = 8 Hz, 2H) ; 6.9 (d, J = 8 Hz, 2H), 3.8 (s, 3H), 2.5 (s, 3H) ; 13C NMR – $\delta$ (ppm) : 197, 165, 130, 129, 114, 56, 26.



(a)



(b)



(c)



(d)

**6.** Distinguish the following pairs of compound by $^1H$ NMR spectroscopy
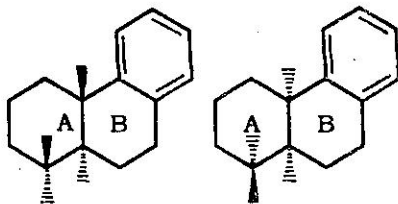


**7.** Distinguish the following compound by Mass spectroscopy :

Cyclopropane and n-propane.

**8.** Deduce the structures of the compounds exhibiting the following data :

Molecular formula :

$C_{12}H_{15}O_2N$, $^1H$ NMR d (ppm) : 8.0 (d, J = 12.3 Hz, 1H), 7.7 (d, J = 8.0 Hz, 2H) 6.8 (d, J = 8.0 Hz, 2H), 5.8 (d, J = 12.3 Hz, 1H), 3.8 (s, 3H), 3.0 (s, 6H) ppm.

### Group-B

Answer any *four* questions.                    4×4

**9.** A and B are two isomer having molecular formula $C_9H_{10}O_2$, deduced the structure of the isomers (A & B) with the help of given FTIR and $^1H$ NMR data :

For isomer A : FTIR : 1680 cm$^{-1}$, $^1$H NMR $\delta$ (ppm) : 7.6 (d, 2H), 6.9 (d, 2H), 3.9 (s, 3H), 2.0 (s, 3H).

For isomer B : FTIR : 1740 cm$^{-1}$, $^1$H NMR $\delta$ (ppm) : 7.2 (s, 5H), 5.0 (s, 2H), 1,98 (s, 3H).

10. Deduce the structures of the compounds exhibiting the following data :

Molecular formula : $C_9H_{10}O$

FTIR : 1710 cm$^{-1}$

$^1$H NMR $\delta$ (ppm) : 2.1 (s, 3H), 3,6 (s, 2H), 7.3 (s, 5H)

11. Calculate the Doppler velocity corresponding to the natural line width of $\gamma$-ray emission from 14,400 ev excited state of $^{57}$Fe nucleus having a half-life of $9.78 \times 10^{-8}$ s.  4

12. What are the essential characteristics which a nuclide must possess in order to exhibit Mössbauer effect ?  4

13. Explain recoilles emission and absorption of $\gamma$-rays.  4

14. Discuss the differences between CD and ORD.  4

15. Explain the nature of the absorption and CD spectra of adenine and guanine.  4

16. Distinguish Z-DNA and B-DNA conformations applying CD-spectroscopic study.  4

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## Group-C

Answer any *two* questions. 2×8

**17.** (a) An organic compound having molecular formula ($C_{10}H_{12}O_2$) exhibit following spectral data :

FTIR ($cm^{-1}$) = 3400, 1600 ; $^1H$ NMR $\delta$ (ppm) 6.90 (d, J = 8 Hz, 1H), 6.8 (s, 1H), 6.75 (s, 1H), 2.5 (d, J = 8 Hz, 3H), 6.28 (d, J = 18 Hz, 1H), 6.0 (dq, 1H, $J_1$ = 18 Hz, $J_2$ = 6 Hz), 5.0 (s, 1H, show $D_2O$ expt.), 3.8 (s, 3H), 1.85 (d, J = 6 Hz, 3H) ; $^{13}C$ NMR - d (ppm) : 146.5, 144.0, 131, 130.5, 123, 119, 114, 108, 55, 18.



(i)



(ii)



(iii)



(iv)

*(Continued)*
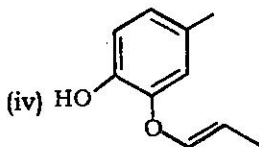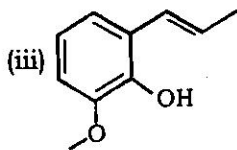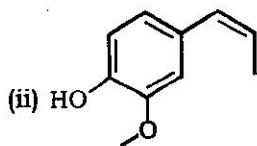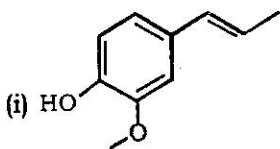
(b) In the following compound marked carbon atom shows $^{13}C$ NMR data given below :
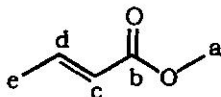


(i) a = 19, b = 143, c = 167, d = 125, e = 52

(ii) a = 52, b = 143, c = 167, d = 125, e = 19

(iii) a = 52, b = 167, c = 143, d = 125, e = 19

(iv) a = 52, b = 167, c = 125, d = 143, e = 19        4+4

18. (a) Identify the correct structure of the compound, which shows the following $^{13}C$ NMR data DEPT 135-Negative peaks at $\delta$ = 30.2, 31.9, 61.9, 114.7 ppm and positive peak at $\delta$ 130.4 ppm.

(i) 

(ii) 

(iii) 

(iv) 
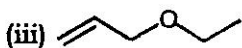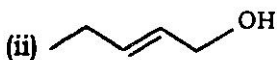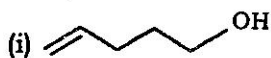
(b) A $C_9H_{10}O_2$ compound shows two strong band infrared absorption bands at 1690 and 1100 cm$^{-1}$. It's $^1H$ NMR

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spectra shows sharp singlet peaks at $\delta$ 2.8 and 3.8 ppm (3H each) and two doublets at $\delta$ 6.9 and 7.8 ppm (2H each). The $^{13}C$ NMR spectrum shows seven lines. Suggest a structure for this compound.          4+4

19. Explain the Mössbauer spectra of

    (i)  $FeSO_4 . 7H_2O$

    (ii) $K_4[Fe(CN)_6]$.                                  4+4
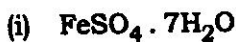
20. (a) Write down the expression for specific and molar ellipticity.

    (b) How can you determine the the a and b sheet of a protein by CD spectrometry.

    (c) What do you mean by left handed circularly polarize light and right handed circulary polarize light.

                                                           2+3+3

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