

AE-759

M.Sc. (Previous)
Term End Examination, 2016-17

CHEMISTRY

Paper - IV (A, B and C)

Spectroscopy, Diffraction Methods, Computers, Biology and Mathematics in Chemistry

Time : Three Hours] [Maximum Marks : 100
[Minimum Pass Marks : 36

Note : Answer from **all** the Sections as directed. The figures in the right-hand margin indicate marks. Do all parts of a question together.

Section - A

(Spectroscopy and Diffraction Methods)

Answer any **three** questions of the following :

1. (a) Explain the following terms : 10
- (i) Diffraction of Radiation
- (ii) Refraction of Radiation

(2)

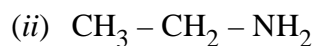
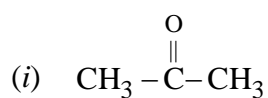
- (iii) Reflection of Radiation
- (iv) Scattering of Radiation
- (v) Dispersion of Radiation
- (b) Calculate the wavelength, wave number and frequency of radiation having an energy of 1.5 eV. 5
- (c) Write the effects of isotopic substitution on the transition frequencies. 5
- 2. (a) Show that on the rigid rotator (rotor) model the energy difference in the adjacent lines in a rotational spectrum of a diatomic molecule is constant. 10
- (b) Calculate rotational constant of HCl. the H-Cl bond length is 1.36 pm. 5
- (c) How does microwave spectra differ from infrared spectra ? 5
- 3. (a) Why are overtones and hot bands appeared in IR spectra ? Discuss the factors affecting band position and intensities of IR spectral lines. 10
- (b) Which of the following will show pure rotational spectra and why ? 5
 - (i) NO
 - (ii) CO

(3)

- (iii) O₂
- (iv) N₂
- (v) HCl
- (c) Why water can not be used as a solvent in IR spectroscopy ? 3
- (d) Why carbon tetrachloride does not yield prominent bands in the main region of IR while chloroform gives ? 2
4. (a) What is Raman effect ? Discuss the quantum theory of Raman Spectrum and give the advantages which Raman Spectroscopy has over infrared spectroscopy. 10
- (b) Discuss the basic principle of Coherent Anti-stokes Raman Spectroscopy (CARS) ? 5
- (c) Why mercury arc is suitable for studying Raman effect ? 3
- (d) Why anti-stokes lines are weaker than stokes lines ? 2
5. (a) Write in brief the basic principle of Nuclear Magnetic Resonance (NMR) Spectroscopy. Discuss the factors influencing chemical shift in NMR Spectroscopy. 15

(4)

- (b) Explain the limitations of NMR Spectroscopy. 3
- (c) Mention the number of signals in the following compounds : 2



6. (a) How X-ray is used to investigate the internal structure of crystal ? 5
- (b) Discuss Ramachandran diagram. 5
- (c) Explain the limitations of Electron Spin Resonance (ESR) Spectroscopy. 5
- (d) Calculate the ESR frequency in a magnetic field of 25000 Gauss, of $g = 2$ and $\beta = 9.273 \times 10^{-24} \text{JT}^{-1}$. 5

Section - B

(Computer for Chemists)

Answer any **one** question from the following :

7. (a) Write short notes on the following terms : 10
- (i) Principles of Programming
- (ii) Algorithms and Flowcharts

(5)

- (b) Write down any five internal and external commands of “DOS”. 5
- (c) Write the full form of the following : 5
- (i) CPU
 - (ii) RAM
 - (iii) ROM
 - (iv) MICR
 - (v) OCR
8. (a) Write the principles of ‘C’ programming of the following : 16
- (i) pH titration
 - (ii) Evaluation of lattice energy from experimental data
- (b) Write applications of MS-Word. 4

Section - C

(Biology, Mathematics for Chemists)

Answer any **one** question from the following :

9. Write down explanatory notes on any **three** of the following : 7+7+6
- (a) Kreb’s cycle
 - (b) Role of sugar in biological recognition

(6)

- (c) β -oxidation of fatty acids
- (d) Structure of RNA
10. (a) What do you know about double helix model of DNA and replication of DNA ? 7
- (b) Write the enzymatic hydrolysis of nucleic acids. 7
- (c) Write the functions of triglycerides. 6
11. (a) Explain Gauss Theorem. 5
- (b) Write exact and in-exact differential with special reference to thermodynamics. 5
- (c) Discuss the concept of differentiation and distinguish among $\frac{dy}{dx}$, $\frac{\Delta y}{\Delta x}$ and $\frac{\partial y}{\partial x}$? 5
- (d) If $u = \frac{y}{x}$, then prove that
- $$x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 0. \quad 5$$
12. Solve the following : 5×4
- (a) $\int \frac{\cos x}{\sin^2 x} dx$

(7)

(b) $\int \frac{1}{1 - \sin x} dx$

(c) $\int e^x \cdot \sin e^x dx$

(d) $\int_0^1 \frac{1}{1+x} dx$
