

Roll No.

(01/23-II)

5233

B. Sc. EXAMINATION

(Fifth Semester)

CHEMISTRY

CH-302

Physical Chemistry

Time : Three Hours

Maximum Marks : 26

Note : Attempt *Five* questions in all, selecting *two* questions from each Section. Q. No. 1 is compulsory.

Compulsory Question

1. (a) What is normalised and orthogonal wave function ? 1
- (b) What do you understand by 'Hamiltonian Operator' ? 1

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- (c) Which of the following molecules show rotational spectral spectra ? 1
HCl, CO, O₂ and H₂
- (d) What do you mean by Degree of Freedom ? 1
- (e) Define the Planck's radiation law. 1
- (f) Why anti-stokes lines are generally less intense than stokes lines in vibrational Raman Spectroscopy ? 1

Section A

2. (a) Derive expression for eigen function for a particle in one dimensional box. How can this function be normalized ? Write expression for normalized wave function. 3
- (b) A 10% solution of maltose in water showed a rotation of 26.2° in 20 cm tube for D lines of sodium at 25°C. Calculate the specific rotation of the solution. 2

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2

3. (a) Explain the effect of temperature on molar polarisation of molecules. How does it help in determining the dipole moment of a substance ? 2
- (b) Write the postulates of quantum mechanics. 3
4. (a) Derive Clausius-Mosotti equation. 3
- (b) Write a note on Compton effect. 2

Section B

5. (a) What is the effect of isotopic substitution on rotational spectra ? 2
- (b) Calculate the force constant for bond in HBr when its fundamental vibrational frequency is $9.667 \times 10^{12} \text{ s}^{-1}$. 3
6. (a) What are the advantages of Raman spectroscopy over infrared spectroscopy ? 2

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3

P.T.O.

(b) The internuclear distance of CN molecule is 1.17\AA . Calculate the energy (in joules) of this molecule in the first excited rotational level. The atomic masses $^{12}\text{C} = 1.99 \times 10^{-26}$ kg; $^{14}\text{N} = 2.3 \times 10^{-26}$ kg. 3

7. (a) What do you understand by P, Q, R branches in rotational-vibrational spectrum of diatomic molecules? How will you arrive at those? Discuss the variation of intensity of spectral lines. 3

(b) Explain the Doppler effect and Lifetime broadening. 2