Roll No. ....

(011/17-I)

5233

B. Sc. EXAMINATION

(Fifth Semester)

CHEMISTRY

CH-302

Physical Chemistry

Time : Three Hours   *Maximum Marks* : 26

Note : Attempt *Five* questions in all. Q. No. **1** is compulsory. Select *two* questions each from Section A and Section B.

1. (a) What is the difference in the result obtained about heat capacities of solids when classical mechanics is applied and when quantum mechanics is applied.

   (b) What are the conditions which an eigen function ψ must satisfy ?

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(c) Define induced dipole moment.

(d) What is a constitutive property ?

(e) Why only one absorption line is expected in the vibrational spectrum of a diatomic molecule, treating it as simple harmonic oscillator.

(f) Arrange the following gps in order of their absorption frequencies :

(i) CF, CCl, CBr, CH

(ii) C-C, C=C, C≡C. $1 \times 6 = 6$

Section A

2. (a) What is meant by zero point energy ? 1

(b) What are the failures of classical mechanics ? 1

(c) What is optical ativity and specification rotation ? What is the cause of optical activity ? 3

3. (a) Define Planck's radiation law derive : 3

$$E_\lambda = \frac{8\pi hc}{\lambda^5} \frac{1}{\left(e^{hc/kT\lambda} - 1 \right)}$$

(b) Define Eigen values and eigen functions.

2

4. (a) Discuss the importance of operators in quantum mechanics. 2

(b) Explain normalized and orthogonal wave functions. 2

(c) The value of $|\alpha|_D^{20}$ for lactose is 55.4°. What is the concentration in grams per litre of a solution of lactose which gives a rotation of 7.24° in a 10 cm cell at 20° with sodium D light ? 1

Section B

5. (a) Discuss the intensity of rotational spectra with reference to the degeneracy factor and Boltzman exponential factor. 2

(b) How is Infrared spectra helpful in the identification of organic compounds ? 1

(c) Write note on vibrational energy levels of a simple harmonic oscillator and define zero point energy. 2

6. Write notes on the following :

    (i) Electromagnetic theory of radiation   1½

    (ii) Resolving power   1½

    (ii) Degrees of freedom.   2

7. (a) Write note on Raman effect.   1½

    (b) Explain Raman effect in terms of Polarizability.   1½

    (c) Calculate the force constant for the bond in HCl from the fact that the fundamental vibrational frequency is 8.667×10^{13} sec.$^{-1}$.   2