

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 ?

- (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. 1×6=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 activity and specification rotation ? What is the cause of optical activity ? 3

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

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

(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 $8.667 \times 10^{13} \text{ sec.}^{-1}$. 2