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94085

B. Sc. Bio-Tech 5th Sem. (N. S.) Examination – November, 2017

PHYSICAL CHEMISTRY

Paper : BT-505

Time : Three Hours] *[Maximum Marks : 40*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions. Selecting ***two*** questions from each Section.

SECTION – A

1. (a) Explain the role of operators in quantum mechanics with suitable examples. 3

   (b) Briefly explain how classical mechanics fails when applied to the following : 5

   (i) Photoelectric effect

   (ii) Heat capacity of solids

   How could these phenomena be explained by Planck's quantum theory ?

2. (a) When are the two eigen functions said to be : 2

(i) Mutually orthogonal

(ii) Orthonormal

(b) If the position of the electron ($m = 9.1 \times 10^{-31}$ kg) in H atom could be determined with an accuracy of 0.01 mm, what would be the uncertainty in its velocity ? Comment on the result. 3

(c) State and derive Planck's radiation law. How can it be verified experimentally ? 3

3. (a) What is dipole moment ? What are its units ? How is it determined by Refraction method ? 4

(b) Write clausius-Mosotti Equation giving relationship between distortion polarization and dielectric constant of the medium. 4

4. (a) Briefly explain the terms piezoelectricity, pyrroelectricity and ferroelectricity. What are the uses of these properties ? 4

(b) Briefly explain Guoy's method for the measurement of magnetic susceptibility. 2

(c) 'Optical activity is a constitutive property.' Exemplify. 2

SECTION – B

5. (a) Write short notes on : 4

(i) Zero point energy and

(ii) Relative intensities of rotation spectral lines.

(b) What types of potential energy curve is obtained for a simple harmonic oscillator ? 4

6. (a) What do you understand by signal to noise ratio ? How can it be enhanced ? 3

(b) The force constant of the bond in $^{12}C^{16}O$ is 1902 $N\,m^{-1}$. Calculate the wave number of the transition corresponding to the vibration of this bond. 2

(c) What do you understand by Doppler broadening and lifetime broadening ? 3

7. (a) Write expression for the vibrational energy of a diatomic molecule taking it as a simple harmonic oscillator. Represent the vibrational energy levels of such a molecule diagrammatically. 4

(b) What is Raman spectrum ? Name the different types of lines present in it and give the reason for observing these lines. 4

8. (a) Explain with suitable derivations what type of rotation vibration spectrum is obtained for a diatomic molecule, taking it as an anharmonic oscillator ? 3

(b) Explain Raman Effect on the basis of polarisability of molecule. 3

(c) Using IR spectroscopy, how will you determine whether the oxygen in an organic compound is present as carbonyl or hydroxyl group ? 2
