CS/2110 5233/NH

Total No. of Questions: 09

Paper III: PHYSICAL CHEMISTRY
Time Allowed: 3 Hours

Maximum Marks: 26

*Note:- Candidates are required to attempt **five** questions (Section C all questions being compulsory) selecting two questions from each of A & B.*

SECTION-A

1. What is photoelectric effect? Discuss its theory. **4 Marks**

2. Briefly explain how classical mechanics fails when applied to the following:

   a) Photoelectric effect b) Heat capacity of solids **4 Marks**

3. Write the expression for energy for the particle in one dimensional box. How can you justify a) Quantisation of energy b) existence of zero point energy **4 Marks**

4. Write the expression for the

   a) Angular and radial wave function. What do different symbols signify? **2 Marks**

   b) What does Hamiltonian operator stand for? **2 Marks**

SECTION B

5. Using Heisenberg's Uncertainty principle and other appropriate equation, prove the validity of the Born-Oppenheimer approximation. **4 Marks**

6. If the visible spectrum ranges between 400 to 800 nm, express in-terms of frequency and wave number. **4 Marks**

7. Discuss the theory of microwave spectroscopy? Give an expression for energy levels of a rigid rotor for diatomic molecules. **4 Marks**

8. Give mathematical expression for determination of force constant along with qualitative relation of force constant and bond energies. **4 Marks**

SECTION C

9. a) What is meant by dual nature of light?

   b) Why are pure rotational spectra studied only in gaseous states of atoms and molecules?

   c) How many fundamental vibrational frequencies would you expect to observe in the IR absorption spectrum of H_2O?

Contd -- 2

d) What is sine wave? Give example of sine waves? What is sinusoidal wave equation?

e) What will happen if the walls of the one dimensional box are suddenly removed?

5 × 2 = 10 Marks

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