

2316

240

Class – B.Sc-VI Sem.

Subject – Chemistry

Paper – Physical

Time Allowed : 3 Hours

Maximum Marks : 35

**SECTION-A**

**Attempt all questions. Each question carries 1 mark.**

1. Define unit cell.
2. Draw crystal structure of NaCl.
3. What do you mean by well behaved wave functions?
4. Draw radial probability curves of 1s and 2p orbitals?
5. What is sinusoidal wave equation? Represent it graphically.
6. What are zero point energies of rigid rotator and Harmonic oscillator?
7. What are limitations of Bohr theory?
8. Define the law of symmetry. Give one example.

(1 × 8)

**SECTION-B**

**PART-I**

**Attempt any six questions. Two questions from each part. Each question carries 4.5 marks.**

- 9.(a) State and explain postulates of quantum

mechanics.

(b) Show that the function  $Ae^{-ax}$  is an eigen function

of the operator  $\frac{d^2}{dx^2}$ . What is eigen value? (3, 1½)

10. (a) Explain photoelectric effect.

(b) What are the main postulates of Bohr model of an atom? (1½, 3)

11. (a) What is Compton effect? Also explain the term Compton shift.

(b) Calculate the energy required for a transition from  $n_x = n_y = n_z = 1$  to  $n_x = n_y = 1, n_z = 2$  for an electron in a cubic hole of a crystal having edge length =  $1 \text{ \AA}$ . (2½, 2)

### PART-II

12. (a) State and explain Kirchhoff's law about black body radiation.

(b) Apply Schrodinger wave equation for a particle in one-dimensional box and obtain the expression for the eigen function and eigen value of the energy. (1½, 3)

13. (a) Using the concepts of quantum mechanics describe the shapes of s & p orbitals.

(b) Write the expression for energy of electron in  $n^{\text{th}}$

shell of hydrogen atom in electron volts. What will be the value of energy if  $n = 3$  (2½, 2)

14. (a) Define the laws related to crystallography.
- (b) Derive Bragg's equation for X-ray diffraction by crystals. (2, 2½)

### PART-III

15. (a) What is linear Harmonic oscillator? Using quantum mechanics derive an expression for energy and wave-function of a linear Harmonic oscillator.
- (b) How does quantum mechanics lead to the concept of orbital? (3, 1½)
16. (a) Write Schrodinger wave equation for Hydrogen atom in spherical co-ordinates. How can you separate the variables of this equation to get expression, each containing one variable only.
- (b) Compare de Broglie wavelength of an electron moving at  $1 \times 10^8 \text{ cm s}^{-1}$  and an object of mass 1g moving with the speed of  $1.0 \text{ cm s}^{-1}$ . (3, 1½)

17. (a) Evaluate the commutator  $\left[ x^2, \frac{d^2}{dx^2} \right]$ .

- (b) What are Weiss indices and Miller indices?
- (c) A crystal plane has intercepts on the three axes of

the crystal as  $\frac{1}{3} a$ ,  $\frac{3}{4} b$  and  $\frac{1}{2} c$ . What are the miller indices of the face?  $(2\frac{1}{2}, 1, 1)$

\*\*\*\*\*