Roll No. ....

Sub. Code : | 0 | 5 | 4 | 9 |

Exam. Code : | 0 | 0 | 0 | 6 |

B.A./B.Sc. (General) 6th Semester

1059

CHEMISTRY

(Same for B.Sc. Microbial and Food Technology)

Paper–XXIII : Physical Chemistry–B

Time Allowed : Three Hours]   **[Maximum Marks : 22**

Note :— (1) Attempt **FIVE** questions in all, selecting **ONE** question from each Section and Question No. **9** is compulsory.

(2) Students may use simple calculator.

SECTION—A

1. (a) Define the terms Axis of symmetry, Mirror planes and Centre of inversion. Show them diagrammatically for a cubic system.

 (b) The crystallographic axes of a unit cell are $\bar{a}, \bar{b}, \bar{c}$. Draw a plane of which Miller indices are (221). Can there be more than one plane with the same Miller indices ?

 2,2

2. (a) Explain the Law of Constancy of interfacial angles and Law of Rationality of indices.

(b) Why do cooling curves of molten crystalline solids have breaks while those of amorphous solids do not have breaks ? 2,2

SECTION—B

3. (a) Draw and discuss the crystal structure of sodium chloride.

(b) The first order reflections from the 100, 110 and 111 planes of a given cubic crystal (NaCl crystal) were found to occur at angles 5.9°, 8.4° and 5.2° respectively. Determine the type of cubic lattice to which the crystal belongs. 2,2

4. (a) Using powder method of crystal analysis, describe how interplanar spacing can be calculated.

(b) Explain the construction and working of X-Ray spectrometer used by Bragg. 2,2

SECTION—C

5. (a) Differentiate between Absorption and Emission spectroscopy. Why absorption spectroscopy is preferred ?

(b) What is Born-Oppenheimer approximation and what are the selection rules followed in atomic spectroscopy ?

2,2

6. (a) What is the effect on rotational energy levels of a molecule if an atom is replaced by its heavier isotope ?

(b) What do you understand by Doppler effect and 'Doppler broadening' or 'Doppler shift' ? What is the effect of temperature on it and why ? 2,2

7. (a) What do you mean by 'zero point energy' ? What type of molecules exhibit vibrational spectra ?

    (b) The reduced mass of diatomic molecule is 2.5×10^{-26} kg and its vibrational frequency is 2900 cm^{-1}. Calculate its force constant.   2,2

8. (a) Differentiate between Raman Spectra and Infra-red spectra. What are the advantages of Raman spectroscopy over Infrared spectroscopy ?

    (b) What are the selection rules for transitions in electronic spectroscopy of molecules ?   2,2

SECTION—E
(Compulsory Question)

9. (i) Show that for the given Miller indices in a crystal, there is a set of equally spaced parallel planes.

    (ii) Define 'space lattice' and 'unit cell'.

    (iii) Why amorphous solids are isotropic but crystalline solids are anisotropic ?

    (iv) What do you understand by degrees of freedom of motion of a molecule ?

    (v) What type of potential energy curve is obtained for a simple harmonic oscillator and why ?

    (vi) What is the most important use of studying pure rotational Raman spectrum ? $1 \times 6 = 6$