(i) Printed Pages: 4 Roll No. .....

(ii) Questions : 9 Sub. Code : 0549

Exam. Code : 0006

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

(2054)

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, including Q. No. 9 which is compulsory and selecting **ONE** question from each section.

(2) Use of log tables and simple calculator is allowed.

SECTION—A

1. (a) What are the Miller indices of the different planes present in three Bravais lattices of a cubic system ? Calculate the ratio of the interplanar distances in each of them.

(b) Explain the terms : Plane of symmetry, Centre of symmetry, rotation-reflection axis of symmetry, rotation-inversion axis of symmetry. 2,2

2. (a) How are crystalline solids classified into different types on the basis of their constituent particles, the types of forces present and the important properties of each of them ?

(b) Explain Steno's law of constancy of interfacial angles. How are interfacial angles measured ? 2,2

SECTION—B

3. (a) Explain the powder method for the determination of crystal structure. What are its advantages over Bragg's method ?

(b) CsCl crystallizes in body centered cubic lattice. Calculate the number of Cs^+ and Cl^- ions in unit cell of CsCl. 2,2

4. (a) When a certain crystal was studied by the Bragg's technique using X-rays of wavelength 229 pm, an X-ray reflection was observed at an angle of 23°20'.

(i) What is the corresponding interplanar spacing ?

(ii) When another X-ray source was used, a reflection was observed at 15°26'. What was the wavelength of these X-rays ?

(b) Based on physical state, how will you classify thermal reactions in the solid state ? What different types of plots are obtained by degree of dissociation versus time for reactions of the type : $A(s) \rightarrow B(s) + C(g)$? 2,2

SECTION—C

5. (a) What are the basic components of a spectrometer ? Show the diagrammatically.

   (b) Considering a diatomic molecule as a rigid rotator, explain the type of rotational spectra obtained after deriving the expressions required. 2,2

6. (a) The rotational spectrum of CO shows a series of equidistant lines spaced 3.84 cm^{-1} apart. Calculate the moment of inertia and the bond length of C=O bond.

   (b) Define degrees of freedom of motion of a molecule. Explain the different types of degree of freedom possessed by linear and non-linear molecules. 2,2

SECTION—D

7. (a) Explain Raman spectra on the basis of polarizability of molecules.

   (b) How are infrared spectra helpful in the identification of organic compounds ? 2,2

8. (a) HCl molecule is irradiated with 434.8 nm mercury line, calculate the Raman line in nm if the fundamental vibrational frequency of HCl is $8.667 \times 10^{13} s^{-1}$.

   (b) Taking the example of carbonyl compounds, represent molecular orbitals and explain the electronic transitions taking place between them. 2,2

SECTION—E

(Compulsory Question)

(a) What type of solids are called pseudo solids or supercooled liquids and why ?

(b) Which lines are missing in the X-ray diffraction pattern of primitive cubic lattice ?

(c) Why are solid state addition reactions exothermic ?

(d) What do you understand by the terms : linear dispersion and angular dispersion ?

(e) In the electronic band spectrum, why there are no simple selection rules for transitions among vibrational levels ?

(f) In the vibration-rotation spectrum of HCl, why each individual line of the spectrum is found to consist of doublets ? 1×6