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**B. Sc. (Bio-Technology) 1st Sem. (w.e.f. 2012-13) Examination – November, 2023**

**PHYSICAL CHEMISTRY**

Paper : BT-105

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 in all, selecting *one* question from each Section. Question No. 1 is *compulsory*.

All questions carry equal marks.

1. Answer the following in brief :  $1 \times 8 = 8$

(a) Define surface tension. What is its unit ?

(b) Which crystal system is anisotropic and why ?

(c) What is Refractive Index ?

(d) Write applications of liquids crystals.

(e) State Collision number.

(f) Name the primitive unit cells in which  $\alpha = \beta = \gamma = 90^\circ$ .

(g) List the various elements of symmetry present in cube.

(h) Write the expression of heat capacity at constant volume ( $C_v$ ) of a linear molecule having 'N' number of atoms.

**SECTION – A**

2. (a) State Maxwell's distribution law of velocities. How does the molecular velocities vary with increase in temperature (represent diagrammatically) ? 4

(b) Calculate the volume occupied by 10 moles of ethane at 10 atm pressure and 300 K (provided with  $z = 0.783$  at this temperature and pressure). 4

3. (a) Define the terms : 3

(i) Collision diameter

(ii) Boyle's temperature

(b) How does Vander Waals equation explain the exceptional behavior of hydrogen and helium ? 3

(c) Write the SI units of the following : 2

(i) Vander Waal's constant 'a'

(ii) Vander Waal's constant 'b'

4. (a) State and explain the principle of corresponding states. Deduce reduced equation of state. 4

(b) Out of Linde's process and Claude's process for liquefaction of gases, which one is better and why? 4

5. (a) Obtain the relation  $RT_c / P_c V_c = 8/3$ . 4

(b) The reduced volume and reduced temperature of  $\text{NO}_2$  are 10 and 0.55 respectively. What will be its critical pressure if its pressure is 35.9 atm? 4

### SECTION - C

6. (a) Explain why: 4

(i) At the boiling point, the temperature of liquid does not rise although it is being heated?

(ii) Glycerol is more viscous than water?

(b) What is vapour pressure? Describe the factors affecting vapour pressure. 4

7. (a) Write notes on the following: 4

(i) Coefficient of viscosity

(ii) Optical exaltation

(b) Write a note on parachor. How parachor is useful in elucidating molecular structure of compounds? 4

### SECTION - D

8. (a) Derive Bragg's equation for diffraction of X-rays by a crystal lattice. 4

(b) Write notes on the following: 2 + 2 = 4

(i) Anisotropy and isotropy

(ii) Law of constancy of interfacial angle

9. (a) Identify the crystal system to which each of the following belongs: 4

(i)  $a = b = c$  and  $\alpha = \beta = \gamma \neq 90^\circ$

(ii)  $a = b = c$  and  $\alpha \neq \beta \neq \gamma = 90^\circ$

(iii)  $a \neq b \neq c$  and  $\alpha = \beta = \gamma = 90^\circ$

(iv)  $a \neq b \neq c$  and  $\alpha \neq \beta \neq \gamma = 90^\circ$

(b) Write notes on the following: 2 + 2 = 4

(i) Haüy's Law of Rational Indices

(ii) Powder method for the determination of crystal structure.