

5712

5. (a) What are the seven crystal systems? Describe each system in terms of its axial lengths (a,b,c) and interaxial angles (α, β, γ).
- (b) What is the effect of molecular mass on the Maxwell Boltzmann distribution curve at a constant temperature?
- (c) Explain various types of point defects in crystals with diagrams and suitable examples. (5,5,5)
6. (a) Briefly describe
- (i) Bragg's Law of X-ray diffraction,
- (ii) Law of rational indices.
- (b) Define interplanar spacing for a crystal lattice and write the equation relating to interplanar spacing d_{hkl} and miller indices for a cubic lattice. Calculate the interplanar spacing of planes with miller indices (121) in a cubic crystal of edge length 1.5 Å
- (c) What is fundamental principle on which powder X-ray diffraction technique works? Explain powder diffraction pattern of NaCl with diagram. (5, 5, 5)

This question paper contains 4 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **5712** **I**

Unique Paper Code : 2174001011

Name of the Paper : GE: STATES OF MATTER

Name of the Course : **B.Sc. (H)**

Semester : II/IV/VI

Time : 2 Hours **Maximum Marks : 60**

Instructions for Candidates :

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
- (b) Use of Scientific Calculator is permitted.
($R = 8.3141 \text{ JK}^{-1}\text{mol}^{-1}$, $k = 1.38 \text{ JK}^{-1}$)

Attempt four questions

Question No. 1 is compulsory

1. Attempt the following questions briefly: **(Any five)**
3×5=15
- (a) In a graph of compressibility factor Z . versus Pressure, the curve for NH_3 shows a much deeper dip than the curve for N_2 at the same temperature. Explain what a 'deeper dip' signifies regarding the nature of the gas and its intermolecular forces.

- (b) What is the ratio of V_{rms} of H_2 and O_2 at the same temperature
 - (c) Write an expression for Van der Waals equation for real gas. Under what conditions does a Van der Waals gas behave like an ideal gas?
 - (d) What is 'Excluded Volume'? How is it related to the actual volume of molecules?
 - (e) Why do raindrops assume a spherical shape?
 - (f) What is Law of Constancy of interfacial angles?
- 2.** (a) Calculate the Miller indices for the following planes:
- (i) $(a/2, b, c/2)$,
 - (ii) $(a, b/2, 3c)$
- (b) Derive an expression for the pressure exerted by an ideal gas as given by the kinetic gas equation and also find kinetic energy of the system.
- (c) Define "Boyle Temperature" T_b . Write its mathematical expression in terms of Vander Waals constants. How does gas behaviour differ above and below this temperature?
- (5,5,5)

- 3.** (a) Discuss the significance of the "Horizontal Portion" in the Andrew isotherms below 31.1°C . Why does it disappear at the critical point?
- (b) Write the expressions for the critical constants T_c , P_c & V_c . Show that the critical compressibility factor Z_c is equal to 0.375.
- (c) A stalagmometer produced 40 drops of water and 60 drops of a liquid. The density of the liquid is 0.85g/cm^3 and that of water is 1.0g/cm^3 . If the surface tension of water is 72.0 dynes/cm at 20°C , calculate the surface of the liquid.
- (5,5,5)
- 4.** (a) Starting from Poiseuille's equation, derive the expression for the determination of the relative viscosity of a liquid using an Ostwald Viscometer. Explain all the terms involved.
- (b) The flow time for water at 20°C is 80 s and 240 s for an unknown solution, their densities are 1.0g/cm^3 and 0.9g/cm^3 respectively. If the absolute viscosity of water is 1.002cP (centipoise), calculate the absolute viscosity of an unknown solution at 20°C .
- (c) Define the three speeds originating from Maxwell-Boltzmann statistics. Provide their mathematical formulas and rank them by magnitude on curve?
- (5,5,5)