

- (b) Draw and show the planes cutting on the three perpendicular axes for the following Miller Indices
(i) (111), (ii) (001) and (iii) (010). (5)
- (c) What is interplanar spacing. Calculate the values of interplanar spacing for different planes in cubic lattice whose miller indices are 100, 110 and 111. Assume the length of the cube is 1.0 pm. (5)
6. (a) In an experiment with Ostwald viscometer, the time of flow of water and ethanol are 80 sec and 175 sec at 20 °C. The density of water = 0.998 g cm⁻³ and that of ethanol = 0.790 g cm⁻³. The viscosity of water at 20°C is 0.01008 poise. Calculate the viscosity of ethanol. (5)
- (b) Differentiate between surface tension and surface energy. Surface tension of ethyl alcohol, acetic acid and water are $22.3 \times 10^{-3} \text{ N m}^{-1}$, $27.6 \times 10^{-3} \text{ N m}^{-1}$ and $72.8 \times 10^{-3} \text{ N m}^{-1}$ respectively. Explain why the surface tension of water is very high in comparison with other two liquids? (5)
- (c) How does surface tension and viscosity of liquids vary with temperature? Explain with relevant relations. (5)

(1000)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3526.

I

Unique Paper Code : 2174001011

Name of the Paper : (GE) States of Matter

Name of the Course : B. Sc. (Hons)

Semester : I/III/V

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **FOUR** questions in all. Question No. 1 is compulsory.
3. The questions should be numbered in accordance to the number in the question paper.
4. Use of Scientific Calculator is permitted.

($R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$, $k = 1.38 \times 10^{-23} \text{ K}^{-1} \text{ mol}^{-1}$; $N_A = 6.023 \times 10^{23} \text{ mol}^{-1}$)

1. Answer any five of the following :

(a) State the law of rational indices. (3)

P.T.O.

- (b) What is the effect of temperature and pressure on the coefficient of viscosity of a gas? (3)
- (c) Calculate the miller indices of crystal planes that cut through the crystal axes at (i) (2a, 3b, c), (ii) (a, b, c), (iii) (∞ a, ∞ b, c). (3)
- (d) How does the change of temperature of a gas influence Maxwell's distribution of molecular velocities? (3)
- (e) Define Boyle's temperature. What is the compression factor (Z) value at Boyle's temperature? (3)
- (f) How does the surface tension of water vary with the addition of ionic salts? (3)
2. (a) Discuss the Andrew's P-V isotherms of CO₂ gas. Define the critical constants. (5)
- (b) Calculate the temperature at which the root mean square and the most probable velocity of oxygen gas are equal to 1,500 m s⁻¹. (5)
- (c) Derive the kinetic gas equation: $pV = mNu^{-2}/3$. (5)

3. (a) What is collision frequency and mean free path? How collision frequency and mean free path depends upon temperature and pressure. Explain. (5)
- (b) Derive the Bragg's equation in X-ray crystallography. (5)
- (c) For oxygen gas at 25 °C, calculate (i) the mean free path at 1 atm & (ii) the mean free path at 0.001 mm Hg pressure. (5)
4. (a) Define excluded volume (b) also derive the mathematical expression of the excluded volume for 1 mol of a gas. (5)
- (b) Discuss the drop number method of the determination of surface tension of a liquid.
- (c) Write short notes on following elements of symmetry (i) rotational axis (ii) reflection plane. (5)
5. (a) Explain the long range and short range order in solids with suitable examples. Define liquid crystals (LCs) and explain the range order present in LC with examples. (5)