

5. a) Derive Kinetic gas equation mentioning its essential postulates. (5)
- b) Under what sets of experimental conditions is the van der Waals equation more applicable than the ideal gas equation? Calculate and compare the pressure of 12.0 mol CO at 298 K in a 10 L vessel using (i) ideal gas and (ii) the van der Waals gas equation. The value of "b" for CO is 0.0399 L mol⁻¹ and for "a" is 1.49 L² atm mol⁻¹ (5)
- c) The coefficient of viscosity of n-heptane is 0.0001328 Poise at 298 K. Calculate the molecular diameter of this gas. Molecular mass of n-heptane is 100 g mol⁻¹. (5)
6. a) What are Isotropic and anisotropic solids? Why Crystalline solids show anisotropic and amorphous solids show isotropic effect? (5)
- b) What is interplanar spacing? Calculate the values of interplanar spacing for different planes in cubic lattice whose miller indices are 100, 110 and 111. Also calculate the ratios of interplanar spacing using these indices. Assume the length of the cube is 1.0 pm. (5)
- c) What is Free Path and Mean Free Path. Explain, how Mean Free Path varies with temperature and pressure. (5)

(1000)

[This question paper contains 4 printed pages.]

Your Roll No.....

आपका अनुक्रमांक.....

Sr. No. of Question Paper : 3026

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 J K⁻¹ mol⁻¹, k = 1.38 x 10⁻²³ K⁻¹ mol⁻¹;
N_A = 6.023 x 10²³ mol⁻¹)

P.T.O.

1. Answer any five of the following:
- Calculate the Miller Indices of crystal planes which cut through the crystal axes at (i) (2a, 3b, c) (ii) (a, b, c) (iii) (6a, 3b, 3c). (3)
 - The parameters of an Orthorhombic unit cell are $a=50$ pm, $b = 100$ pm and $c = 150$ pm. Determine the spacing between the (123) planes. (3)
 - How Viscosity in gases arises? Explain. (3)
 - State the Law of Constancy of Interfacial angles with an example. (3)
 - How the surface tension of water varies with the addition of detergents? (3)
 - Two van der Waals gases have the same value of "b" but different value of "a". Which of these will occupy greater volume under the identical conditions? (3)
2. a) What are the different types of defects in crystals? How do these defects arise? Differentiate between Schottky's and Frenkel's defects with suitable examples. (5)
- b) Explain the following elements of symmetry and their associated operations using suitable examples: (i) n-fold axis of symmetry (ii) Mirror plane parallel to the principal axis. (5)
- c) Draw and differentiate the powder XRD of NaCl and KCl with diffraction pattern (5)

3. a) The critical constants for water are 647 K, 22.09 MPa and $0.0566 \text{ dm}^3 \text{ mol}^{-1}$. Calculate the values of a, b and R. (5)
- b) Write Maxwell Distribution of molecular velocities of gases, explain various terms involved and roughly sketch the Maxwell Distribution curve for a gas at different temperatures. Label both the axes and explain the effect of temperature on the distribution curve. (5)
- c) What is compression factor (Z)? Explain this factor with plots of Z vs pressure for different gases (CO_2 , CH_4 , N_2 , and H_2). (5)
4. a) Define surface tension of a liquid, give its unit and describe in details its determination using stalagmometer with drop number and drop weight method. (5)
- b) How viscosity in liquids arises and how it varies with temperature? Ostwald Viscometer cannot be used for the determination of viscosity of highly viscous liquids like glycerol. Explain why? (5)
- c) Why surface tension of water is very high in comparison to other organic solvents (ether, acetone, acetic acid, ethanol, etc.)? Write and explain the effect of the following impurities on the surface tension of water (i) ionic salts and (ii) organic solvents (mainly alcohols). (5)