

5305

4

5. (a) It is not possible to deduce the position of hydrogen atom from X-ray diffraction. Why? What are the advantages and limitations of using powder method for X-Ray diffraction?

(b) Calculate the pressure exerted by 22 g of carbon dioxide in 0.5 dm^3 at 298.15 K using: (i) the ideal gas law and (ii) van der Waals equation. Given: $a = 363.76 \text{ kPa dm}^6 \text{ mol}^{-2}$ and $b = 42.67 \text{ cm}^3 \text{ mol}^{-1}$.

(c) What is meant by "point group" and "space group"? What is the difference between them?

(5,5,5)

6. Write notes on any **three** of the following :

(a) Liquid Crystals

(b) Andrews Isotherms

(c) Cleansing action of soaps and detergents

(d) Frenkel and Schottky defects

(5,5,5)

(300)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5305

L

Unique Paper Code : 2174001011

Name of the Paper : STATES OF MATTER

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

Semester : VIII

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 any **four** questions.
3. Use of scientific calculators is allowed.

1. (a) Write down the postulates of kinetic theory of gases. Derive kinetic gas equation.

(b) Explaining the terms involved, write down the expression of Maxwell-Boltzmann equation. Draw the graph showing variation of fraction of molecules and molecular speed. How does this graph change on increasing the temperature? Explain.

P.T.O.

- (c) Calculate the root mean square, average and the most probable speeds for oxygen molecules at 25°C. At what temperatures would these speeds be possessed by butane molecules? (5,5,5)
2. (a) On what factors does the viscosity of gases depend? Neon and mercury vapours have very nearly equal van der Waals b parameters, which implies equal atomic volumes and radii. At the same temperature, would you expect any difference in the viscosities of these gases and why?
- (b) Define mean free path. Write down its expression in terms of collision diameter and number density of molecules. The collision diameter for helium is 207 pm and for methane, 414 pm. How does the mean free path for He compare with that for CH_4 under the same conditions?
- (c) Starting from van der Waals equation of gas, derive the expressions of critical constants T_c , P_c and V_c . (5,5,5)
3. (a) What is meant by surface tension of a liquid? Write down SI unit of surface tension. How does surface tension of liquids change on increasing the temperature? Explain,

- (b) Describe the method of determination of viscosity of a liquid using Ostwald's viscometer. The viscosity of an oil is $0.05 \text{ N m}^{-2} \text{ s}$ and its density is 0.97 g cm^{-3} at 298 K. How long a given volume of the oil will take to flow through a viscometer if the same volume of water takes 50 s? Given: $\eta(\text{H}_2\text{O}) = 8.9 \times 10^{-4} \text{ N m}^{-2} \text{ s}$. Take $\rho(\text{H}_2\text{O}) = 1.0 \text{ g cm}^{-3}$.
- (c) What is the cause of viscosity in case of gases? How does it differ from viscosity in liquids? Explain the temperature dependence of viscosity of gases and liquids. (5,5,5)
4. (a) State the essential condition for obtaining a bright spot in diffraction. Show that for X-ray diffraction through crystals $n\lambda = 2d \sin \theta$.
- (b) Compute the Miller indices for a face having intercepts on the three axes as
- (i) $a, b, \frac{1}{4}c$ (ii) $\frac{1}{2}a, \frac{1}{4}b, \infty c$
- (c) Molybdenum forms body-centred cubic crystals whose density is 10.3 g cm^{-3} . Calculate: (i) edge length of the unit cube, (ii) distance between the (110) planes. Molar mass of Mo = 95.94 g mol^{-1} . (5,5,5)