SL NO of QP 9106

B.Sc. (H) VIth Semester

GE: States of Matter

UPC: 2174001011

Duration: 02 hours **Max. Marks: 60**

Attempt any 04 questions

1. a) State the assumptions of Kinetic theory of gases. Which assumptions had to be greatly modified to explain behaviors of real gases.
   b) The Vanderwaals constant 'a' and 'b' for NO2 gas are 5.36 atm.dm^6.mol^{-2} and 0.04424 dm^3.mol^{-1} respectively. Calculate the critical temperature, critical pressure and critical volume of the gas. (R= 0.08206 dm^3.atm.$K^{-1}mol^{-1}$)
   c) Describe with the help of a diagram, the Ostwald's viscometer method for determination of viscosity of the liquid.

   (5, 5, 5)

2. a) Sketch the Maxwell distribution curve for the gas molecules in terms of molecular velocities. Label both axes and explain the effect of temperature on the distribution curve.
   b) What are liquid crystals? What are their types? Discuss the characteristic of each type with the help of a diagram.
   c) The coefficient of viscosity of CO_2 gas is 160 x 10^{-6} Poise at 27°C. Calculate its collision diameter and mean free path.

   (5, 5, 5)

3. a) State the laws of crystallography. Explain the laws with the help of suitable diagram and examples.
   b) Write the equation relating interplanar spacing d_{hkl} and miller indices (hkl) for a cubic crystal. Use it to calculate interplanar spacing of planes with miller indices (121) in a cubic crystal of edge length 1.5 Å.
   c) Define surface tension. Describe laboratory method for determination of surface tension.

   (5, 5, 5)

4. a) KNO3 crystallizes in orthorhombic system with the unit cell dimensions a= 542 pm, b= 917 pm and C= 645 pm. Calculate the diffraction angles for first order X-ray reflections from (100), (010) and (111) planes using radiation with wavelength= 154.1 pm.
   b) "*While the viscosity of the gas increases with the increase in the temperature, that of a decrease with the increase in the temperature*" How would you account for it.
   c) Explain the terms collision diameter, collision cross-section, collision number, collision frequency and mean free path.

   (5, 5, 5)

5. a) Derive the Bragg's equation in X-ray crystallography.
   b) Calculate Miller indices of crystal planes which cut through the crystal axes at (2a, 3b, c) and (2a, -3b, -3c).
   c) Define average velocity, most probable velocity and root mean square velocity. Derive a mathematical expression for the three types of velocities.

   (5, 5, 5)

6. a) Calculate the mean free path of O_2 molecule at 25°C and pressure 0.001mm Hg, given that the collision diameter is 361pm.
   b) Define inversion temperature. How is it related to Vanderwaal's constants.
   c) For oxygen gas at 25°C, calculate (a) the mean free path at one atm pressure (b) mean free path at 10-3 mm Hg pressure (c) number of collisions per second per molecule at one atm pressure. The collision diameter of oxygen molecule is 361 pm.
   (5, 5, 5)