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**GSE/D-20** **793**

CHEMISTRY

(Physical Chemistry)

Paper–II

Time : Three Hours] [Maximum Marks : 32

**Note :** Attempt *five* questions in all, selecting *two* questions from each section. Question No. 1 is compulsory.

## Compulsory Question

**1.** (a) What are the crystallographic dimensions of their unit cells if some solids belong to the following crystal systems ?

(i) Triclinic

(ii) Tetragonal. 2

(b) Explain the significance of Vander Waal's constants 'a' and 'b'. 2

(c) Why ether has higher vapour pressure than benzene at the same temperature ? 1

(d) Calculate the temperature at which the hydrogen molecules will have an average velocity of 176400 cm $s^{-1}$. ($R = 8.314 \times 10^7$ ergs/degree/mol). 2

(e) Which type of cyrstalline solids have highest melting point and why ? 1

## SECTION–A

**2.** (a) Why do real gases show deviations from ideal behaviour ? 1½

(b) Calculate the root mean square velocity, average velocity and most probable velocity of sulphur dioxide molecules at 427°C.

($R = 8.314 \times 10^7$ ergs/degree/mol) 2½

(c) Define (i) Collision number (ii) Collision frequency (iii) Mean free path. Write expressions for each of them. 2

**3.** (a) Derive Vander Waal's equation for real gases. 3

(b) Describe Andrew's experiment on critical phenomenon. 3

**4.** (a) Calculate the collision frequency of oxygen molecules at 273 K and one atmospheric pressure, given that the molecular diameter of oxygen molecules is $2 \times 10^{-8}$ cm.

($R = 8.314 \times 10^7$ ergs $K^{-1}mol^{-1}$) 3

(b) Using Vander Waal's equation, derive reduce equation of state. Also state the "Law of corresponding states". 3

**5.** (a) Derive expressions for critical constants in terms of Vander Waal's constants and hence derive the relationship between them. 4

(b) Can we liquify an ideal gas ? Explain. 1

(c) What is a Boyle's temperature ? 1

## SECTION–B

**6.** (a) What is Parachor ? Describe briefly the effect of temperature on surface tension. 2½

(b) A solution of a certain optically active substance in water containing 1.56 g in 100 ml rotated polarized light 4.91° in a polarimeter which had a cell 20 cm long. Calculate its specific rotation. 2

(c) What are primitive and non-primitive unit cells ? Calculate the number of particles per unit cell in each of them. 1½

**7.** (a) Using X-rays of wavelength 154.1 pm and starting from the glancing angle, the reflection from silver crystal was found to occur at $\theta = 22.20°$. Calculate the spacing between the planes of silver atoms that gave rise to the above reflection ($\sin 22.20° = 0.3778$). 2

(b) Define coefficient of viscesity. Describe briefly the effect of temperature on viscosity. 2

(c) What are the factors on which optical solution depends ? Derive an expression for specific rotation. 2

**8.** (a) A five fold axis of symmetry cannot be present in any crystal. Why ? 1

(b) Calculate the molar refraction of acetic acid at temperature at which its density is 1.046 g $cm^{-3}$. The experimentally observed value of refractive index at this temperature is 1.3715. 2

(c) Explain the terms (i) Axis of symmetry (ii) Plane of symmetry (iii) Centre of symmetry. 3

**9.** (a) At 20°C, the density of water is 0.9983 g $cm^{-3}$ and its viscosity is 0.010087 poise. Explain how these figures indicate water is an associated liquid. 3

(b) Derive Bragg's equation for the diffraction of X-rays by crystals. 3