Roll No. [redacted]

Total Pages : 3

GSE/D-19

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CHEMISTRY
(Physical Chemistry)
Paper–II

Time : Three Hours]

[Maximum Marks : 32

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

Compulsory Question

1. (a) At what temperature the root mean square velocity of chlorine gas will be equal to that of SO_2 at NTP ? 2

(b) Distinguish between an ideal gas and a real gas. Explain graphically in terms of compressibility factor how real gases show deviation from ideal behaviour. 3

(c) Briefly explain the law of constancy of interfacial angles. 2

(d) What is Boyle's temperature ? 1

SECTION–A

2. (a) The reduced volume and reduced temperature of a gas are 10.2 and 0.7 respectively. What will be its pressure if its critical pressure is 42 atmospheres ? 2½

(b) Define the terms (i) Mean free path, (ii) Collision number, and (iii) Collision frequency. Discuss the effect of temperature and pressure on collision frequency. 3½

3. (a) Using Van der Waal's equation, derive the reduced equation of state. Also state the "Law of corresponding states". 3

(b) Calculate mean free path of oxygen molecules at 0°C and one atmospheric pressure, given that the molecular diameter of oxygen molecule is 2×10^{-8} cm. 3

4. (a) Explain diagrammatically how the molecular velocities change with increase of temperature. 1½

(b) Define the terms (i) Critical temperature, (ii) Critical pressure, and (iii) Critical volume. Derive expressions for critical constants in terms of Van der Waal's constants. 4½

5. (a) Describe Andrew's experiment on critical phenomenon. 3½

(b) Briefly explain the terms (i) Root mean square velocity, (ii) Average velocity, and (iii) Most probable velocity. 2½

SECTION–B

6. (a) At what angle will X-rays of wavelength 1.542×10^{-10} m undergo second order reflection by planes separated by 3.5×10^{-10} m ? 2

(b) Define Surface tension. Describe any *one* method for the determination of surface tension of a liquid. 3

(c) Why cooling is caused by evaporation ? 1

7. (a) The value of $[\alpha]_D^{20}$ for lactose is 55.4°. What is the concentration in grams per litre of a solution of lactose which gives a rotation of 7.24° in a 10 cm cell at 20°C with sodium D light ? 2

(b) Both NaCl and KCl have similar structures, yet their X-ray diffraction patterns are remarkably different. Why ? 2

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

8. (a) Describe Ostwald's method for determination of viscosity of the liquid. 2

(b) What are elements of symmetry in crystallography ? Describe each of them. 4

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

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

(c) What is Dunstan's rule ? Explain with an example. 1