

Roll No. ~~XXXXXXXXXX~~

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  $\text{SO}_2$  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 ?  $2\frac{1}{2}$
- (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.  $3\frac{1}{2}$

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7/12

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  $0^{\circ}\text{C}$  and one atmospheric pressure, given that the molecular diameter of oxygen molecule is  $2 \times 10^{-8}$  cm. 3
4. (a) Explain diagrammatically how the molecular velocities change with increase of temperature.  $1\frac{1}{2}$
- (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.  $4\frac{1}{2}$
5. (a) Describe Andrew's experiment on critical phenomenon.  $3\frac{1}{2}$
- (b) Briefly explain the terms (i) Root mean square velocity, (ii) Average velocity, and (iii) Most probable velocity.  $2\frac{1}{2}$

### SECTION-B

6. (a) At what angle will X-rays of wavelength  $1.542 \times 10^{-10}$  m undergo second order reflection by planes separated by  $3.5 \times 10^{-10}$  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  $55.4^\circ$ . What is the concentration in grams per litre of a solution of lactose which gives a rotation of  $7.24^\circ$  in a 10 cm cell at  $20^\circ\text{C}$  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  $1.046\text{ cm}^{-3}$ . 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
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