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(February)

CHEMISTRY

(Honours)

(Part-A : Physical)

[Chem-H-502]

Marks : 37

Time : 2 hours

The figures in the margin indicate full marks
for the questions

1. (a) Discuss Maxwell's distribution of molecular velocities. What is the effect of temperature on distribution of molecular velocities? 3+1=4
- (b) Discuss the principle of equipartition of energy. 3
- (c) Calculate the root-mean-square velocity of CO₂ molecule at 27 °C.
[Given, $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$] 2

OR

2. (a) State the law of corresponding states and derive the reduced equation of state. 3
- (b) Calculate the various degrees of freedom of H₂O and CO₂ molecules. $1\frac{1}{2}+1\frac{1}{2}=3$
- (c) Explain the following : 1+1+1=3
(i) Collision frequency
(ii) Mean free path
(iii) Vapour density
3. (a) Define surface tension of a liquid. Describe the capillary rise method for determining surface tension of a liquid. 1+3=4
- (b) Calculate the molar refraction of acetic acid at a temperature at which its density is 1.046 g cm⁻³. The refractive index at this temperature is 1.3715. 2

OR

4. (a) Define dipole moment. How are dipole moments used to distinguish between cis- and trans-isomers of 1,2-dichloroethene? 1+2=3
- (b) Define additive property and constitutive property giving one example for each. $1\frac{1}{2}+1\frac{1}{2}=3$

(3)

5. (a) Define the following : 1+1+1=3
(i) Plane of symmetry
(ii) Axis of symmetry
(iii) Centre of symmetry
- (b) Calculate the number of atoms present per unit cell in (i) primitive cubic, (ii) body-centred cubic and (iii) face-centred cubic. 1+1+1=3

OR

6. (a) Describe the powder method for the determination of crystal structure. 3
- (b) Find the interplanar distance in a crystal in which series of planes produce a first-order reflection at an angle of 22.5° , when X-rays of wavelength 1.539 \AA are used. 3
7. (a) Derive an expression for the chemical potential of a component in an ideal mixture. 4
- (b) Explain the following : 1½+1½=3
(i) Residual entropy
(ii) Partial molar quantities

(4)

OR

8. (a) Derive Gibbs-Duhem equation for a mixture consisting of i number of components. 3
- (b) State the third law of thermodynamics. How does the third law help in determining the absolute entropy of a substance? 1+3=4
9. (a) Discuss the transition state theory of bimolecular reactions. 5
- (b) Write notes on the following : 2+2=4
(i) Opposing reactions
(ii) Homogeneous catalysis

OR

10. (a) Derive the Michaelis-Menten equation for an enzyme-catalyzed reaction. 5
- (b) Write notes on the following : 2+2=4
(i) Steady-state approximation
(ii) Parallel reactions

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