

SECTION – A

Answer ALL the questions.

(10×2 = 20 Marks)

1. What is Brownian motion?
2. In an experiment the viscosity of a gas is found to be $2.25 \times 10^{-5} \text{ Nm}^{-1} \text{ s}$. The RMS velocity of the molecules is $4.5 \times 10^2 \text{ m/s}$. If the density of the gas is 1 gram per litre, calculate the mean free path of the molecules.
3. Distinguish adiabatic and isothermal changes?
4. What is superfluidity?
5. What do you mean by intensive and extensive variables?
6. Give Kelvin statement of second law of thermodynamics.
7. What is the change in entropy in a reversible adiabatic process?
8. Define latent heat of vapourisation.
9. Define phase -space.
10. State Planck's quantum hypothesis.

SECTION - B

Answer any FOUR questions.

(4 × 7.5 = 30 Marks)

11. Discuss the energy distribution of molecules in a gas.
12. (a) Define molar specific heat capacity at constant volume and constant pressure.
(b) Derive Mayer's relation.
13. (a) Write the expressions for volume expansivity and isothermal compressibility in terms of partial derivatives.
(b) The equation of state of an ideal gas is $PV = nRT$ where n and R are constants.
(i) Show that the volume expansivity is equal to $\frac{1}{T}$.
(ii) Show that the isothermal compressibility is equal to $\frac{1}{P}$.
14. Define Helmholtz and Gibbs functions and deduce Gibbs – Helmholtz equation.
15. (a) What do you mean by black body radiation?
(b) Deduce Wien's law and Rayleigh -Jean's law from Planck's radiation formula.

SECTION - C

Answer any FOUR questions.

(4 × 12.5 = 50 Marks)

16. (a) State and explain the principle of equipartition of energy.
- (b) Derive an expression for the viscosity of a gas on the basis of Kinetic theory of gases.
17. (a) Describe, with theory, Clement and Desormes method of determining the ratio of specific heat capacities of air.
- (b) Mention any four important properties of helium II.
18. (a) Derive Clausius – Clapeyron latent heat equation.
- (b) What do you mean by Clausius inequality?
19. (a) Explain second - order phase transition with an example and hence deduce Ehrenfest's equation.
- (b) Write a note on specific heat capacity of saturated vapour.
20. State the postulates of quantum statistics and establish Bose – Einstein distribution law.

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