INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH KOLKATA

SEMESTER 2

CH1201: Elements of Chemistry - II

Mid-Semester Examination

Maximum mark: 20 Duration: $1^{1/2}$ hr. Date: 24.02.2025

Answer all questions, each question carries equal mark.

1. (a) Show and explain which region in the van der Waals isotherm would represent super-saturated vapour, super-heated liquid. (b) Explain pictorially how the Lennard-Jones potential depends on the intermolecular distance. If $U(r) = 4\varepsilon ((\sigma/r)^{12} - (\sigma/r)^{6})$ obtain an expression for r_{min} and $U(r)_{min}$. Show them pictorially.

2+(1+2)

2. (a) Plot Z vs P curve for hydrogen, helium at 30 K. Explain the difference. (Given: T_B for hydrogen is 110 K, for helium ~22K). (b) The critical constants of a gas are Pc = 50 atm., Vc = 150 cm^3mol^{-1}, and Tc = 300 K. Calculate the van der Waals parameters of the gas and estimate the radius of the molecule.

2+3

3. (a) Why 'seeding' is sometimes necessary for raining at certain atmospheric condition? Explain mathematically. (b) How do viscosity of liquid and gas depend on temperature? Explain mathematically and pictorially.

2+3

4. (a) How does the vapour pressure of a liquid depend on temperature? Explain mathematically and pictorially. (b) How does the magnitude of cohesive force control vapour pressure and heat of vaporization for a liquid? (c) Calculate increase in vapour pressure of a liquid for one atmosphere rise in external pressure at 20° C. (Given: V_L = 18 cc/mole, R = 82.05 cc atm. per Kelvin per mole).

2+1+2

All terms have their usual meaning.