Reg. No…….. Name…… **19U530**

B.Sc. DEGREE END SEMESTER EXAMINATION - OCTOBER 2019

SEMESTER **–5: CHEMISTRY (CORE COURSE)**

COURSE: **15U5CRCHE07: PHYSICAL CHEMISTRY - I**

(Common for Regular 2017 Admission & Supplementary/Improvement 2016/2015 Admissions)

Time: Three Hours Max. Marks: 60

SECTION A

Answer ALL questions 1 mark each

1. Define the term mean free path of a gas
2. What is meant by compressibility factor
3. State Raoult's law.
4. Name a molecule that possesses C_4 axis
5. Define the term space lattice.
6. Mention two applications of liquid crystals.
7. Give the Freundlich adsorption equation and specify the terms.
8. Define van't Hoff factor. (1 x 8 = 8)

SECTION B

Answer ANY SIX questions 2 mark each

9. Give the Maxwell-Boltzmann law of distribution of molecular velocities and explain terms used
10. Calculate the RMS velocity of N_2 molecules at 27^0C.
11. Explain the term parachor.
12. Name the point group to which the molecule belongs in each of the following cases.
    (i) NH_3 (ii) CH_4
13. Obtain the Miller indices of a plane which intercepts at a, b/2, 3c in a simple cube unit cell.
14. Give BET equation and explain the terms involved in this equation.
15. Differentiate between smetic and nematic liquid crystals.
16. Explain the terms osmosis and osmotic pressure. (2 x 6 = 12)

SECTION C

Answer ANY FOUR questions 5 mark each

17. What is Boyle temperature? Show that for a van der Waals gas, the Boyle temperature $T_B = a/RB$
18. Derive the Bragg equation and explain its significance in X-Ray crystallography.
19. The density of Li metals is 0.53 g cm^{-3} and the separation of the (100) planes of the metal is 350pm. Determine whether the lattice is f.c.c. or b.c.c. M(Li) = 6.941g mol^{-1}
20. At 0^0C and 1atm, the volume of nitrogen gas required to cover a sample of silica gel, assuming Langmuir monolayer adsorption, is found to be 130 cm^3g^{-1} of the gel. Calculate the surface area per gram of a silica gel. Given that the area occupied by a nitrogen molecule is 0.162 $(nm)^2$.

21. Derive thermodynamically the expression relating the freezing point depression of the solution with the mole fraction of the dissolved solute.
22. Explain the term coefficient of viscosity of a liquid. Discuss the effect of temperature on the viscosity of a liquid. (5 x 4 = 20)

SECTION D

Answer ANY TWO questions. 10 marks each

23. (a) Discuss briefly Langmuir's unimolecular theory of adsorption. (2 marks)
    (b) Derive an expression for Langmuir's adsorption isotherm. (5 marks)
    (c) Show that at normal pressure, Langmuir's unimolecular adsorption isotherm becomes identical Freundlich adsorption isotherm. (3 marks)
24. (a) Show that for an ideal solution containing two components A and B, the Gibbs free energy of mixing is minimum when the mole fractions of the two components are the same, i.e., equal to ½ each. (5 marks)
    (b) One mole of component A and two moles of component B are mixed at 27^0C to form an ideal binary solution. Calculate ΔV_{mix}, ΔS_{mix} and ΔG_{mix}. Assume that R = 8.314 $JK^{-1}mol^{-1}$ (5 marks)
25. (a) Derive the vander Waals equation for describing the P-V-T relationship in real gases. (5 marks)
    (b) Illustrate how vander Waals equation satisfactorily explains the departure of real gases from ideal behavior at different pressures and temperatures. (5 marks)
26. (a) Discuss the powder method for the X-ray diffraction studies of crystals. (5 marks)
    (b) KNO_3 crystallizes in orthorhombic system with the unitcell dimensions a=52pm, b=917pm and c=645pm. Calculate the diffraction angles for first order X-ray reflections from (100), (010) and (111) planes using radiation with wavelength=154.1 pm. (5 marks)

(10 x 2 = 20)

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