

2005 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

II B.TECH. I SEMESTER REGULAR EXAMINATIONS
PHYSICAL CHEMISTRY
(CHEMICAL ENGINEERING)

MAY 2005

TIME: 3 HOURS
MARKS: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Define the terms
 - i. Rayleigh Scattering
 - ii. Molar volume
- (b) Explain the apparatus used for studying Raman effect.
- (c) Discuss various applications of Raman effect.
2. (a) The absorption of UV and visible radiations can be conveniently studied together, but IR studies are made separately. Explain.
- (b) Write notes on the essential component of infrared spectrophotometer.
- (c) Differentiate additive and colligative properties.
- (d) How many translational, rotational and vibrational degrees of freedom is there for
 - i. Linear CO₂ molecule and
 - ii. non-linear H₂S molecule.
3. (a) State Nernst distribution Law and discuss applications of the same in detail.
- (b) What is chromatography? Give an account of classification of Chromatography.
- (c) An aqueous solution contains 1×10^2 kg of solute per 1 DM³. When 1 DM³ of the solution is treated with 0.1 DM³ of ether, 6×10^3 kg of solute is extracted. How much more solute would be extracted by a further 0.1 DM³ ether? Assume that the molecular state of solute in the same in ether and water.
4. (a) Discuss the following:
 - i. Detector
 - ii. Columns
 - iii. injection port
- (b) What are the important requirements of carrier gas and solid support in gas chromatography?
- (c) The distribution coefficient of Iodine between carbon tetra chloride and water

in 85 in favour of carbon tetra chloride. Calculate the volume of carbon tetra chloride required for 95% extraction of iodine from 100ml of aqueous solution in a single stage extraction.

5. (a) Calculate the energy of an Einstein radiation of wavelength 250 nm.

(b) Discuss the photochemical formation of hydrogen chloride

(c) Write notes on:

i. photo-sensitization

ii. phosphorescence.

6. (a) Define

i. Einstein and

ii. quantum yield

(b) Discuss the photochemical formation of hydrogen bromide.

(c) For a chemical reaction $B \rightarrow C$, 1×10^{-5} mole of B was formed on absorption

6.62 J at 3600 \AA . Calculate the quantum yield.

7. (a) Define colligative property and molal depression constant.

(b) Write notes on VanHoff theory of dilute solutions.

(c) Find the osmotic pressure of an aqueous solution of BaCl_2 at 288 K . Containing $3.9 \times 10^{-4} \text{ kg}$ per 0.06 DM^3 . The salt is 60% ionized (Barium atomic weight=137, chlorine atomic weight=35.5)

8. (a) Define hypotonic, isotonic and hypertonic solutions.

(b) Derive an expression relating lowering vapour pressure and osmotic pressure.

(c) A brass sample composed of 20% zinc and 80% copper by mass melts at 1268 K . Pure copper melts at 1357 K . What is the molal freezing point constant for copper (atomic mass of zinc 65 g mol^{-1} and copper 63.5 g mol^{-1}).