

U.G. 4th Semester Examination - 2021

CHEMISTRY

Course Code : BCEMCCHC 401

Course Title: Physical Chemistry-III

Full Marks : 30

Time : 2 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer any **ten** questions: 1×10=10
- What is the difference between ideal solution and ideally dilute solution?
 - Is it possible to get elevation of freezing point? If yes, when?
 - How can you get adsorption coefficient of Langmuir adsorption isotherm?
 - State how Tyndall effect can be applied to determine size of colloidal particles.
 - Give an example of nanowire.
 - Write down the expression for chemical potential of an ion in a solution. Explain the term.

- An aqueous glucose solution has osmotic pressure 2.718 atm at 298K. Calculate concentration of glucose in kg/L assuming the solution to be ideal.
- 'Critical point of a liquid is invariant'? Justify.
- Why electrochemical equivalents are proportional to chemical equivalents?
- Calculate $[\text{OH}^-]$ from H_2O in a 0.02(M) HCl solution.
- Define SI unit of surface energy.
- Define isothermal fractional distillation.
- Draw an approximate plot of $\log^{\gamma} I$ vs \sqrt{I} for $\text{Ba}(\text{NO}_3)_2$ solution.
- State one disadvantages of Top down and Bottom up approach of synthesis of nanomaterials each.
- Draw a diagram showing glass electrode.

2. Answer any **five** questions: 2×5=10
- Draw a \ln vs T plot showing ΔT_b and ΔT_f .
 - At 303K, surface tension of ethanol in contact with its vapour is $2.189 \times 10^{-2} \text{Nm}^{-1}$. Calculate capillary rise. Density of ethanol = 0.780g/cm^3 .
Internal radius of capillary = 0.2mm.

- c) What is quantum dot?
- d) Express mean activity of an electrolyte in terms of mean ionic activity coefficient.
- e) State two limitations of Debye. Hückel equation.
- f) ΔS for a cell reaction is -9.65 J/K/mol . Calculate $(\partial E/\partial T)_p$.
- g) Explain the action of emulsifying agents.
- h) State two characteristics of Chemisorption.
3. Answer any **two** questions: $5 \times 2 = 10$
- a) i) Draw phase diagram of water. Explain and indicate the existence of supercooled liquid water. $1 \frac{1}{2} + 2$
- ii) Why in the p-x diagram vapour composition curve lies below the liquid composition curve? $1 \frac{1}{2}$
- b) Explain with an example how electrolysis
- i) is applied during extraction of metals 2
- ii) Arrive at the expression of chemical potential of a charged species in a solution in terms of activity of the species. 3

- c) Draw a p-n diagram of a non ideal
- i) Solution indicating the Raoult's law and Henry's law lines under limiting conditions. 2
- ii) For this concentration cell
- $\text{Pb}|\text{PbSO}_4|\text{CuSO}_4(a_{\pm} = 0.022) : \text{CuSO}_4(a_{\pm} = 0.0064)$
 $|\text{PbSO}_4|\text{Pb}$
- EMF is 0.0118 v at 298k .
- Calculate ${}^t\text{Cu}^{2+}$. 2
- iii) What is surface excess? 1