

Name:			
Enrolment No:			
UPES End Semester Examination, December 2023			
Course: Physical Chemistry III Program: BSc (H) Chemistry Course Code: CHEM 2022		Semester: III Time : 03 hrs. Max. Marks: 100	
Instructions: All questions are compulsory.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	How many phases and components are present in the following system? (a) Mixture of molten lead, tin and bismuth (b) Two ice cubes floating on water in a closed container in the presence of water vapour.	4	CO1
Q 2	What is the effect of temperature and pressure on the adsorption of a gas on a solid?	4	CO1
Q 3	A particular mass of charcoal absorbs a large volume of ammonia than of hydrogen at a given temperature. Explain?	4	CO2
Q 4	Discuss in detail the various applications of adsorption in industry and in everyday life.	4	CO2
Q 5	Calculate the degree of freedom for the following: (a) A mixture of nitrogen and oxygen gases contained in a vessel. (b) Rhombic sulphur in equilibrium with monoclinic sulphur.	4	CO1
SECTION B (4Qx10M= 40 Marks)			
Q 6	Draw a labelled phase diagram of the sulphur system and discuss its salient features.	10	CO2
Q 7	Define the term: ionic mobility. Derive the relation between ionic mobility and molar ionic conductance.	10	CO1
Q 8	How is the standard electrode potential of an electrode measured using (a) standard hydrogen electrode, and (b) calomel electrode, as reference electrode? Explain with suitable examples.	10	CO1
Q 9	If ionic conductance for H^+ and OH^- ions are 394.8 and $198.5 \text{ ohm}^{-1}\text{cm}^2$ respectively at 25°C and if the specific conductance of water at this temperature is $5.54 \times 10^{-8} \text{ ohm}^{-1}\text{cm}^2$. Calculate the ionic product of water. <i>Or</i> Describe Nernst distribution law: its derivation and applications.	10	CO2

SECTION-C
(2Qx20M=40 Marks)

Q 10	<p>(i) Water boils at 100 °C at a pressure of 1 atm. Calculate the vapor pressure of water at 90 °C. The heat of vaporization of water is 9.80 kcal mol⁻¹.</p> <p style="text-align: center;"><i>Or</i></p> <p>Describe a typical galvanic cell and show how the chemical energy is converted to electrical energy. What is the relation between free energy and EMF of a cell?</p> <p>(ii) A dilute solution of AgNO₃ has an equivalent conductivity of 115.3 ohm⁻¹ cm² eq⁻¹ and the transport number of silver ion is 0.47. Calculate the ionic conductance and ionic mobilities of silver and nitrate ions.</p>	10 + 10	CO3
Q 11	<p>(i) State the phase rule. Explain the terms used. Apply this rule to the lead-silver system.</p> <p>(ii) A cell uses Zn²⁺ Zn and Ag⁺ Ag electrodes. Write the cell representation, half-cell reactions and net cell reaction. Calculate the EMF of the cell. Given E⁰ Zn²⁺ Zn = -0.76 V and E⁰ Ag⁺ Ag = 0.8V.</p>	10 + 10	CO3