MID TERM EXAMINATIONS – April 2024

Programme	:	B.Tech.			
Course Title/ Course Code	:	Engineering Chemistry/ CHY1001	Semester	:	Winter 2023-24
			Slot	:	B11+B12+B13
Time	:	1 ½ hours			
			Max. Marks	:	50

Answer all the Questions

Q.No.	Sub. Sec.	Question Description	Marks
1		Showing chemical reactions and physical steps involved (in detail), give advantages and disadvantages of using Ion exchange resins over Zeolite water softening.	10
2	A	a). Which salts cause temporary hardness of water? Suggest one method to remove this type of hardness.	2
		b). Calculate the hardness of a water sample (in terms of equivalents of $CaCO_3$) containing 10^{-3} M $CaSO_4$. (molar mass of $CaSO_4$ =136 g mol^{-1}) 735	3
	B	Name the kind of damage happens to boiler due to presence of high alkaline water. Explain it using chemical reactions involved.	3
		Enlist the methods to prevent kind of damage.	2
3		Phase diagram of CO_2 is given. TO represents line equilibrium of solid-liquid. 1) Draw phase diagram of water with Triple point T, TO represents of solid-liquid freezing curve. 2) Calculate degree of freedom along line TO using Phase rule in picture above. 3) Explain the reason of difference in slope of freezing curve phase diagram of CO_2 and water.	10
4	A	Briefly explain with examples following terms Phase, Component and degrees of freedom.	4
	B	Using Gibbs' Phase rule, calculate degree of freedom along the curve/lines AC, BC, point C and areas in following diagram.	6

For Q3 figure:

CO_2

Pressure p (y-axis), Temperature T_{tr} (x-axis)

Labels: Solid, Liquid, Gas, O, T, P_{tr}

Handwritten below Q4 B: 2 3   1 ,1 , 2 , 2

Phase diagram with axes: Temperature (y-axis) and Composition (% B in A) (x-axis). Labels: 1 phase: liquid; $T_{m,A}$; A; liquid + solid A; C; 2 phases: solid A + solid B; X; B; $T_{m,B}$; T_1; liquid + solid B; Y.
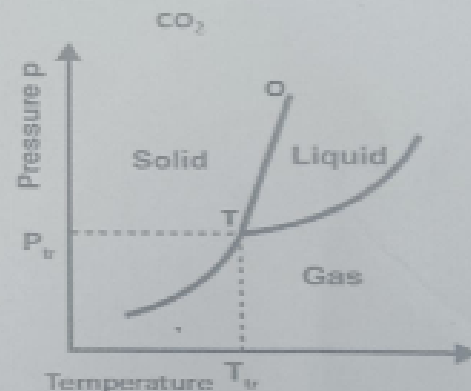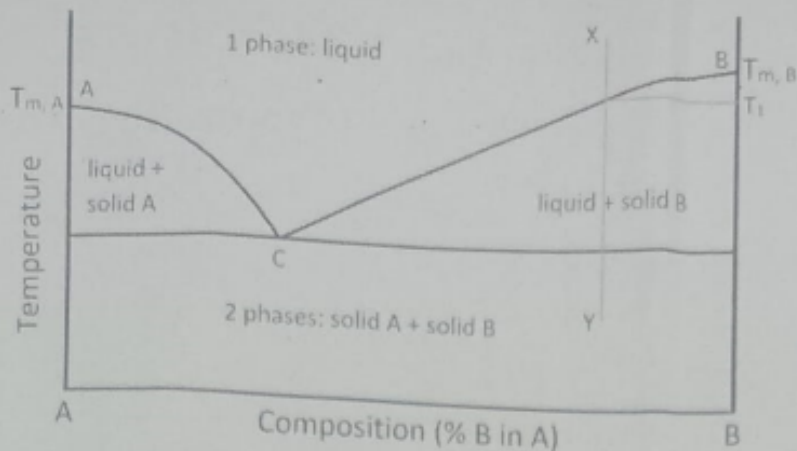
5 A $Zn|Zn^{2+}(1M)\|Cu^{2+}(1M)|Cu$, is shorthand or cell representation form of Galvanic cell, Identify anode half, Cathode half and write half-cell reactions. Mention constituents of salt bridge in this cell.

6

B The Cu^{2+} ion concentration in a copper-silver electrochemical cell is 0.1 M. If $E^{o}(Ag^{+}/Ag) = 0.8$ V, $E^{o}(Cu^{2+}/Cu) = 0.34$ V, and Cell potential (at 25°C) = 0.422 V. Find the silver ion concentration. · 0 o 5

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