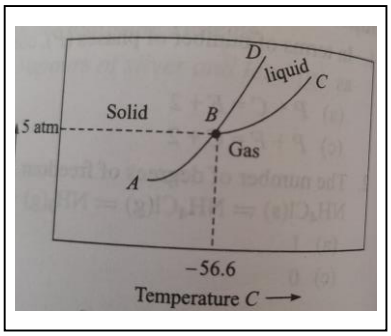
Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

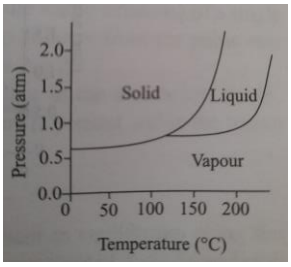
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, December 2020

Course: Physical Chemistry III **Semester: III**
Program: B.Sc. (H) Chemistry **Time 03 hrs.**
Course Code: CHEM 2003 **Max. Marks: 100**

SECTION A

1. **Each question will carry 5 marks**
2. **Instruction: Complete the statement/ Select the correct answer**

S. No.	Question	Marks	CO
Q 1	(i) In the phase diagram of CO_2, the system is bivariant a. at the point B b. at the critical point c. in the region ABD d. along BD  (ii) A compound with an incongruent melting point decomposes on heating into a. a liquid of the same composition as solid b. a new solid phase and a solution with a composition different from that of the solid phase c. a new solid phase and a solution with the same composition as that of the solid phase d. a solution of fixed composition	**3+2**	**CO1**
Q 2	An aqueous system containing K+, Na+, Cl- is a three component system whereas K+, Na+, Cl-, Br- is a four component system. What are the number of components if the salts are present in equal amounts? a. 1 c. 3 b. 2 4. 4	**5**	**CO1**
Q 3	Suggest the possible maximum number of phases that can co-exist in the following systems: a. Sulphur system	**5**	**CO1**

	b. Lead and silver alloy system c. Potassium iodide-water system		
Q 4	(i) Whether zinc react with 1 N sulphuric acid to give out hydrogen gas or not. [$E^0_{Zn2+/Zn}$ = -0.76V] a. True b. False (ii) Whether copper react with 1 N sulphuric acid to give out hydrogen gas or not. [$E^0_{Cu2+/Cu}$ = 0.34V] a. True b. False	**5**	**CO3**
Q 5	What will be the standard emf of a cell which involve the following reaction $Zn + 2Ag^+ \rightarrow Zn^{2+} + 2Ag$ Given $E^0_{Zn/Zn2+}$ = 0.76V and $E^0_{Ag/Ag+}$ = -0.80V. a. 1.56 V b. -1.56 V c. 0.04 V d. -0.04V	**5**	**CO3**
Q 6	Five applications of adsorption are ….., ….., ….., ….., and …..	**5**	**CO2**
SECTION B **1. Each question will carry 10 marks** **2. Instruction: Write short / brief notes**			
Q 7	By using the phase diagram (a) Determine the normal boiling point and melting point of the substance (b) Determine the physical state of the substance at 2 atm pressure and 110 degree C. 	**10**	**CO1**
Q 8	Suppose solid water-liquid water equilibrium is maintained at triple point temperature (0.0075 degree C) and triple point pressure (4.6 mmHg). Calculate how much change in temperature be made so that the equilibrium is maintained at an external pressure of 1 atm. Given: density (ice) =0.917 g cm^{-3}, density (liquid) = 0.99987 g cm^{-3}, and $\Delta_{fus}H_m$ = 6008.5 J mol^{-1}.	**10**	**CO1**
Q 9	(i) Calculate emf of the cell: Zn/Zn^{2+} (a = 0.1) // Fe^{2+} (a = 0.005) / Fe at 25^0C. Given $E^0_{Zn2+/Zn}$ = -0.76V and $E^0_{Fe2+/Fe}$ = -0.44V. (ii) Write four applications of electrolysis in industry/metallurgy.	**6+4**	**CO3**
Q 10	Discuss the construction of Standard Hydrogen electrode with its redox reactions.	**10**	**CO3**

Q 11	Differentiate these terms: (i) Adsorption and absorption (ii) Physisorption and Chemisorption **OR** Discuss briefly BET theory of multilayer adsorption. Write the BET equation and explain the terms involved in this equation.	**10**	**CO2**
	SECTION-C **1. Each question carries 20 marks** **2. Instruction: Write long answers**		
Q 12	**a)** A cell is prepared by dipping a copper rod in 1 M CuSO4 solution and a nickel rod in 1M NiSO4 solution. Write down half-cell reactions, overall reaction, standard emf of cell and cell representation. Given $E^0_{Cu^{2+}/Cu} = 0.34V$ and $E^0_{Ni2+/Ni} = -0.25V$. **OR** A cell is prepared by dipping an iron rod in 1M FeSO4 solution and a zinc rod in 1M ZnSO4 solution. Write down half-cell reactions, overall reaction, standard emf of cell and cell representation. Given $E^0_{Fe2+/Fe} = -0.44V$ and $E^0_{Zn2+/Zn} = -0.76V$. **b)** Consider a cell Pt / H_2(g, 1atm) / H^+ (x molar) // KCl (0.1 M) / Hg_2Cl_2 / Hg If the emf of this cell is 0.50 volt at 25^0C, what would be the pH of the x molar acid solution? (Given Ecalomel = 0.281 volt at 25^0C) **OR** Discuss in detail the graph of potentiometric titration for a strong acid-strong base titration.	**10** **10**	**CO3**