SCHOOL OF CHEMICAL AND LIFE SCIENCES
M.Sc. CHEMISTRY, SEMESTER-I EXAMINATION-2021
Paper Code: MCHCC-101(END-SEM EXAM)
Paper Title: PHYSICAL CHEMISTRY-I

Time: Three Hours **Max Marks: 75**

(Please write your Roll No. at the top of the Answer sheet.)

Attempt all the questions. Use of Scientific Calculator is permitted.

It should be noted that 1hr extra time will be provided for uploading the answer sheet in pdf format (single file). Please mention the total number of sheets used on the first sheet and sequence of the answer sheet should be clearly mentioned at the top of every sheet used.

Q1. Explain very briefly of the following (ANY FIVE): **[5x3=15]**

A Factors affecting extent of adsorption
B Adsorption Isobar
C Adsorption from solution
D Heat of adsorption
E Gibbs Duhem equation
F Roughness Factor
G Surface area of porous material
H Kinetics of chemisorptions
I Joule Thompson effect
J Chemical activity

Question 2: Attempt ANY THREE of the following: **[5x3=15]**

A. Describe four laws of thermodynamics?
B. Discuss the partial molar functions and it's physical significance?
C. Explain fugacity and fugacity coefficient? How to we experimentally determine it?
D. 10 moles of an ideal gas expand isothermally and reversible from a pressure of 10atm to 2 atm at 300k. What is the largest mass which can be lifted through a height of 1 metre in this expansion?
E. Calculate w and Δu from the conversion of one mole of water at 100°c to steam at 1atm pressure. Heat of vapourisation of water at 100° c is 40670 J/mol.
F. Discuss the Clausius-Clapeyron equation?

Question 3: Attempt ANY THREE of the following: **[5x3=15]**

A. Show that for an ideal gas, the work differential dw is not an exact differential. (3 marks) Show that is an isothermal expansion of an ideal gas (a) $\Delta u = 0$ and (b)$\Delta H = 0$.
B. One mole of an ideal mono-atomic gas at 27° c expands reversibly and adiabatically from a volume of 10 dm^3 to volume of 20dm^3. Calculate I) q ii) Δu iii) w and iv) ΔH . Assume that C_v = 3/2k.
C. One mole of an ideal gas is heated from 100k to 300k. Calculate Δs if (a) the volume is kept constant (b) the pressure is kept constant. Assume that Cv= 1.5k.
D. Differentiate between Chemisorption and Physisorption?

Question 4: Attempt ANY THREE of the following: **[5x3=15]**

A. Describe the different type of adsorption curves?
B. Explain the classical Freundlich Adsorption Isotherm and discuss its limitation?
C. Describe the experimental methods of determining gas adsorption?
D. Explain the Langmuir Adsorption isotherm and discuss its limitation?
E. Write the B.E.T equation and write the failures

Question 5: Attempt ANY THREE of the following: **[5x3=15]**

A. Write the Gibbs adsorption equation
B. Discuss the experimental methods for the determination of surface area?
C. Discuss the applications of adsorption
D. Test graphically the applicability of the Langmuir isotherm to the following data referring to the adsorption of a gas on charcoal

pressure	100	200	500	900
(x/m)	1.56	1.97	2.29	2.14

From your graph calculate the value of k_1 and k_2 **[4x1=4]**

E. Freundlich gave the data for the adsorption of a acetic acid on blood charcoal

Concentration	0.0181	0.0616	0.2677	0.8817	2.785
(x/m)	0.457	0.801	1.55	2.84	3.76

Obtain the constants k and n in the Freundlich equation $(\frac{x}{m}) = k(c^{\frac{1}{n}})$

Terms have their usual meaning

Avogadro number: N_A=6 x10^{23}/mol;
Universal gas constant: R=8.31x10^{7} erg/mol/K;
Boltzmann Constant: k_B =1.38x10^{-16} erg/K