BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSC **SEMESTER: II**
BRANCH: CHEMISTRY **SESSION: SP/2023**

SUBJECT: CH114 PHYSICAL CHEMISTRY-II

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	For adiabatic reversible changes in an ideal gas, prove that PV^{γ} = constant	[5]	1	1
Q.1(b)	An ideal gas expands reversibly and isothermally from 10 bar to 1 bar at 298 K. Find out the values of W, Q, ΔU and ΔH per mole of the gas. [R = 8.314 J K^{-1} mol^{-1}]	[5]	1	2
Q.2(a)	What is heat of formation of water? Explain the Hess's law of constant heat summation.	[5]	2	1
Q.2(b)	Given the following data $0.5H_2(g) + 0.5F_2(g) = HF(g)$ ΔH° = -273.3 kJ/mol $H_2(g) + 0.5O_2(g) = H_2O(l)$ ΔH° = -285.8 kJ/mol Calculate the value of ΔH° for the following reaction $2F_2(g) + 2H_2O(l) = 4HF(g) + O_2(g)$	[5]	2	2
Q.3(a)	Discuss how thermodynamic (Kelvin) temperature scale could be defined by taking help from an appropriate Carnot cycle.	[5]	2	1
Q.3(b)	Discuss Clausius' inequality. Quantitatively explain the concept of residual entropy.	[2+3]	2	2
Q.4(a)	The reaction: $N_2O_3(g) = NO_2(g)+NO(g)$, was studied at 298K with initial amount of the reactant equal to 1 mol. At equilibrium, the extent of reaction was found to be 0.3 mol for a total pressure of 1 bar. Find out the values of K_p^0 and $\Delta_r G^0$ for this reaction.	[5]	2	2
Q.4(b)	The equilibrium constant for the reaction: $2SO_2(g)+O_2(g)=2SO_3(g)$ is 4×10^{24} at 300K, 2.5×10^{10} at 500K and 3×10^4 at 700K. Estimate the reaction enthalpy at 500K.	[5]	2	2
Q.5(a)	What is chemical potential? Explain the stability of different phases of a compound at different temperature.	[5]	5	2
Q.5(b)	Show that the free energy of mixing of two components has a minimum value when they are in equal amounts.	[5]	5	1

:::::18/07/2023:::::