

Name of Examination		Continuous Assessment Test I , Fall 2022-23 Semester (Nov.2022)	
Slot: F1 + TF1		Course Mode: Offline	Class Number: CH2022231700654
Course Code:	BCHY101L	Course Title:	Engineering Chemistry
Faculty Name:	Dr. G. Ramachandran	Department:	SAS

Answer any FIVE (5 x 10 = 50 Marks)

Q. No.	Sub-division	Questions	Marks
1.		(a) 1 mole of an ideal monoatomic gas ($C_v = 3R/2$) at 27°C expands reversibly and adiabatically from a volume of 15 dm^3 to a volume of 45 dm^3 . Calculate q , ΔU , W and ΔH . ($R = 8.314\text{ J mol}^{-1}\text{ K}^{-1}$) V_1 V_2	5
		(b) Given that, ΔH and ΔS for a reaction are 40 kJ mol^{-1} and $75\text{ JK}^{-1}\text{mol}^{-1}$ respectively. Find out the temperature conditions required for the reaction to be spontaneous and reversible.	5
2.		(a) Half-life of a compound is <u>140 minutes</u> . how long will it take for <u>75%</u> of the compound to decompose? Consider that the decomposition of a compound is of <u>first order</u> .	5
		(b). At <u>330 K</u> , a reaction of first order is <u>50 %</u> completed in <u>50 minutes</u> . At <u>380 K</u> , <u>50 %</u> of the same reaction is completed in just <u>10 minutes</u> . Calculate the energy of activation of the reaction.	5
3.		(a) Explain a pseudo first order reaction in detail with any one example.	5
		(b) Heat supplied to a heat engine is <u>3000 kJ</u> . How much useful work can be done by the engine which works between $\frac{10^\circ\text{C}}{T_1}$ and $\frac{110^\circ\text{C}}{T_2}$.	5
4.		(a) Within each given set of compounds, which one has more stabilized ' t_{2g} ' set of orbitals than the other compounds. Justify your choice. Set 1 : $[\text{Cr}(\text{NH}_3)_6]^{3+}$; $[\text{CrF}_6]^{3-}$; $[\text{Cr}(\text{CO})_6]$ Set 2: $[\text{Fe}(\text{NH}_3)_6]\text{Cl}_3$; $[\text{Os}(\text{NH}_3)_6]\text{Cl}_3$; $[\text{Ru}(\text{NH}_3)_6]\text{Cl}_3$; (Atomic Number of Cr:24, Fe:26, Ru:44 and Os:76)	5
		(b) Brief out any two diverse potential applications of Coordination compounds with suitable examples.	5



5.		Determine <u>primary and secondary valency</u> , <u>hybridization</u> , <u>geometry</u> , <u>magnetic behaviour</u> and <u>crystal field splitting energy</u> of the complexes $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ and $[\text{CuCl}_4]^{2-}$. (Atomic Number of Co is 27; Atomic Number of Cu is 29)	10
6.	(i)	(a) We know <u>CO</u> is a <u>strong ligand</u> when compared with <u>dioxygen</u> and Fe can form stable carbonyl compound by binding with CO. However, Fe present in <u>haemoglobin</u> can <u>selectively bind with O₂</u> rather than CO. How can you justify it? (b) With a proper justification, arrange the following complexes in an increasing order with respect to their CO IR stretching frequency. $[\text{Cr}(\text{CO})_3(\text{PPh}_3)_3]$; $[\text{Cr}(\text{CO})_3(\text{pyridine})_3]$; $[\text{Cr}(\text{CO})_3(\text{PF}_3)_3]$ (Atomic Number of Cr is 24)	5 5