VIT

Vellore Institute of Technology

Question Format & QP Setter Information

Name of Examination		Continuous Assessment Test - I, Fall Semester 2022-23 (Nov. 2022)		
Slot: C1 + TCC1		Course Mode: Offline	Class Number(s): CH2022233201024	
Course Code:	BCHY1011	Course Title:	Engineering Chemistry	
Emp. No.:	52837	Faculty Name:	T. S. Prathima	School: SAS
Contact No.:	7708510172	Email:	prathima.t@vit.ac.in	

General Instructions (if any): I. CLOSED BOOK Examinations

Answer Any FIVE Questions Total Marks: 5 X 10 Marks = 50

Q. No.	Question Text	Marks
1.	(i) 0.70 moles of an ideal gas expands adiabatically from 1.0 atm to 2.5 atm at a temperature of 30°C. Calculate the values of q, w, ΔU, ΔS, and ΔG. (7 Marks) (ii) An engine absorbs 1600 J from a hot reservoir and expels 1000J to a cold reservoir in each cycle. Determine its efficiency. (3 Marks)	10
2.	(i) The rate constant at 325°C for the decomposition reaction $C_4H_8 \rightarrow 2C_2H_4$ is 6.1×10^{-5} s^{-1} and the activation energy is 261 kJ per mole of C_4H_8. Determine the frequency factor for the reaction. (4 Marks) (ii) An organic peroxide decomposes in aqueous solution. Assume the decomposition follows first order rate law. From the given data determine the rate constant. (6 Marks) **Time (s)** — **[Peroxide] (M)** 0 — 1.00 2.16×10^4 — 0.500 4.32×10^4 — 0.250 6.48×10^4 — 0.125 8.64×10^4 — 0.0625	10
3.	i) Some of the metal elements like Iron, Cobalt etc., CO -exist in two oxidation states. The rate at which one of the complexes Fe(III) was reduced to Fe(II) in water was measured. Determine the activation energy of the reaction from the following data. (5 Marks) T,K — k, s^{-1} 293 — 0.054 298 — 0.100 (ii) Highly strained molecule cyclopropane when heated to 499°C isomerizes and forms propene with a rate constant of 5.95×10^{-4} s^{-1}. What is the half-life of the reaction? What fraction of the cyclopropane remains after 0.75h at 499°C? (5M)	10

	(i) Applying VB theory explain the hybridisation, shape and magnetic behavior of $[Ni(CN)_4]^{2-}$ and $Ni(NH_3)_6]^{2+}$ (At. No. of Ni= 28) (6 Marks) (ii) How can we differentiate the types of metal carbonyl interactions? Explain in with pictures (4 Marks)	10
	(i) Draw the crystal filed splitting diagram for $[CoF_6]^{3-}$ and $[Co(CN)_6]^{3-}$ in Octahedral field and calculate CFSE and spin only magnetic moment. Which complex is diamagnetic? (At. No. of Co= 27) (6 Marks) (ii) Which of the following neutral molecules does not obey 18 electron rule. Justify. (4 Marks) (a) $(\eta^5\text{-}C_5H_5)Fe(CO)_2$ (b) $(\eta^5\text{-}C_5H_5)_2Co$	10
	(i) Explain in detail how the presence of Magnesium metal ion enhances the energy transfer process in chlorophyll. (6 Marks) (ii) Applying CFT, explain the stability of Fe containing porphyrin ring present the Hemoglobin when coordinated with O_2 and CO molecules. (4 Marks)	10

Signature with date