Vellore Institute of Technology
CHENNAI

Name of Examination	Continuous Assessment Test - 1, Winter Semester 2023, (March. 2023)				
Slot: D1+TD1	Course Mode : Offline		Class Number(s): CH2022232300237		
Course Code:	BCHY101L	Course Title:	Engineering Chemistry	School: SAS	
Emp. No.:	52774	Faculty Name:	Dr. Pritam Ghosh		
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Q. No.	Question Text	Marks
	Answer **Any FIVE** Questions Total Marks: 5X 10 Marks = 50	
1.	(i) Calculate the efficiency of a certain power station operates with superheated steam at 300 °C (T_h = 573 K) and discharges the waste heat into the environment at 20 °C (T_c = 303 K) (4 marks) (ii) Among the below mentioned process in Carnot engine, which one does more work. (6 marks) (a) Isothermal reversible expansion (b) Isothermal irreversible expansion Explain with mathematical support.	10
2.	(i) The activation energy of a chemical reaction is 100 kJ/mol and it's A factor is 10 $M^{-1}s^{-1}$. Find the rate constant of this equation at a temperature of 323 K. (5 marks) (ii) A plot of ln k against 1/T in a temperature-dependent rate reaction is a straight line. This reaction's slope increases by a factor of two by adding the catalyst. Whether the reaction rate will increase or decrease? Explain (5 marks)	10
3.	(i) Calculate the work done considering an irreversible isothermal expansion of H_2 at (a) Constant pressure of 1.5 Pa with change in volume about 20 m^3. (b) The same process under vacuum with appropriate explanation (5 marks) (ii) Calculate the half-life of the first order reaction from their rate constants given below: (i)200 s^{-1} (ii)2 min^{-1} (iii) 2 $year^{-1}$ (5 marks)	10
4.	(i) Calculate the crystal field stabilization energy of $Fe(CN)_6]^{3-}$ and $[Co(NH_3)_6]^{2+}$ complexes with suitable diagram. (5 marks) (ii) What is the relation between the wavelength and strength of the ligand? Discuss briefly about it. (5 marks)	10
5.	Which of the following neutral molecules does not obey 18 electron rules? Justify each case. (a) $(\eta^5\text{-}C_5H_5)Fe(CO)_2$ (b) $(\eta^5\text{-}C_5H_5)_2Co$ (c) $(\eta^5\text{-}C_5H_5)Mo(CO)_3$ (d) $(\eta^5\text{-}C_5H_5)Re(\eta^6\text{-}C_6H_6)$ (e) $Cr(C_6H_6)_2$	10
6.	(i) In the heme molecule of the porphyrin ligand with iron as central metal atom, compare ligand strength of the O_2 and CO with suitable crystal field stabilization energy diagram (6 marks) (ii) Explain the role of Mg^{2+} in chlorophyll for the photosynthesis. Justify using the necessary mechanism (4 marks)	10

3	4	5	6	7	8	9	10	11	12
21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn
39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd
57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg
89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn