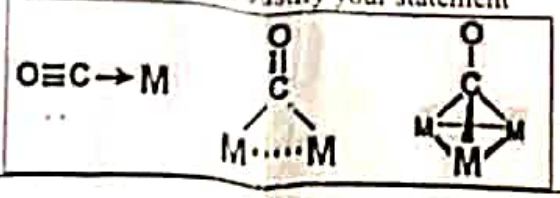
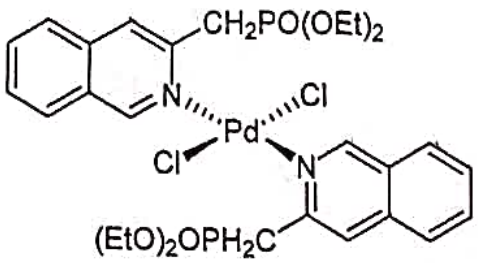
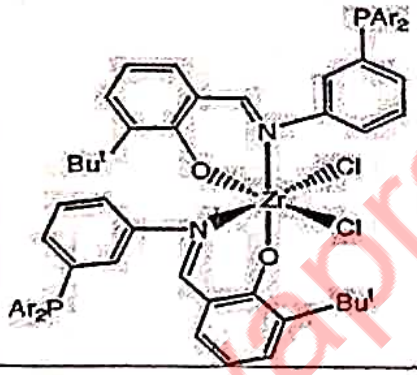
Name of Examination	Continuous Assessment Test I (CAT I), Fall 2022-23 Semester (October 2022)			
Slot: F2	Course Mode: Offline		Class Number: CH2022231700658	
Course Code:	BCHY101L	Course Title:	Engineering Chemistry	
Emp. No.:	51939	Faculty Name:	Ganesan Pandian	School: SAS
Contact No.:	89342308754	Email:	ganesan.p@vit.ac.in	

General Instructions (if any):

Q. No.	Sub-division	Question Text	Marks	Unit / Module No.	HOTS? (Y/N)	Difficulty Level E/A/T	CO
Answer All the Questions			Total Marks: 5 X 10 Marks = 50				
1.	(a)	Define mathematically the first law of thermodynamics. Apply the same for isothermal reversible and irreversible expansion of an ideal gas.	5+5	1	Y	Average (E)	1
	(b)	2 moles of an ideal monoatomic gas at 27 °C expands reversibly and adiabatically. During the expansion, the volume shifted from 20 litres to 40 litres. Calculate q, w, ΔH and ΔU. Given that Cv/R = 3/2 (R value)					
2.	(a)	Why is it impossible for any heat engine to have its efficiency 100%?	5+5	1	N	Easy	1
	(b)	How increase in the temperature of a reaction enhances the rate of the reaction? Explain.					
3.	(a)	Distinguish homogeneous catalysis from heterogeneous catalysis with examples.	5+5	1,2	Y	Easy	1
	(b)	Explain the significance of Iron organometallic complexation for the transport of oxygen to cells of human body.					
4.		Determine primary and secondary valency, hybridization, geometry and crystal field splitting energy of the complexes $[MnCl_4]^{2-}$ and $[Ni(H_2O)_6]^{2+}$ (Atomic No. of Mn =25 and Ni = 28		2	N	Easy	1
5.	(a).	Hexafluoro Cobalt (III) is Green in color while hexacyano Cobalt (III) in yellow color compound. Explain the reason for color variation in compounds.					
	(b)	How the C-O stretching frequency of the following metal carbonyls varies? Justify your statement 					

6.	(a)	List any four applications of coordination compounds?	5+5				
	(b)	State and prove whether complexes follow octet rule or not. (Atomic Number of Pd = 46 and Iridium Zr= 40)  		2	N	Tough (E)	1

31/10/2022

Signature with date

Name of Examination	**Continuous Assessment Test 1 (CAT-I), FALL 2022-23 Semester,** (November, 2022)			
Slot: C2+TC2	Course Mode: Classroom Based		**Class Number (s):** CH2022231700903	
Course Code:	BCHY101L	Course Title:	Engineering Chemistry	
Emp. No.:	52805	Faculty Name:	Dr. Lakkoji Satish	School: SAS
Contact No.:	8895446990	Email:	lakkoji.satish@vit.ac.in	

General Instructions (if any): ***Answer ANY FIVE questions*** Total Marks: 5 X 10 Marks = 50

Q. No.	Sub-division	Question Text	Marks
1.	i)	Heat supplied to Carnot engine is 373 kcal. How much useful work can be done by the engine which works between 30° C and 120° C?	5
	ii)	A gas contained in a cylinder fitted with a frictionless piston expands against a constant pressure 1 atmosphere from a volume of 2 litres to a volume of 5 litres. In doing so, it absorbs 500 J thermal energy from surroundings. Determine ΔU for the process. (Note: 1L.atm= 101.35 J)	5
2.	i)	How does entropy of the system changes when (a) a solid is melted (b) a gas is liquefied (c) water is frozen (d) addition of impurity to crystal (e) dissolving of NaCl in water. Give your answer with proper justification.	5
	ii)	The rate of a reaction doubles when temperature changes from 20°C to 70°C. Calculate energy of activation for the reaction. ($R = 8.314 JK^{-1} mol^{-1}$)	5
3.	i)	How the rate of an enzyme catalysed reaction does varies with increasing concentration of substrate.	5
	ii)	Explain the role of catalyst in the chemical reactions and its types with one example.	5
	i)	Explain the stability the following complexes based on 18-electrons rule. a) $Ni(CO)_4$ b) $Ni(CO)_2(C_2H_5)_2$	5
	ii)	Discuss briefly the role of Mg in photosynthesis process.	5
		Find the hybridization, geometry, primary and secondary valency, Crystal field stabilization energy and magnetic moment of $Na_3[CoF_6]$ and $[Co(NH_3)_6]Cl_3$	10

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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): CH2022231701024	
Course Code:	BCHY101L	Course Title:	Engineering Chemistry	
Emp. No.:	52837	Faculty Name:	T. S. Prathima	School: SAS
Contact No.:	7708510172	Email:	prathima.ts@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 --> $2C_2H_4$ is 6.1 x 10^{-8} 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

4.	(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
5.	(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
6.	(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

Question Format & QP Setter Information

Name of Examination	Continuous Assessment Test - 1, Fall Semester 2022-23, (Nov. 2022)			
Slot: C1 + TC1	Course Mode: Offline		Class Number(s): CH2022231701025	
Course Code:	BCHY101L	Course Title:	Engineering Chemistry	
Emp. No.:	51939	Faculty Name:	Ganesan Pandian	School: SAS
Contact No.:	9342308754	Email:	ganesan.p@vit.ac.in	

General Instructions (if any): ***1. CLOSED BOOK Examinations,***

Q. No.	Question Text	Marks	Unit / Module No.	HOTS? (Y/N)	Difficulty Level E/A/T	CO
	Answer **Any FIVE** Questions	Total Marks: 5X 10 Marks = 50				
1.	(i) 0.70 moles of an ideal gas expand 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. (7M) (ii) An engine absorbs 1600 J from a hot reservoir and expels 1000J to a cold reservoir in each cycle. Determine its efficiency. (3M)	10	1	N	A	1,2
2.	(i) The rate constant at 325°C for the decomposition reaction C_4H_8 --> $2C_2H_4$ is 6.1 x 10^{-8} s^{-1} and the activation energy is 261 kJ per mole of C_4H_8. Determine the frequency factor for the reaction. (4M) (ii) An organic peroxide decomposes in aqueous solution Assume the decomposition follows first order rate law. From the given data determine the rate constant by plotting ln[peroxide] verses time. (6M) **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	1	N	T	1,2
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 F(II) in water was measured. Determine the activation energy of the reaction from the following data. (5M) T,K k, s^{-1} 293 0.054 298 0.100	10	1	Y	A	1

	(ii) Highly strained molecule cyclopropane when heated to 499°C isomerizes and forms propene with a rate constant of $5.95 \times 10^{-4}\ s^{-1}$. What is the half-life of the reaction? What fraction of the cyclopropane remains after 0.75h at 499°C? (5M)					
4.	(i) Applying VB theory explain the hybridization, shape and magnetic behavior of $[Ni(CN)_4]^{2-}$ and $Ni(NH_3)_6]^{2+}$ (At. No. of Ni= 28) (6M) (ii) How can we differentiate the types of metal carbonyl interactions? Explain in with pictures (4M)	10	2	N	E	1,2
5.	(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) (6M) (ii) Which of the following neutral molecules does not obey 18 electron rule. Justify. (4M) (a) $(\eta^5\text{-}C_5H_5)Fe(CO)_2$ (b) $(\eta^5\text{-}C_5H_5)_2Co$	10	2	N	A	1,2,4
6.	(i) Explain in detail how the presence of Magnesium metal ion enhances the energy transfer process in chlorophyll. (6M) (ii) Applying CFT, explain the stability of Fe containing porphyrin ring present the Hemoglobin when coordinated with O_2 and CO molecules. (4M)	10	2	Y	A	1,2

Signature with date