Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF ADVANCED SCIENCES
Department of Chemistry
Fall Semester 2023-24
Continuous Assessment Test – 2

Course Code: BCHY101L **Duration:** 90 Minutes **Slot: C1 + TC1**

Course Name: Engineering Chemistry **Max. Marks:** 50

Class Numbers: VL2023240106241, 6244, 6248, 6252, 6257, 6276, 6280, 6284, 6288, 6292

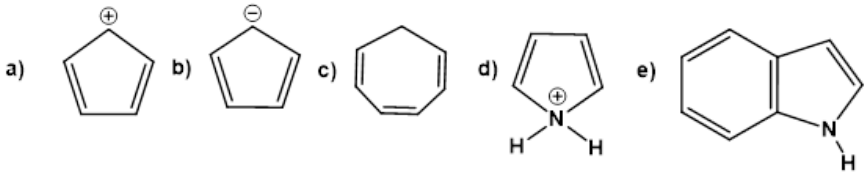
Faculty Names: Dr. Vijayaraghavan R, Dr. Palanisami N, Dr. Thirumanavelan G, Dr. Mohana Roopan S, Dr. Logesh Mathivathanan, Dr. Manju S L, Dr. Ravikanth K, Dr. Madhvesh Pathak, Dr. Susanta Kumar Bhunia and Dr. Karpagam S.

Note: Students are allowed to carry their self-hand written note book and one textbook to the examination.

Q. No.	Answer ALL the questions (5 X 10 = 50 Marks)	Marks	CO	BL
1	The role of heat engine in vehicles convert thermal energy to work and 100% efficiency is impossible. Illustrate the various working process of heat engine with appropriate state functions. **Ans:** Identification of Carnot Theorem/Cycle (**1 mark**) 4 -Strokes (each step1 mark, **4 marks**) Diagram (**2 marks**) Efficiency equation: **1 mark** From this equation, the explanation why it is impossible: **2 marks**	**10**	CO2	BL2
2	(a) The ethyl acetate is present in paints, coatings, adhesives and nail polish remover. During the process ethyl acetate will be evaporated by conversion of acetic acid with ethanol. The scientific data shows that the conversion does not depend on quantity of the water present in the above said materials. Reason out based on chemical kinetics with suitable rate law and equation.	**5**	CO2	BL3

	Ans: Pseudo First Order Reaction (**1 mark**) Definition with equation (**2 marks**) **$CH_3COOC_2H_5 + H_2O \rightarrow CH_3COOH + C_2H_5OH$** **Rate = *k* $[CH_3COOC_2H_5]$ (1 mark)** Explanation based on water concentration (**1 mark**) (b) Calculate the maximum work done when 1 mol of a gas expands isothermally and reversibly from a volume of 10L to 30L at 27 ^oC. What is the internal energy change if 10000 Joule of heat is absorbed? **Ans:** Reversible isothermal expansion: w = $nRT \ln \frac{V_f}{V_i}$ (**2 mark**) w = 1 mole x 300 K x 8.314 $J^{-1}mol^{-1}K^{-1}$ x ln (30/10) = 2740 J (**2 mark**) According to 1st law of thermodynamics at isothermal condition, $\Delta U = 0$ $(\mathbf{1\ mark})$	**5**	CO2	BL5

3	(a) Decomposition of nitrogen pentoxide (N_2O_5) ($2N_2O_5 \rightarrow 2NO_2 + ½\ O_2$) is an example for first order reaction. 5.0 g of N_2O_5 decomposes for 60 minutes lead 80% of decomposition. Calculate the value of first order rate constant. **Ans:** After 80% of decomposition, the remaining N_2O_5 from 5.0 g is = 1.0 g (**1 mark**) Formula (**2 marks**) $$\ln \frac{[A]_t}{[A]_0} / t = -k$$ K = - ln 1g /5g / 60 min K = -ln 0.2/60 min K= 1.609/60 min Rate constant= 0.02682 min^{-1} (**Answer with unit 2 marks**)	**5**	CO2	BL5
	(a) Catalase is an enzyme found in plant and animal tissues. The role is the breakdown of hydrogen peroxide into water and oxygen. It accelerates the hydrogen peroxide decomposition process 10^{15} than the conventional catalysis process. Discuss the mechanism with suitable diagram. **Ans:** Enzyme catalysis with definition (**1 mark**) Details on mechanism of enzyme-catalyzed reactions (2 **marks**) (Lock and key) Enzymes effect on the activation energy with diagram (**2 marks**)	**5**	CO2	BL5
4	(a) Identify the cyclooxygenase inhibition drug and discuss its synthesis with any two applications. **Ans:** dentification of aspirin (**1 mark**) Synthesis (**2 marks**, No mechanism)	**5**	CO1	BL3

	-any two applications (**1 mark** each) (b) Find out the dye which is used in Denim Jeans, and write a short note on the synthesis and dyeing process. **Ans:** dentification of indigotin dye (**1 mark**) Synthesis (**2 marks**, No mechanism) Dyeing process [**2 marks** (**1 mark** for equation + **1 mark** for the details)]	**5**	CO1	BL3
5	Depict the following chemical species as aromatic, nonaromatic, or antiaromatic. Justify your answer.  a) Anti aromatic, 4πe, Planar b) Aromatic, 6πe, Planar c) Non-aromatic, 6πe, non-Planar (SP^3 carbon) d) Non-aromatic, 6πe, non-Planar (no conjugation) e) Aromatic, 10πe, Planar (Each species-**2 marks**)	**10**	CO1	BL4