BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: B TECH **SEMESTER: V**
BRANCH: BIOTECHNOLOGY **SESSION: MO/2022**

SUBJECT: BE304 REACTION ENGINEERING

TIME: 2 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. **The total marks of the questions are 25.**
2. **Candidates attempt for all 25 marks.**
3. **Before attempting the question paper, be sure that you have got the correct question paper.**
4. **The missing data, if any, may be assumed suitably.**
5. **Tables/Data handbook/Graph paper etc. to be supplied to the candidates in the examination hall.**

		Marks	CO	BL
Q1 (a)	Explain why the rate of disappearance of NO and the rate of formation of N_2 are not the same in the reaction, $2CO(g) + 2NO(g) \rightarrow 2CO_2(g) + N_2(g)$.	[2]	1,2	3,4
Q1 (b)	On doubling the concentration of reactant, the rate of reaction triples. Find the reaction order.	[3]	1,2	3
Q2 (a)	What plot of experimental data can be used to evaluate the activation energy, E_a, of a reaction? How is E_a related to this plot?	[2]	1,2	1, 2
Q2 (b)	The reaction between nitric oxide and oxygen $2 NO + O_2 \rightarrow 2 NO_2$ follows the rate law - $d[O_2] / dt = k[NO]^2[O_2]$. Suggest a reaction mechanism between nitric oxide and oxygen.	[3]	2	3,4
Q3 (a)	What are the chief requirements that must be met by a plausible reaction mechanism? Why do we say "plausible" mechanism rather than "correct" mechanism?	[2]	1,2	2,3
Q3 (b)	(i) In the reaction $H_2O_2(aq) \rightarrow H_2O(l) + ½ O_2(g)$, the initial concentration of H_2O_2 is 0.2546 M, and the initial rate of reaction is 9.32×10^{-4} M s^{-1}. What will be $[H_2O_2]$ at t = 35 s ? (ii) For the reaction, A → products, a graph of [A] versus time is a curve. What can be concluded about the order of this reaction?	[1.5 x 2 = 3]	2	2,3,4
Q4 (a)	Following are two statements pertaining to the reaction 2A + B → 2C, for which the rate law is *rate* = k[A][B]. Identify which statement (A or B) is true and which is false (A or B) and explain your reasoning. (A) The value of k *is* independent of the initial concentrations $[A]_0$ and $[B]_0$. (B) The unit of the rate constant for this reaction can be expressed either as s^{-1} or min^{-1}.	[2]	1,2	3
Q4 (b)	The following liquid-phase series reaction is taking place in a constant volume batch reactor. $$A \xrightarrow{k_1} B \xrightarrow{k_2} C$$ The first reaction is first order, and the second reaction is zero order. Determine the concentrations of A, B and C as functions of time.	[3]	2	3

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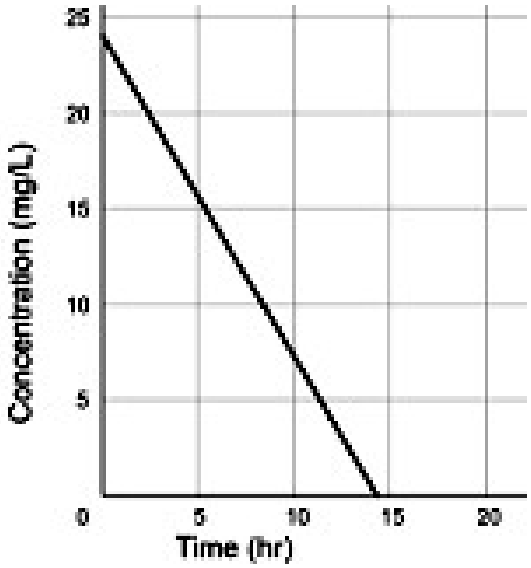
Q5 (a)	In a reaction mechanism, (a) what is the difference between an *activated complex* and an *intermediate*? (b) What is meant by the rate-determining step? Which elementary reaction in a reaction mechanism is often the rate-determining step?	[2]	1,2	2
Q5 (b)	(i) Why reaction of higher order is unknown? (ii) What affects the rate constant of a reaction? (iii) Why do drugs follow zero order kinetics? You may use the following sample profile of common drug metabolism:	[1x3 = 3]	1,2	2,3,4



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