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(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE

OF

BACHELOR OF SCIENCE (CHEMISTRY)

COURSE CODE: **SCH 341**

COURSE TITLE: **CHEMICAL KINETS**

DATE: Monday, 25th April 2022 **TIME**: 12.00 noon- 2.00 PM

INSTRUCTIONS TO CANDIDATES

- Answer all the Questions

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over.

QUESTION ONE (20 MARKS)

a) Define the following terms as used in Chemical kinetics **[5 marks]**
   i. Order of a reaction
   ii. Transition state
   iii. Enzyme
   iv. Rate determining step
   v. Differential rate law

b) For a reaction mechanism to be considered correct, what property must it demonstrate? **[2 marks]**

c) Show that $t_{1/2}$ for the first order reaction equals to 0.693/k **[3 marks]**

d) A first order reaction has a half-life of 20.0 mins.
   i. Calculate the rate constant for this reaction **[3 marks]**
   ii. How much time is required for this reaction to be 75% complete? **[2 marks]**

e) Derive the integrated rate law for type I second order reaction **[5 marks]**

$$A \rightarrow \text{Products}$$

QUESTION TWO (15 MARKS)

a) How is a simple reaction different from a complex reaction? **[2 marks]**

b) What is the reaction intermediate? Can intermediate be present in the rate law expression for the overall reaction? **[3 marks]**

c) The reaction $A+2B \rightarrow C+2D$ is form is found to be first order in A and first order in B. A proposed mechanism for the reaction involves the following first step:

$$A+B \rightarrow I+D \qquad \text{(slow)}$$

   i. Write a plausible second step in a two-step mechanism **[3 marks]**

   ii. Is the second step slow or fast? Explain. **[3 marks]**

d) The decomposition of nitrogen dioxide is a second order reaction with rate constants as follows: $522 M^{-1}s^{-1}$ at 592K and $755 M^{-1}s^{-1}$ at 603K. Calculate E_a and Log A of the reaction. **[4 marks]**

QUESTION THREE (20 MARKS)

a) What is the steady-state approximation and when is this approximation employed? **[3 marks]**

b) What is a transition state? How is the concept of a transition state used in activated complex theory? **[3 marks]**

c) Consider the following mechanism for ozone decomposition: