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KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR**

**SECOND YEAR SECOND SEMESTER
MAIN EXAMINATIONS**

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 241

COURSE TITLE: CHEMICAL KINETICS

DURATION: 2 HOURS

DATE: 3/8/2018 TIME: 2-4PM.

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.
- You are provided with graph papers where necessary.

This paper consists of 4 printed pages. Please Turn Over



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QUESTION ONE (30 MARKS)

1. a) Define the following terms as used in chemical kinetics. (5marks)
- Half life
 - Steric factors
 - Catalyst
 - Rate of a reaction
 - Molecularity

b) The table below was obtained for the results involving different concentrations of reactants. $2\text{ClO}_2(\text{a}) + 2\text{OH}^-(\text{a}) \longrightarrow \text{ClO}_3(\text{g}) + 2\text{ClO}_2^-(\text{g}) + \text{H}_2\text{O}$

Experiment	$[\text{ClO}_2]$ (in mols/liter)	$[\text{OH}^-]$ (in mols/liter)	Initial rate (in mols/Sec)
1	0.01	0.03	6.00×10^{-4}
2	0.01	0.075	1.50×10^{-3}
3	0.055	0.035	1.82×10^{-2}

- Determine the order of reaction in respect to $[\text{ClO}_2]$ and $[\text{OH}^-]$ (4marks)
 - Determine the rate expression of the rate law? (2marks)
 - Calculate the rate constant. (3marks)
 - What is the rate constant when the concentration of $[\text{ClO}_2]$ is 0.04M and that of $[\text{OH}^-]$ is 0.05M? . (3marks)
- c) Briefly explain determination of first order reaction which obeys the scheme $\text{A} \longrightarrow \text{p. products}$, using the graphical method, integration method and The fraction life method(9marks)
- d) What is the order of a chemical reaction (2marks)
- e) Research into catalysis is a major field in applied science and involves many areas of chemistry. Explain two areas of application (4marks)

QUESTION TWO (20 MARKS)

- Derive Michaelis-Menten equation (10marks)
- Explain the application of Michaelis-Menten equation in the study of enzymes (7marks)
- Write the Arrhenius equation and clearly define each of the terms in the equations. (3marks)

QUESTION THREE (20 MARKS)

- a) Define the following terms as used in complex reactions **(6marks)**
- Consecutive reaction
 - Parallel reaction
 - Reversible reaction
- b) In the reaction;



Propose a possible mechanism, clearly identifying the reaction intermediate and the rate determining step. **(3marks)**

- c)
- What is the difference between homogenous and heterogeneous catalysis? **(4marks)**
 - Explain the following theories of reaction rates as used in chemical kinetics **(7marks)**
 - Collision theory
 - Transition state theory

QUESTION FOUR (20 MARKS)

- a) State TWO factors which affect the molecular speed of a gas particle in a system. **(2marks)**
- b) Define the following with respect to the distribution of molecular speeds of a gas sample. **(3marks)**
- c) Using Maxwell and Boltzman's postulates about the distribution of molecular speeds, explain how the kinetic energy and rate of reaction are affected by the following; **(5marks)**
- Temperature of the gas sample. **(5marks)**
 - Molecular mass of the particle. **(5marks)**
 - Use of a catalyst **(5marks)**

(Use distribution function diagrams to show how each property affects the fraction of molecules with kinetic energy above activation energy.)

QUESTION FIVE (20 MARKS)

- a). Why is the study of chemical kinetics is quite important it the application chemistry. **(5marks)**
- b) What doundestant by the trem rate of a chemical reaction **(2marks)**
- C). A second order reaction in solution has a rate constant $5.7 \times 10^{-5} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ at 25°C and of $1.64 \times 10^{-4} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ at 40°C . Calculate the E_a and the pre exponential factor

assuming that Arrhenius law applies

(5marks)

d) Consider the decomposition of nitrogen dioxide in a closed system



- i). Explain the circumstances where a reverse reaction would occur (2marks)
- ii). Explain what happens when gaseous NO_2 is placed in empty container (3marks)
- iii). What other reaction conditions other than d (ii) would avoid the accumulation of products (3marks)