THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

MAIN EXAMINATION

AUGUST – DECEMBER 2018 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF NATURAL SCIENCE (CHEMISTRY)

REGULAR PROGRAMME

CHEM 203: CHEMICAL KINETICS

Date: DECEMBER 2018   **Duration: 2 Hours**

INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions

Q1. a) In chemical kinetics, rate constants are usually preferred to rates. Explain.
(3 marks)

b) What do you understand by kinetic control of a reaction? **(3 marks)**

c) Explain how increase in concentration of reactants leads to a corresponding increase in reaction rates. **(3 marks)**

d) Explain the three key parts of any rate-law expression. **(4 marks)**

e) Activated complex is not a reaction intermediate that can be isolated and studied like ordinary molecules. Explain. **(3 marks)**

f) Explain the two different ways in which the Arrhenius equation can be used. **(4 marks)**

g) Explain the application of the isolation method in the determination of the reaction rate of a chosen reactant given that all other reactants are present in a large excess. **(4 marks)**

h) Differentiate between homogeneous and heterogeneous catalysis.
(3 marks)

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     i)   In a reaction mechanism, molecules fall apart; other molecules form. Explain. **(3 marks)**

Q2. a)   The experimentally determined rate law is one of the most useful tools in trying to determine a mechanism. Explain the three critical steps in the determination of any given mechanism. **(6 marks)**

b)   Consider an equilibrium $PCl_5(g) = PCl_3(g) + Cl_2(g)$ $K_c = 0.030$. A system initially containing only PCl_5 at a concentration of 0.100M has a $Q_c = 0$ which is less than 0.030. What are the equilibrium concentrations of the three gases? **(8 marks)**

c)   What do you understand by the steady-state assumption? **(6 marks)**

Q3. a)   Given a simple reaction $A \rightarrow B$ and that it is a first order reaction, determine both its differential and integral forms. **(8 marks)**

b)   What do you understand by the rate determining step is a multi-step reaction? **(4 marks)**

c)   For slow reactions, the composition of the reaction mixture may be analyzed while the reaction is in progress either by withdrawing a small sample or by monitoring the bulk. Explain how the quenching method can be applied in this exercise? **(4 marks)**

Q4. a)   Explain the main steps of a chain reaction. (8 marks)

b)   Catalysts serve one of the two functions; making reactions faster or more 'selective'. Explain how catalysts achieve these functions. **(6 marks)**

c)   What do you understand by the collision theory as it applies to the kinetics of reactions? **(6 marks)**

Q5. a)   Explain what you understand by Half-life and further derive the $t_{1/2}$ of a first order reaction. **(8 marks)**

b)   What are pseudo-order reactions? **(8 marks)**

c)   Explain your understanding of relaxation methods as applied to equilibrium reactions. **(4 marks)**

END

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