Technical University of Mombasa

Faculty of Applied and Health Sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY (ANALYTICAL AND INDUSTRIAL OPTION)

BTAC 12J

ACH 4201: CHEMICAL KINETICS AND REACTION DYNAMICS

SEMESTER EXAMINATION

DECEMBER 2013 SERIES 2 HOURS

Instructions to candidates:

This paper consist of FIVE questions
Answer question ONE (compulsory) and any other TWO questions

QUESTION ONE

a) Explain graphically how you will proof that a reaction is of third order. **(3marks)**
b) Outline :-

(i) Advantages of Nickel over tungsten as catalyst **(3marks)**
(ii) Significant of Arrhenius law **(3marks)**
(iii) Limitation of transition state theory **(3marks)**
(iv) Different mechanism of Enzymes **(5marks)**

c) Differentiate between Activated complex and intermediate complex. **(3marks)**
d) The rate constant for the decomposition of Nitrogen pentoxide is 3.46×10^{-5} at 25˚C and 4.87×10^{-3} at 65˚C. Calculate the energy of Activation **(5marks)**
e) The following experimental data fit second order rate equation. Calculate the concentration after 8 minutes **(5marks)**

Time in minutes	5	0	9	13
Concentration (m)	0.00755	0.01	0.00637	0.00547

QUESTION TWO

a) Explain briefly:-

(i) Different methods of measuring reaction rates **(4marks)**
(ii) Why Grignard reagents have induction period **(3marks)**
(iii) Characteristic of zero order reactions **(3marks)**

b) Dinitrogen pentoxide decomposes by first order reaction with rate constant 4.8×10^{-4} sec^{-1} at 50˚C. If the initial concentration was 0.45M. Calculate conversion percentage after 3.2 minutes. **(4marks)**

c) Use the following data to determine:-

(i) Order of reaction
(ii) Value of rate constant Kr

(4marks)

Initial concentration in mol/litre	4.13	5.22	6.72	8.16
Half life in Sec	490	388	301	243

d) Define mechanism of enzymes **(2marks)**

QUESTION THREE

a) Proof that half life of second order reaction is inverse proportional to initial concentration. **(3marks)**
b) Define induced catalysis **(3marks)**
c) Deduce rate of formation of methane which proceed vie Rice-Herzfeld mechanism as shown below. **(5marks)**

I. $CH_3CHO \xrightarrow{K_1} CH_3 + CHO$
II. $CH_3CHO + CH_3 \xrightarrow{K_2} CH_4(g) + CH_3CO$
III. $CH_3CO \xrightarrow{K_3} CH_3 + CO$
IV. $CH_3 + CH_3 \xrightarrow{K_4} 2CH_3$

d) Define poisoning **(2marks)**
e) Explain how temperature affects rate of reaction **(3marks)**
f) The rate of disappearance of Nitrogen is 1.5×10^{-4} moles $Sec^{-1}L^{-1}$ calculate rate of formation of Ammonia

Reaction $0.5N_2(g) + 1.5H_2(g) \rightleftharpoons 2NH_3(g)$ **(2marks)**

g) Define order of reaction **(2marks)**

QUESTION FOUR

a) Describe catalytic theory of Enzymes **(6marks)**
b) State significant of Michaeli constant Km **(3marks)**
c) Use the following experimental result to graphically determine the value of rate constant **(5marks)**

Time in minutes	0.01	0.005	0.002	0.001
Concentration (mols/l)	0.00	0.025	0.4	0.6

d) The following are experimental result for certain reaction:

(i) Proof if it fits first order reaction
(ii) Determine conversion after 25minutes **(6marks)**

Time in minutes	10	20	30
Conversion %	35.4	57.43	73.3

QUESTION FIVE

a) Discuss different types of enzyme inhibition **(5marks)**
b) Define consecutive reaction and sketch its concentration time curve **(2marks)**
c) Explain how temperature of concentration influence occurrence of explosion reaction. **(4marks)**
d) State advantages of Adsorption theory of catalysis over intermediate theory. **(2marks)**
e) The following data was obtain for the reaction

$I_2 + CH_3COCH_3 + H_2O \rightarrow ICH_2COCH_3 + H_3O + I^-$ at 290K.

Determine respective order of each reactant and the values of rate constant Kv **(7marks)**

Concentration in mol/litre				Initial Rate of reaction M/min
CH_3COCH_3		H_2O	I_2	
1	1.0	0.150	0.025	4.20×10^{-6}
2	1.0	0.200	0.025	5.6×10^{-6}
3	2.0	0.200	0.025	11.20×10^{-6}
4	2.0	0.20	0.010	8.4×10^{-6}