KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2009/2010

INSTITUTIONAL BASED PROGRAMME

EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION (SCIENCE)

SCH 305: CHEMICAL KINETICS

DATE: WEDNESDAY, 28TH APRIL 2010 **TIME: 2.00 P.M. - 4.00 P.M.**

Useful data:

R = 8.314J mole^{-1}K^{-1}

O^{o}C = 273.15K

INSTRUCTIONS: Answer ALL THREE questions.

1. (a) Write concisely to distinguish between mechanism, molecularity and order as used in chemical kinetics. (8 marks)

   (b) The rate equation for a reaction of nth order in a single substance A is represented thus

   $$-\frac{d}{dt}[A] = k[A]^n.$$

   Derive that, for a first order reaction, the half-life is independent of the initial concentration of the reactant.

   Further, if the rate constant is 5 x 10^{-4} sec^{-1}, how long does it take before the concentration of the reactant falls to one-fifth of the initial value? (9 marks)

   (c) Account for the increase in the rate of a chemical reaction with increase in temperature. (5 marks)

   (d) In the decomposition of substance A at 518^{o}C, the time taken to decompose half the material was found to be 410 sec, when the initial pressure was 363 mmHg and 880 sec for the initial pressure of 169 mmHg. Work out the order of the reaction. (6 marks)

2. (a) Explain the stationary (steady) state concept. (4 marks)

(b) Explain, using a suitable example, the essential features of a chain reaction. (6 marks)

(c) For a certain reaction the following table gives the specific reaction rate constant, *k*, at four temperatures:

T, ^{o}C	319	330.2	354	378.5
k(mole^{-1}ls^{-1})	0.522	0.755	1.70	4.020

Determine the value of the activation energy by drawing the appropriate graph. (12 marks)

3. (a) Write concisely on the kinetics of heterogeneous unimolecular gas reactions at low and high pressures. (11 marks)

(b) The initial rate of the reaction

B + C $\longrightarrow$ D was measured for several different starting concentrations of B and C and the results given as below:

EXPT #	[B]	[C]	INITIAL RATE, mole s^{-1}
1	0.100	0.100	4.0 x 10^{-5}
2	0.200	0.100	4.0 x 10^{-5}
3	0.100	0.200	16.0 x 10^{-5}

Using the above data, determine:

i) the rate law for the reaction

ii) the magnitude of the rate constant

(9 marks)

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