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**University Examinations 2015/2016**

THIRD YEAR, FIRST SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE CHEMISTRY

**SCH 2305: REACTION KINETICS**

**DATE: NOVEMBER, 2015 TIME:** $2$**HOURS**

**INSTRUCTIONS:** *Answer question* ***one*** *and any other* ***two*** *questions.*

**QUESTION ONE – (30 MARKS)**

1. Define the following terms;
2. Molecularity (1 Mark)
3. Order of reactions (1 Mark)
4. Discuss four conditions that must prevail for a reaction to take place. (4 Marks)
5. Give examples of a ;
6. Unimolecular reaction (1 Mark)
7. Pseudo unimolecular reaction (1 Mark)
8. Bimolecular reaction (1 Mark)
9. Describe two methods available for determining the order of a reaction. (4 Marks)
10. During the initial stages of the reaction between H2 and Br2, the rate law is found to be



1. What is the order of the reaction? (2 Marks)
2. Is it an elementary reaction? (1 Mark)
3. At a high temperature of 3000k, a mixture of H atoms and Ar produces hydrogen molecules. 2H + Av$ \rightarrow $ H2 + Ar. It is an elementary reaction with K equal to 2.21 x $10^{6} mol^{2-}l^{2}s^{-1}$. What would be the rate law for the reaction? (1 Mark)
4. (i) Define the term half-life period. (1 Mark)

(ii) A reaction is second order in one of the reactants and the rate constant is 0.5 $mol^{-1 }dm^{3}min^{-1}$. What is the half life period if the initial concentration is;

1. 0.2 mol $dm^{-3}$ (2 Marks)
2. 0.1 mol $dm^{-3}$ (2 Marks)
3. If it was a first order reaction (2 Marks)
4. State two characteristics of catalysed reactions. (2 Marks)
5. Distinguish between homogenous and heterogenous catalysis. ( 2 Marks)

**QUESTION TWO (20 MARKS)**

1. Distinguish between concurrent reactions and consecutive reactions. (2 Marks)
2. Briefly, discuss how the following factors affect the rate of chemical reactions.
3. Temperature
4. Isotopic composition of a reactant
5. Reaction medium
6. Ionic strength of solution. (8 Marks)
7. Determine the order of reaction from the following data.

Conc. of A M 1.00 1.00 0.02 0.04

Conc. of B M 0.02 0.04 1.00 1.00

Rate of reaction (M$ min^{-1})$ 4.6 x $10^{-4}$ 9.2 x $10^{-4}$ 9.2 x $10^{-6 } $3.68 x $10^{-4}$

 Calculate;

1. The order of reaction with respect to B (2 Marks)
2. The order of reaction with respect to A (2 Marks)
3. The overall order of the reaction (1 Mark)
4. Write the rate expression (1 Mark)
5. calculate the true rate constant (4 Marks)

**QUESTION THREE (20 MARKS)**

1. At a certain temperature, the half life periods and initial concentrations for a reaction are

 t½ = 420s, $a=0.405mol dm^{-3}$a

 t½ = 275s, $a=0.64mol dm^{-3}$

 Calculate the (i) Order of the reaction (3 Marks)

 (ii) Rate constant (3 Marks)

1. With suitable examples, distinguish between “promoter” and inhibitor as used in catalysis. (4 Marks)
2. The activation energy for decomposition of N2O5 is 103 kJ$mol^{-1}$
3. What will be the ratio of their rates at 00C and 250C (the rates being measured at the same concentration of the reactants) (4 Marks)
4. If the rate constant of the reaction at 250C is 2 x $10^{-3}$min, calculate the rate constant for the reaction at 00C and 500C. (6 Marks)

**QUESTION FOUR (20 MARKS)**

1. Briefly explain the transition state theory. (5 Marks)
2. The rate of a reaction was followed by measuring the concentration of one of the reactants at different intervals. Following data was obtained ;

Time 0 10 20 40 80 120 160

Concentration (x$10^{-2}M)$ 3.33 2.22 1.67 1.11 0.667 0.476 0.370

1. Find the order of this reaction, graphically. (5 Marks)
2. If this is the only reactants (I) What is the rate law for the reaction? (1 Mark)

(II) What it the specific reaction rate? (2 Marks)

1. What will be the rate of this reaction when the concentration of the reactants are $10^{-3}m$ (4 Marks)
2. The rate constant of a zero order reaction is 0.2 mol$dm^{-3}h^{-1}$. what will be the initial concentration of the reactant if after half an hour its concentration is 0.05 mol $dm^{-3}$

(3 Marks)