

DEPARTMENT OF CHEMISTRY  
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA  
SECOND SEMESTER EXAMINATION 2011/2012 SESSION

COURSE CODE: CHM322

UNITS: 2

COURSE TITLE: CHEMICAL KINETICS

TIME ALLOWED: 1 Hour 30 Minutes

INSTRUCTIONS: Answer any three questions

1 (a). Define the term rate of chemical reaction.

b (i). Write short notes on the factors affecting rate of chemical reaction.

(ii). Reaction rate is expressed in terms of changes in concentration of reactants and products. Write a balanced equation for

$$\text{Rate} = -\frac{1}{2} \frac{\Delta[\text{N}_2\text{O}_5]}{\Delta t} = \frac{1}{4} \frac{\Delta[\text{NO}_2]}{\Delta t} = \frac{\Delta[\text{O}_2]}{\Delta t}$$

(c) (i). The Inversion of sucrose in the presence of HCl gave the following values for the optical rotations:

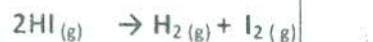
|                    |       |       |       |       |       |          |
|--------------------|-------|-------|-------|-------|-------|----------|
| Time (minutes)     | 0     | 15    | 30    | 45    | 63    | $\infty$ |
| Rotation (degrees) | +32.4 | +28.8 | +25.5 | +22.4 | +19.6 | -11.0    |

Show that the inversion of sucrose is a first order reaction.

(ii). Give a brief account of the method use in determining the order of reaction.

(2) (a). Explain the term activation energy.

(b) The decomposition of hydrogen Iodide,



has rate constants of  $9.51 \times 10^{-9} \text{ L/mol/s}$

at 500K and  $1.10 \times 10^{-5} \text{ L/mol/s}$  at 600K. Determine the activation energy,  $E_a$ .

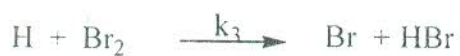
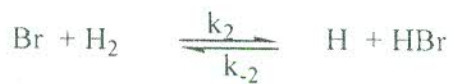
( $R = 8.314 \text{ J/mol/K.}$ )

(c) (i). Explain Collision and transition state theories of reaction rates.

(ii). With the aid of diagram explain the effect of temperature on the fraction of collision.

3a). What is a complex reaction?

b). The  $\text{H}_2 + \text{Br}_2 \longrightarrow \text{HBr}$  reaction takes place in the following steps



Derive the kinetic equation for the formation of HBr

4a) Define the term fast reaction

b). Discuss any two of the following methods of monitoring fast reactions

i). Stopped flow method. ii). Continuous flow method and iii). Flash photolysis.