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7. CHEMICAL KINETICS

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7. CHEMICAL KINETICS

- ▶ INTRODUCTION
- ▶ The word kinetics is derived from the greek word “Kinesis” meaning movement.
- ▶ It is study of the rate and the mechanism of chemical reactions proceeding under given conditions of temperature, pressure, concentration etc.
- ▶ In this unit we are going to learn the rate of a chemical reaction and the factors affecting it.
- ▶ We are going to learn in this unit discuss the theories of the reaction rate and temperature dependence of a chemical reaction.

RATE OF CHEMICAL REACTION

▶ INITIAL RATE

- (i) Rate of a reaction, & Unit of rate of a reaction.
- (ii) Stoichiometry and rate of a reaction.

▶ AVERAGE REACTION

▶ INSTANTANEOUS REACTION

- (i) Isomerisation of Cyclopropane
- (ii) Rate law and Rate constant
- (iii) Differences between rate and rate constant of a reaction.

ORDER & MOLECULARITY

- ▶ ORDER DEFINITION
- ▶ MOLECULARITY DEFINITION
- ▶ DIFFERENCES BETWEEN ORDER & MOLECULARITY OF REACTION
- ▶ THE INTEGRATED RATE EQUATION
 - (i) Integrated rate law for a First order reaction
 - (ii) Pseudo first order reaction
 - (iii) Integrated rate law for a Zero order reaction
 - (iv) Half life Period of a reaction.

THEORIES

▶ COLLISION THEORY

- (I) Progress of the reaction
- (ii) Orientation of reactants – schematic representation

▶ ARRHENIUS THEORY

- (I) Arrhenius equation – The effect of Temperature on reaction rate.

FACTORS AFFECTING THE REACTION RATE

► THE RATE OF A REACTION IS AFFECTED BY THE FOLLOWING FACTORS:

- (I) Nature and state of the reactant
- (ii) Concentration of the reactant
- (iii) Surface area of the reactant
- (iv) Temperature of the reaction
- (v) Presence of Catalyst.

DO YOU KNOW

► CHEMICAL KINETICS IN PHARMACEUTICALS

(i) It is used to study the lifetimes and bioavailability of drugs within the body and this branch of study is called "PHARMOCOKINETICS".

(ii) Pharmacokinetics studies is used to determine the prescription (dosage and frequency).

(iii) For example, Paracetamol is a well known anti-pyretic and analgesic that is prescribed in cases of fever and body pain.

(iv) Pharmacokinetics studies shows that the Paracetamol has a half-life of 2.5hrs within the body (i.e. Plasma concentration of a drug is halved after 2.5 hrs.)

(v) After 10 hours (4 half-lives) only 6.25% of drugs remain.

(vi) Based on such studies the dosage and frequency will be decided.

(vii) In case of Paracetamol, it is usually prescribed to take once in 6 hours depending upon the conditions

GRAPH

- ▶ FIGURE 7.1 GRAPH: Change in Concent. of A & B for the reaction. $A \rightarrow B$. (V-I, Pg.No.206)
- ▶ FIGURE 7.2 GRAPH: Concent. Of Cyclopropane vs time – graph. (V-I, Pg.No.208)
- ▶ FIGURE 7.3. GRAPH : A plot of $\ln[A]$ Vs t for a first order reaction, $A \rightarrow \text{Product}$. with initial concentration of $[A] = 1.00\text{M}$ and $k = 2.5 \times 10^{-2} \text{min}^{-1}$. (V-I, Pg.No.213)
- ▶ FIGURE 7.4 GRAPH: A plot of $[A]$ Vs time for zero order reaction $A \rightarrow \text{product}$ with initial concentration of $[A] = 0.5\text{M}$ and $k = 1.5 \times 10^{-2} \text{mol}^{-1} \text{L}^{-1} \cdot \text{min}^{-1}$. (V-I, Pg. No.214)
- ▶ FIGURE 7.5 GRAPH: Progress of the reaction. (V-I, Pg.No.218)
- ▶ FIGURE 7.6 DIAGRAM: Orientations of reactants – schematic representation (V-I, Pg.No.219).
- ▶ TEXT BOOK EXAMPLE PROBLEMS FROM 1 TO 8.(REFER TEXT BOOK)

THANK YOU