Answer:

• CHEMICAL KINETICS

- Order and molecularity
- Kinetics of first and second order reaction
- Pseudounimolecular reaction

• Chemical Kinetics

Chemical kinetics is the branch of physical chemistry which deals with a study of the speed of chemical reactions. Such studies also enable us to understand the mechanism by which the reaction occurs. Thus, in chemical kinetics we can also determine the rate of chemical reaction.

From the kinetic stand point the reactions are classified into two groups:

a) homogeneous reactions which occur entirely in one phase

b) heterogeneous reactions where the transformation takes place on the surface of a catalyst or the walls of a container.

• Rate of reaction

The rate of reaction i.e. the velocity of a reaction is the amount of a chemical change occurring per unit time.

The rate is generally expressed as the decrease in concentration of a reactant or as the increase in concentration of the product. If C the concentration of a reactant at any time t is, the rate is $-\frac{dC}{dt}$ or if the concentration of a product be x at any time t, the rate would be $\frac{dx}{dt}$.

The time is usually expressed in seconds. The rate will have units of concentration divided by time.

The concentrations are taken in gm-moles/litre, hence rate is moles/litre/second.

Factors influencing the rate of reaction

Rate of a chemical reaction is influenced by the following factors

(i) Temperature

(ii) Concentration of the reactants

(iii) Nature of reactants

(iv) Catalysts

(v) Radiation

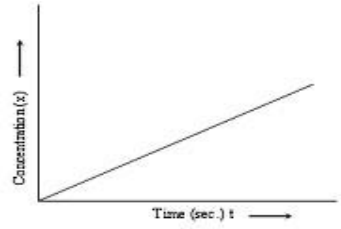
Zero Order Kinetics

A chemical reaction whose rate does not depend on concentration of reactants is called a zero order chemical reaction.

The rate of the reaction can be written as

$\underline{Dx}/dt=k$

$[A] = - kt + [A]0$



First Order Kinetics

A reaction of the first order is represented as

$$X \longrightarrow Y$$

where X is the reactant and Y the product. The rate of the reaction will be directly proportional to the concentration i.e.,

$$dc/dt=kc$$

in which C is the concentration of the reactant at any time t and K is a constant, called the velocity constant or specific reaction rate.

$$Dc/c=kdt$$

Answer:

On integration $-\int \frac{dc}{C} = K \int dt$

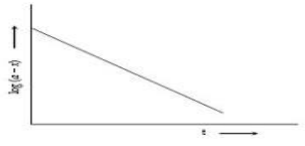
$-\ln c = kt + Z$ (Integration Constant).

If at the start of the reaction the initial concentration of the reactant is C_o then we have at $t = 0$, $C = C_o$

Substituting $-\ln C_o = -\ln C = Kt - \ln C_o$

$$-\ln(a-x) = Kt - \ln a$$

$$K = 2.303/t.\log dc/dt$$



Then $t1/2 = K1 \ln a - a\alpha/2 = K$

Second Order Kinetics

A reaction will be of the second order when the reaction rate would depend upon the product of two concentrations.

Second order reactions are of two types

(i) The rate is proportional to the square of the same reactant concentration

(ii) The rate is proportional to the product of the two reactant concentration

(i) The rate is proportional to the square of the same reactant concentration

Let say,

$2A \longrightarrow$ Products

$(a-x)$

If the two substances have the same initial concentration(a)and if x denotes the concentration of the reactants which disappears in time t, then the rate will be

dx —

On integration,

$$\int \frac{dx}{(a-x)^2} = K \int dt$$

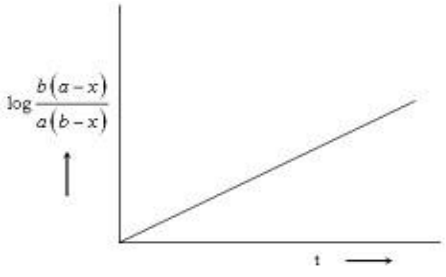
$\frac{1}{(a-x)} = Kt + Z$ (Integration constant)

When $t = 0,\ x = 0\ \therefore\ \frac{1}{a} = Z$

Substituting the value of Z

In a second order reaction, where the two initial concentrations are the same then from the ha

rate=k[A][B]=k[A][A]=k[A]2.



Pseudounimolecular Reactions

There are a number of reactions, which follow the first order kinetics though more than one kind of reactants is involved in the reaction. Common examples are the inversion of cane sugar or the hydrolysis of an ester in an acid medium.

C12 H22 011 +H20 = 2
C6 H12 06

What is the difference between order and molecularity of a chemical reaction?

Order of reaction	Molecularity of reaction

Answer:

It is experimentally determined quantity.	It is theoretical concept. It is calculated on the basis of the rate determining step.
It is obtained from the rateof the overall reaction.	It is always a whole number.
It may have whole number,zero and even fractional value.	It can be obtained from balanced equation of single reaction.
It can not be obtained frombalanced or stoichiometric equation.	It is equal to the minimumnumber of species (molecule, atom or ions) taking part in a single rate determining step of chemical reaction.
It is equal to the sum of the exponents of the molar concentration of the reactants in the rate equation.	

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