

Chapter 11....Reaction-Kinetics

SHORT QUESTION WITH ANSWERS

Q.1 What is meant by chemical kinetics?

Ans.

It is that branch of chemistry which helps to study the followings.

- (i) Rates of chemical reactions.
- (ii) Study the mechanism of reactions.

Q.2 Differentiate between instantaneous rate of reaction and average rate of reaction.

Ans.

The rate of a chemical reaction at a specific time or at any moment is called as instantaneous rate of a reaction. It is very fast at the start and very slow at the end.

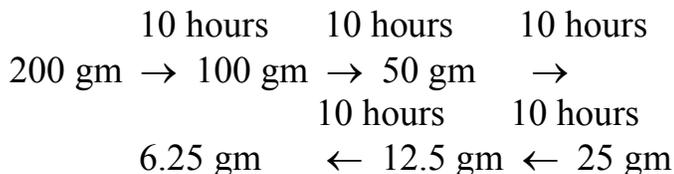
Q.3 Rate of a chemical reaction is an ever changing parameter under the given conditions. Comment.

Ans.

According to law of mass action, the rate of chemical reaction is directly product of active masses of reactants. When the reaction progress, the reaction is very fast at the beginning slow, somewhere in the middle and very slow at the end. The reason is that rate depends upon concentration as conc. decreases every moment, rate decreases every moment.

Q.4 A student started to work on 200 gms of a compound A whose half life 10 hours. How much of the compound will be left after 50 hours.

Ans.

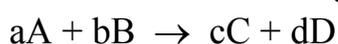


Q.5 What is meant by rate law?

Ans.

The rate of a chemical reaction is directly proportional to the product of concentrations of reactants each raised to some power.

Consider the following reaction



Rate of reaction $\propto [A]^a [B]^b$

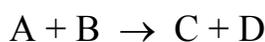
This equation is called rate law.

Q.6 What is meant by specific rate constant, or rate constant?

Ans.

The rate constant of a reaction is the rate when the concentration of reactant are unity.

For the reaction



Rate of reaction = $K [A] [B]$

This equation is called rate law where K is called specific rate constant.

When $[A] [B] = 1$ then

Rate of reaction = K

Q.7 What is meant by order of reaction?

Ans.

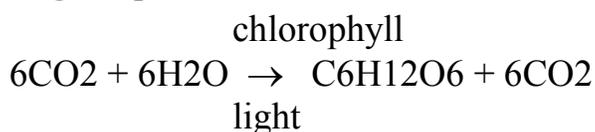
The order of reaction is the sum of exponents of the concentration terms in the rate equation. OR

Number of reacting substances whose concentration changes during the chemical reaction.

Q.8 Explain zero order reaction?

Ans.

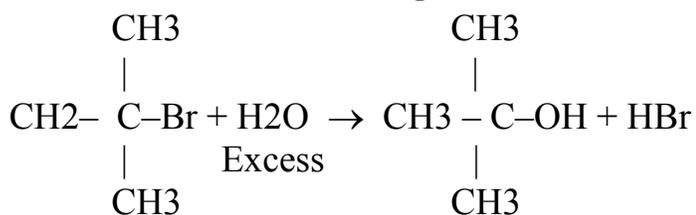
That chemical reaction whose rate is independent of concentration of reactant e.g. all photochemical reaction are zero order e.g.



Q.9 What are pseudo order reaction?

Ans.

When one of reactant is taken in large excess its concentration is consider as constant and the order becomes pseudo.



Rate = $K [(\text{CH}_3)_3 \text{CBr}]$

The conc. of H_2O is taken as constant.

Q.10 What is half life period?

Ans.

Half life period of a reaction is the time required to convert 50% of reactants into products e.g. half life of decomposition of N_2O_5 at 45°C is 24 minutes. For first order reaction, half life period is independent of the initial concentration of reactants.

Q.11 The radioactive decay is always first order reaction.

Ans.

The radioactive decay of a substance is directly proportional to the number of nuclei in the sample. Its half life period is independent of its initial conc. of reactant.

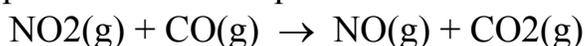
$$[t_{1/2}] \propto$$

$$[t_{1/2}] \propto \quad \text{For first order } n = 1$$

Q.12 What is meant by rate determining step?

Ans.

If a reaction occurs in several steps, one of the steps is the slowest. The rate of this step determines the overall rate of reaction. This slowest step is called as rate determining step. The number of molecules taking part in the rate determining step appears in the rate equation of the reaction e.g.



The rate equation of the reaction is found to be

$$\text{Rate} = K [\text{NO}_2]^2$$

This equation shows that rate of reaction is independent of conc. of CO . In other words the equation tells us that reaction involve more than one step.

Q.13 Describe electrical conductivity method for determination of rate of reaction.

Ans.

The rate of a reaction involving ions can be studied by electrical conductivity method the conductivity of such a solution depends upon the rate of change of conc. of the reacting ions or the ions formed during reaction.

Q.14 Explain briefly spectrometry for the rate determination.

Ans.

This method is applicable if a reactant or a product absorbs ultraviolet, visible or infrared radiations. The rate of reaction can be measured by measuring the amount of radiations absorbed.

Q.15 What is difference between dilatometric and refractometric method?

Ans.

Dilatometric method is useful for those reactions, which involve small volume changes in solutions. The volume change is directly proportional to the extent of reaction, where refractometric method is applicable to reactions in solutions where there are changes in refractive indices of the substances taking part in the chemical reaction.

Q.16 Describe briefly optical rotation method.

Ans.

In this method, the angle through which plane polarised light is rotated by the reacting mixture is measured by a polarimeter. The extent of rotation determines the concentration of optically active substance. If any of the species in the reaction mixture is optically active, then this method can be followed to find out the rate reaction.

Q.17 Describe Half-life method for finding the order of reaction?

Ans.

Order of reaction can be determined if half-life and initial concentration is inversely proportional to the initial concentration of reactants raised to the power one less than the order of reaction.

Therefore $(t_{1/2})^n \propto$

Let us perform a reaction twice by taking two different initial concentrations a_1 and a_2 and their half-life periods are found to be t_1 and t_2 respectively

$(t_1)^n \propto$ and $t_2 \propto$

= Dividing the two relations.

Taking log on both sides:

$\log = (n - 1) \log$

Rearranging $n = 1 +$

Q.18 Describe how surface area effect rate of reaction?

Ans.

The increased surface area of reaction increases the possibilities of atoms and molecules of reactants to come in contact with each other and rate increase e.g. Al foil reacts with NaOH moderately when warmed but powdered Al reacts rapidly with cold NaOH and H_2 is evolved.

Q.19 Differentiate between positive and negative catalyst.

Ans.

The substance which increase the rate of reaction is called positive catalyst

Pt

e.g. $2H_2 + O_2 \rightarrow 2H_2O$

without pt reaction is very slow when the rate of reaction is retarded by adding a substance, then it is said to be a negative catalyst e.g. tetra ethyl lead is added to petrol, because it saves the petrol from pre-ignition.

Q.20 Differentiate between auto catalysis and promoter.

Ans.

In some reactions, a product formed act as catalyst and this phenomenon is called auto catalysis. e.g., In the hydrolysis of ethyl acetate, acetic acid acts as catalyst for further reaction.

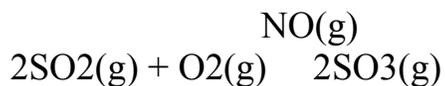


where as promoters are those substances which increases the activity of a catalyst. It is therefore called as catalyst of catalyst. e.g. Hydrogenation of vegetable oils is accelerated by Nickle. The activity of Nickle can be increased by using copper and tellurium.

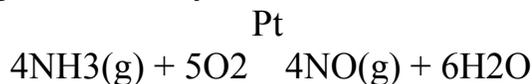
Q.21 Differentiate between homogeneous catalysis and heterogeneous catalysis.

Ans.

That process, in which catalysts and reactants have same phase is called as homogeneous catalysis e.g.,



but if the catalyst and reactants have different phases it is called as heterogeneous catalysis



Q.22 Can a catalyst can change the equilibrium constant?

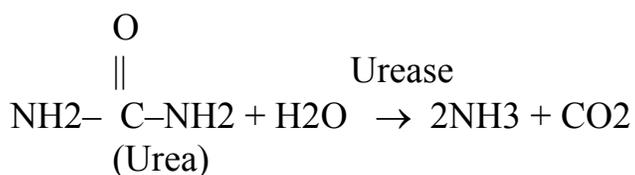
Ans.

A catalyst cannot affect the equilibrium constant of a reaction but it helps the equilibrium to establish earlier. The rates of forward and backward steps are increased equally.

Q.23 What is meant by enzyme catalysis?

Ans.

Those reactions in which enzymes are used as catalyst are called as enzyme catalysis e.g.



Urea undergoes hydrolysis into NH_3 and CO_2 in the presence of enzyme urease.

Q.24 What is poisoning of catalyst?

Ans.

Catalytic poisoning happens due to presence of trace amount of substances, which renders them in-effective, such substances are called poisons. The

poisoning of a catalyst may be temporary or permanent. In permanent poisoning, the poison reacts chemically with the catalyst. e.g., the manufacturing of H_2SO_4 in the contact process needs Pt as catalyst. The traces of arsenic present as impurities in the reacting gases make platinum ineffective.

Q.25 What is effect of temperature on catalyst?

Ans.

Some catalysts are physically changed by a change in temp and hence their power will be decreased e.g. colloidal catalysts like Pt may be coagulated with rise in temp.