Factors Influencing the Rate of Reaction:-

Rate of reaction depends upon experimental conditions such as concentration of reactants (pressure in case of gases), temp and catalyst.

Dependence of Rate on Concentration:-

The rate of any reaction depends on following factors:-

Nature of reactants:-

Consider the following 2 reactions:-

$$2NO + O_2 \rightarrow 2NO_2 \text{ (fast)}.$$

$$2CO + O_2 \rightarrow 2CO_2 \text{ (slow)}.$$

These reactions appear to be similar but the first is fast while the second is slow. This is becoz different amount of energies are reqd. for breaking of different bonds.

Concentration (concn) of reactants:-

Greater the concn of reactants, faster is the reaction and vice versa.

Temp:- Rate of rxn increases with increase of temp. In most of the cases the rate of reaction becomes double for 10° rise of temp.

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Presence of catalyst:- If it is a positive catalyst it increases the rate of reaction and if it is a negative catalyst it decreases the rate of reaction.

Surface area of reactants:- For a reaction involving solid reactant or catalyst, the smaller is the particle size i.e. the greater is the surface area, the faster is reaction.

Rate Law Expression and Rate Constant:-

The representation of rate of reaction in terms of concentration of the reactants is known as the rate law. It is also called as rate equation or rate expression.

Rate of reaction decreases with the passage of time as the concn of reactants decreases. Conversely, rates generally increase when reactants concn increases. So rate of reaction depends upon the concentration of reactants.

Consider a general reaction:-

$$aA + bB \rightarrow cC + dD$$

where a, b, c and d are stoichiometric coefficients of reactants and products.

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The rate expression for this reaction is:-

$$\text{Rate} \propto [A]^x [B]^y$$

where exponents x and y may or may not be equal to the stoichiometric coefficients (a and b) of the reactants. Above equation can also be written as:-

$$\text{Rate} = k[A]^x [B]^y \quad \text{— (i)}$$

$$-\frac{d[R]}{dt} = k[A]^x [B]^y \quad \text{— (ii)}$$

Eqn (ii) is known as differential rate equation, where k is a proportionality constant called as rate constant

"Rate law is the expression in which reaction rate is given in terms of molar concentration of reactants with each term raised to some power, which may or may not be same as stoichiometric coefficient of the reacting species in a balanced chemical equation.

~~For eg:- $2NO + O_2 \rightarrow 2NO_2$.~~

"Rate constant may be defined as the rate of the reaction when the molar concentration of each reactant is taken as unity. That is why rate constant is also called specific reaction rate."

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Characterstics rate Constant:-

Some important characterstics of rate constant are:-

(I) Rate constant is a measure of rate of reaction. Greater is the value of rate constant, faster is the reaction.

(II) Each reaction ~~value~~ has a definite value of rate constant at a particular temp.

(III) The value of the rate constant for the same reaction changes with temp.

Order of Reaction:-

In the rate eqn:-

$$\text{Rate} = k[A]^x[B]^y$$

$x+y$ will give the order of reaction.

Hence the sum of powers of the concentration of the reactants in the rate law expression is called as the order of that chemical reaction.

Order of reaction can be 0, 1, 2, 3 and even a fraction.

A zero order reaction means that the rate of reaction is independent of concn of reactant.

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