

## Chemical reactions

On the basis of reaction rates, the chemical reactions have been classified into the following three groups:-

(1) **Very fast or instantaneous reactions:** These reactions occur at a very fast rate generally these reactions involve ionic species and known as ionic reactions.

These reactions take about  $10^{-14}$  or  $10^{-16}$  seconds for completion. Its rate can be measured by employing special methods. So, it is almost impossible to determine the rates of these reactions.

Examples: (i)  $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$  (Precipitation reaction)  
(Ppt.)

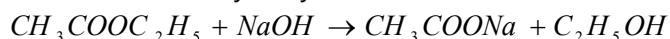
(ii)  $HCl + NaOH \rightarrow NaCl + H_2O$  (Neutralization reaction)  
(acid) (base) (Salt)

(2) **Moderate reaction:** These type of reactions proceed with a measurable rates at normal temperature. In this a large number of bonds have to be broken in reactants molecules and a large number of new bonds have to be formed in product molecules. Mostly these reactions are molecular in nature.

Examples: (i) Decomposition of  $H_2O_2$ :  $2H_2O_2 \rightarrow 2H_2O + O_2$

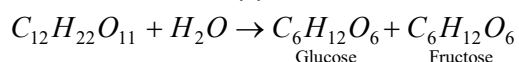
(ii) Decomposition of  $N_2O_5$ :  $2N_2O_5 \rightarrow 2N_2O_4 + O_2$

(iii) Hydrolysis of ester:



(iv) Reaction of NO with chlorine:  $NO + Cl_2 \rightarrow NOCl_2$

(v) Inversion of cane sugar in aqueous solution:



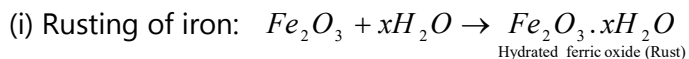
(vi)  $2FeCl_3(aq.) + SnCl_2 \rightarrow 2FeCl_2(aq.) + SnCl_4(aq.)$

(vii)  $NO_2 + CO \rightarrow NO + CO_2$

(viii) Decolourisation of acidified potassium permanganate with sodium oxalate.

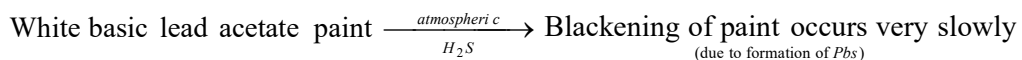
(3) **Very slow reactions:** These reactions are extremely slow and take months together to show any measurable change. The rate of such type of reactions are very slow. So, it is also very difficult to determine the rate of these reactions.

Examples:



(ii) Reaction between  $H_2$  and  $O_2$  to form  $H_2O$  at ordinary temperature in absence of catalyst.

(iii) Reaction of atmospheric  $H_2S$  on basic lead acetate paint.



Note: The chemical reactions can be slowed down or speed up by changing conditions under which they occur. e.g.  $CO + 2H_2 \xrightarrow[\text{temp.}]{\text{At room}} CH_3OH$  (Very slow reaction)

The reaction can be speeded up by maintaining temperature around  $400^\circ\text{C}$ , pressure about 300 atm and using a catalyst containing  $ZnO$  and  $Cr_2O_3$ .