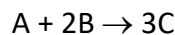


Rate of a Reaction:

The rate of a reaction is defined as *the rate at which one of the reactants disappears or the rate at which one of the products appears*. For example, consider the following reaction:



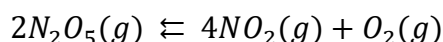
In the above reaction, it can be observed that two moles of B disappear for every mole of A reacting and three moles of C are formed for each mole of A disappears.

$$\therefore \frac{d[A]}{dt} = -\frac{1}{2} \frac{d[B]}{dt} = \frac{1}{3} \frac{d[C]}{dt}$$

Negative sign indicates that the consumption of the reactants and *positive sign* indicates the production of the product.

$$\begin{aligned} \text{Unit of Rate of reaction} &= \frac{\text{unit of concentration}}{\text{unit of time}} \\ &= \text{mole litre}^{-1} \text{ time}^{-1} \end{aligned}$$

How to express rate for the decomposition of N_2O_5



The rate of disappearance of $N_2O_5 = -\frac{\Delta[N_2O_5]}{\Delta t}$

Rate of appearance of $NO_2 = +\frac{\Delta[NO_2]}{\Delta t}$

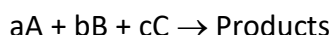
Rate of appearance of $O_2 = +\frac{\Delta[O_2]}{\Delta t}$

In the above reaction one mole of O_2 is formed, four moles of NO_2 are formed and two moles of N_2O_5 disappear.

Rate Law or Rate Expression

Rate of a reaction depends on the concentrations of one or more of the reactants. However, from the stoichiometric equation of a reaction we cannot tell which reactants, products or foreign substances (like catalysts) will affect the rate. This information can be obtained only from *actual experimental* studies.

For a reaction of the type



the rate equation is written in the form

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

where the constant of proportionality, k , is called the *rate constant*. If $[A] = [B] = [C] = 1$, then $k = r$. Thus, rate constant may be *defined as the rate of the reaction when the concentration of each of the reactants is unity*.

Example:

