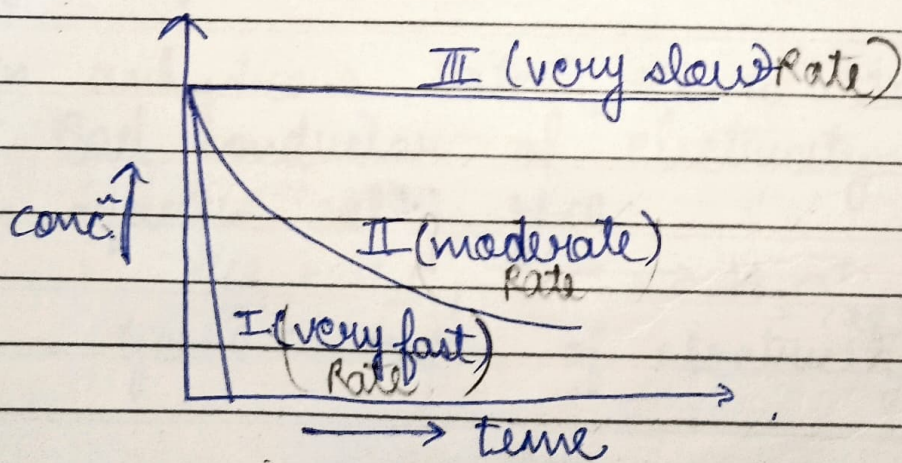
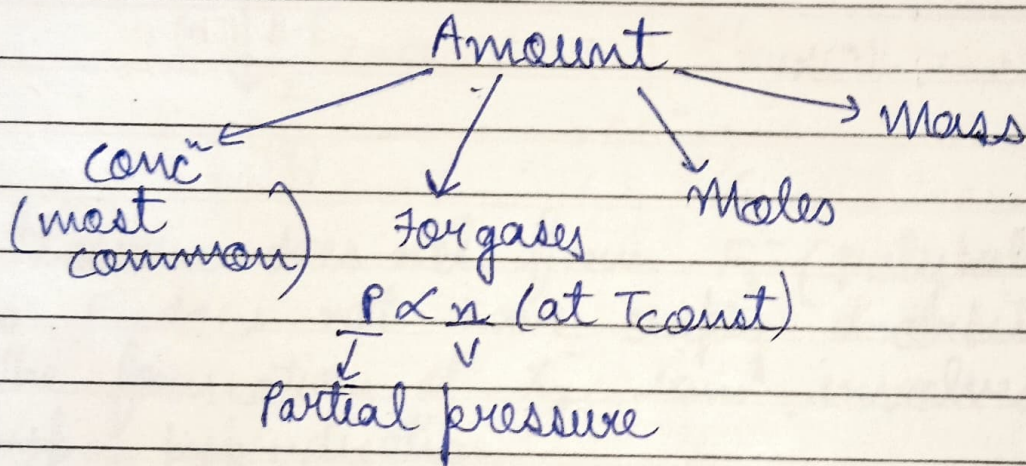


CHEMICAL KINETICS

$$\text{Rate} = \frac{\text{Change in amount of Reactant/Product}}{\text{Time Taken}}$$
$$= \frac{\text{Change in conc}^n \text{ of Reactant/Product}}{\text{time taken}}$$

Unit \rightarrow $\frac{\text{Mole}}{\text{L-sec}}$

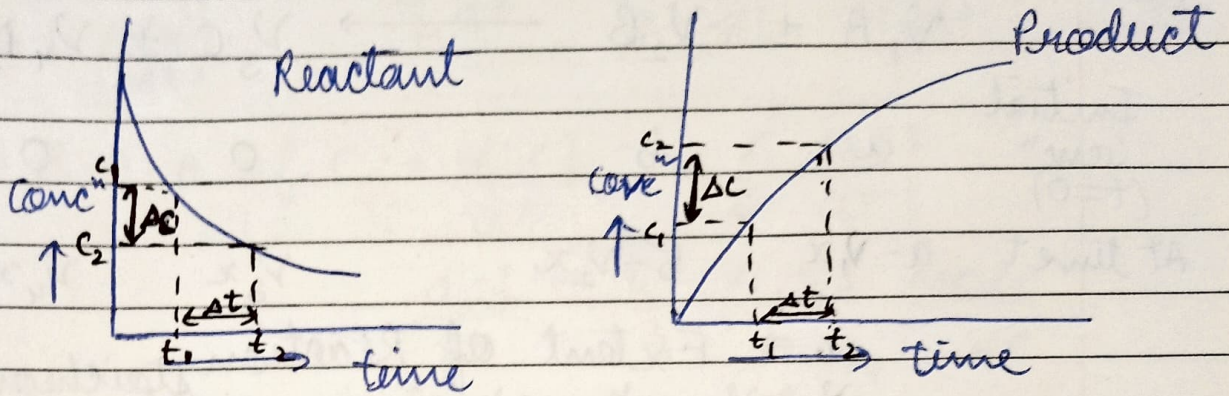


Types of Rate:

(I) Average Rate: Measured over a given time interval

$$\text{Avg. Rate (w.r.t. Reactant)} = \frac{-(C_2 - C_1)}{t_2 - t_1} = -\frac{\Delta C}{\Delta t}$$

$$\text{Avg. Rate (w.r.t product)} = \frac{c_2 - c_1}{t_2 - t_1} = \frac{\Delta c}{\Delta t}$$

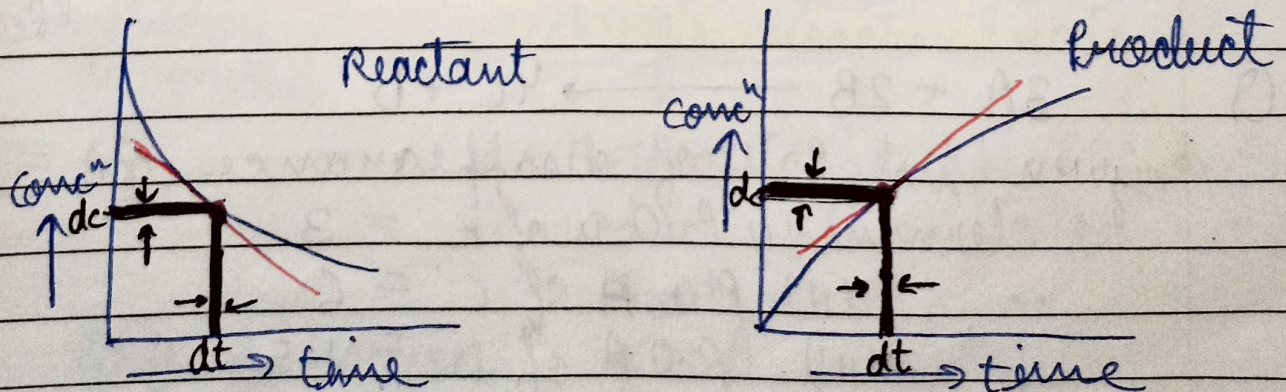


(II) Instantaneous Rate :

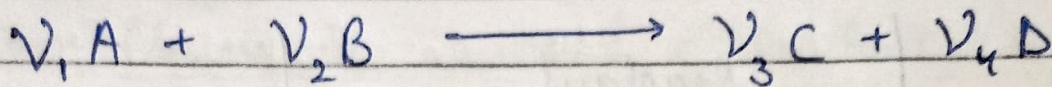
Measured at a particular instant

$$\text{Inst Rate (w.r.t reactant)} = \lim_{\Delta t \rightarrow 0} \frac{-\Delta c}{\Delta t} = -\frac{dc}{dt} = - \left(\begin{array}{l} \text{slope of} \\ \text{c vs t curve} \\ \text{at that} \\ \text{instant} \end{array} \right)$$

$$\text{Inst. Rate (w.r.t. product)} = \lim_{\Delta t \rightarrow 0} \frac{\Delta c}{\Delta t} = \frac{dc}{dt} = \left(\begin{array}{l} \text{slope of c vs t} \\ \text{curve at that} \\ \text{instant} \end{array} \right)$$



Rate of appearance (Formation) , Rate of disappearance (consumption) & Rate of Reaction



Initial concⁿ (t=0)

a b 0 0

At time t

a - $\nu_1 x$ b - $\nu_2 x$ $\nu_3 x$ $\nu_4 x$

$x \Rightarrow$ Extent of Reaction
 $\nu_1, \nu_2, \nu_3, \nu_4 \rightarrow$ stoichiometric coeffⁿ
 Rate of Reaction = $\frac{dx}{dt}$

Inst. Rate of disappearance of A = $-\frac{d[A]}{dt} = \nu_1 \frac{dx}{dt}$
 (at time t)

" " " " of B = $-\frac{d[B]}{dt} = \nu_2 \frac{dx}{dt}$

" " " Appearance of C = $\frac{d[C]}{dt} = \nu_3 \frac{dx}{dt}$

" " " " D = $\frac{d[D]}{dt} = \nu_4 \frac{dx}{dt}$

Rate of Reaction = $-\frac{1}{\nu_1} \frac{d[A]}{dt} = -\frac{1}{\nu_2} \frac{d[B]}{dt} = \frac{1}{\nu_3} \frac{d[C]}{dt} = \frac{1}{\nu_4} \frac{d[D]}{dt}$

(Rate of Rxn = Rate of Appearance or Rate of disappearance / stoichiometric coeffⁿ)