

→ Order of reaction:

$$\text{rate} = k [A]^m [B]^n \rightarrow \text{rate eqn.}$$

order w.r.t A = m
 B = n
 rxn = m+n

* order is experimentally derived - can be 0, fraction, ± integer.

Q. In $A+B \rightarrow \text{Products}$:

Rate doubles when [A] is doubled.

Rate becomes 4 times both A and B conc. is doubled.

Then order is :-

A. Rate-1 = $k [A]^m [B]^n$
 rate-2 = $2 \times \text{rate-1} = k \cdot 2^m [A]^m [B]^n$

$\therefore 2^m = 2$

$m = 1$

rate-3 = $4 \times \text{rate-1} = k \cdot 2^m \cdot 2^n [A]^m [B]^n$

$2 \times 2^n = 4$

$n = 1$

$m+n = 2$

Q. Rate rate eqn. for a rxn $A+B \rightarrow \text{products}$.

S.No.	[A]	[B]	rate
1.	0.1	0.1	2×10^{-2}
2.	0.2	0.1	2×10^{-2}
3.	0.1	0.2	4×10^{-2}

$2 \times 10^{-2} = (0.1)^m \cdot (0.1)^n$

$2 \times 10^{-2} = (0.2)^m \cdot (0.1)^n$

$(0.1)^m = 2^m \cdot (0.1)^m$

$m = 0$

* no. of times rate change = $(\text{no. of time of A})^n (\text{no. of time of B})^m$

$$\therefore \frac{(0.1)^n}{(0.2)^n} = \frac{2 \times (0.1)^n}{(0.04)^n}$$

$$n = 2$$

$$2 = 1^0 \times 2^n$$

$$n = 1$$

Rate eqn: $\text{rate} = k[B]$

→ Rate constant / Specific rate (k)

$$\text{rate} = k[R]^n$$

$$k = \frac{\text{rate}}{[R]^n}$$

units of k: $\frac{(\text{mol/l}) \cdot \text{time}^{-1}}{(\frac{\text{mol}}{\text{l}})^n}$

$$(\text{mol})^{1-n} \cdot (\text{lt})^{n-1} \cdot (\text{time})^{-1}$$

* For $n=0$, units - $\text{mol l}^{-1} \text{time}^{-1}$
 $n=1$, units - time^{-1}

- Units of rate are same for all rxns but units of k depend on order of the rxn and for $n=0$, units of rate & k are same.
- For a given rxn., k is constant throughout the rxn. at a given temp.
- k increases with temp. and on using +ve catalyst.

→ Molecularity :

* In many exams, molecularity of complex rxn is that of the RDS of the rxn.

+ No. of molecules involved in an elementary step is known as molecularity of that step.

* It is theoretically deduced and cannot be a fraction.
Generally, max. = 3.