* Methods of determination of order of reaction :-

(1). Half life methods ($t_{1/2}$) :- or Equifractional method :-

For 1st order reaction —

$$t_{1/2} \propto \frac{1}{a^0} \quad (\text{independent of } a)$$

for 2nd Order reaction —

$$t_{1/2} \propto \frac{1}{a} \quad (\text{dependent of } a)$$

for 3rd order reaction —

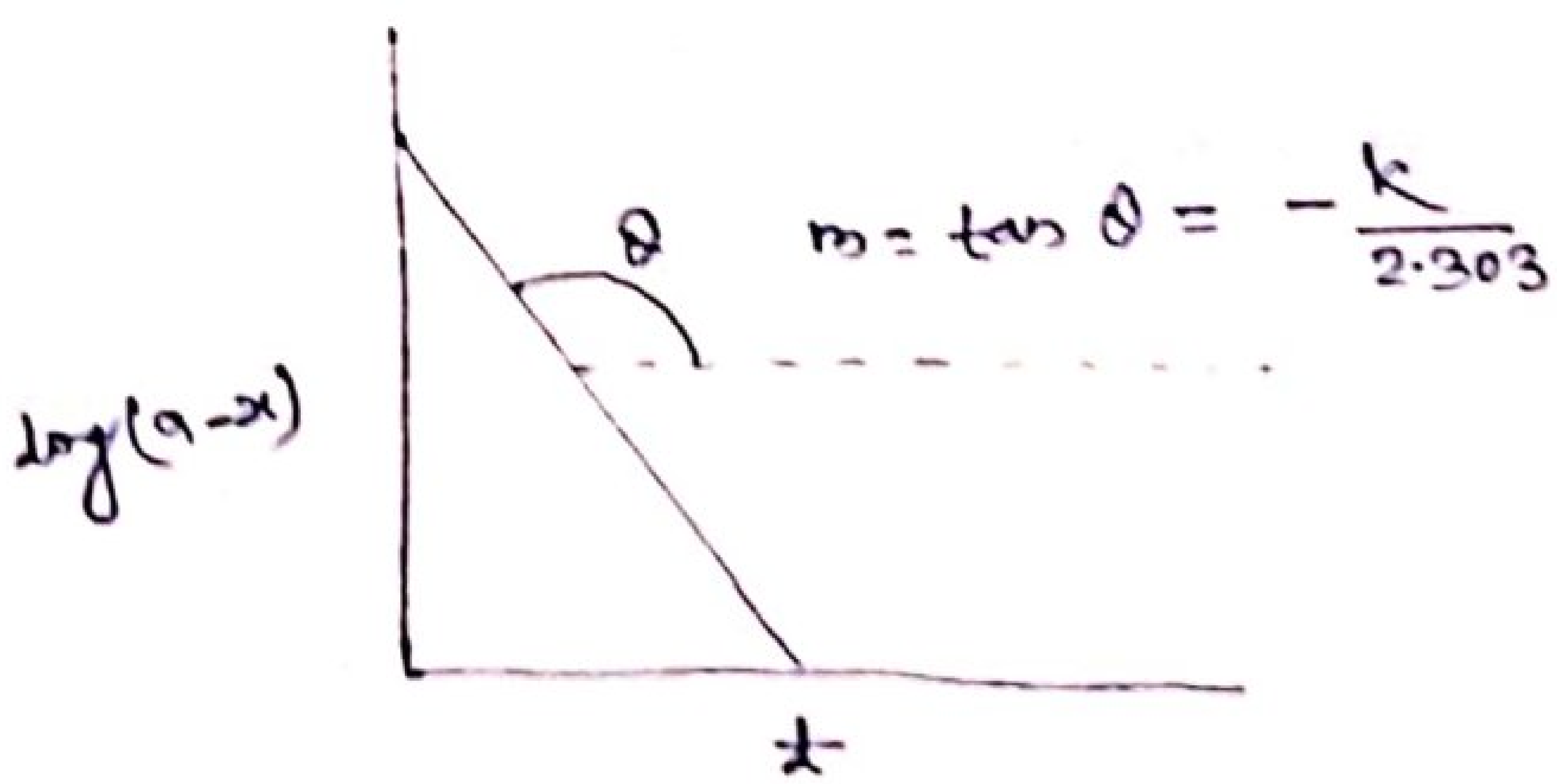
$$t_{1/2} \propto \frac{1}{a^2}$$

Thus, for nth order reaction —

$$\boxed{t_{1/2} \propto \frac{1}{a^{n-1}}}$$

(2). Graphical method :-

A plot of log (a−x) Vs t gives a straight line for 1st order reaction —



— 1st Order reaction —

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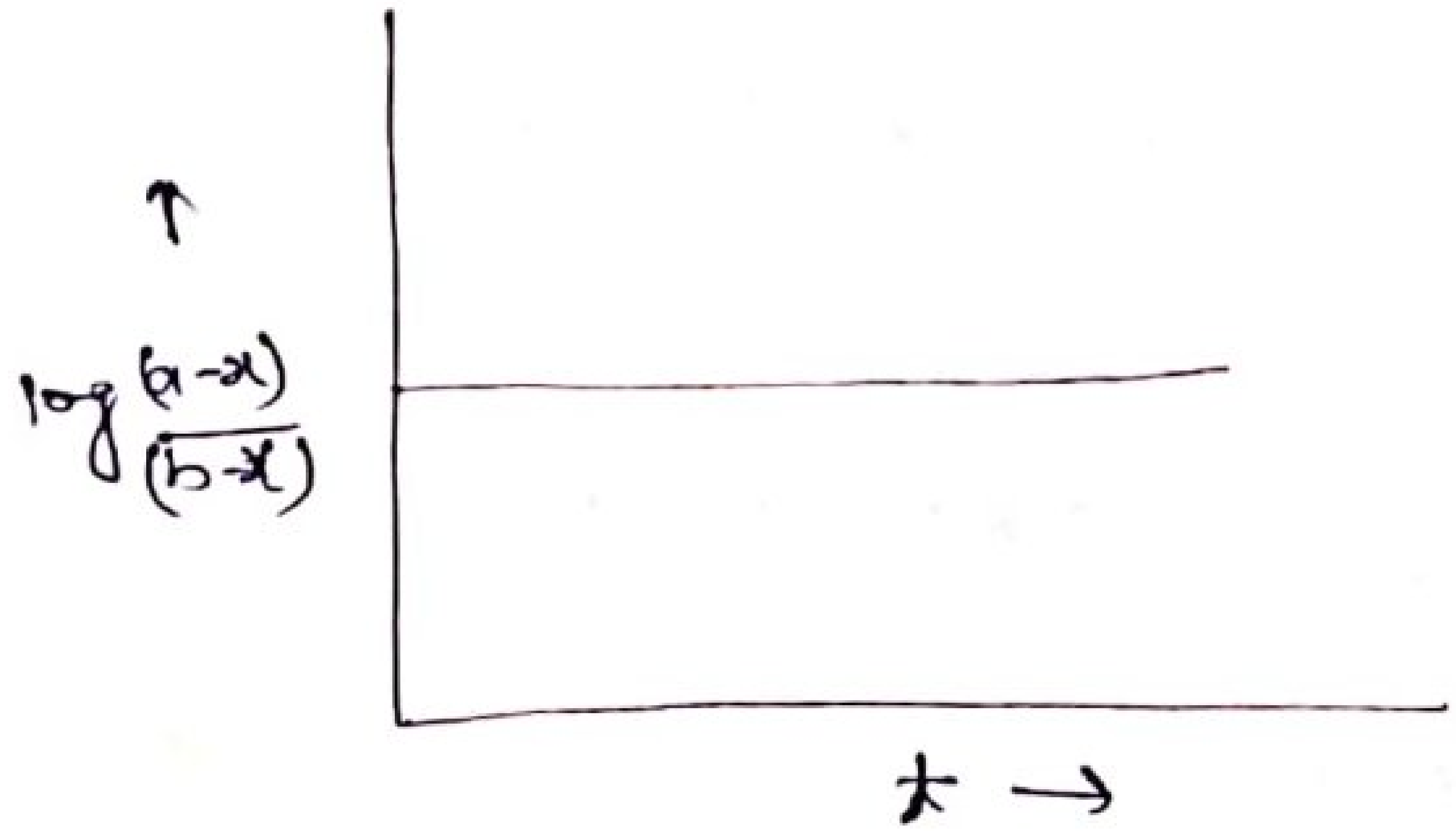
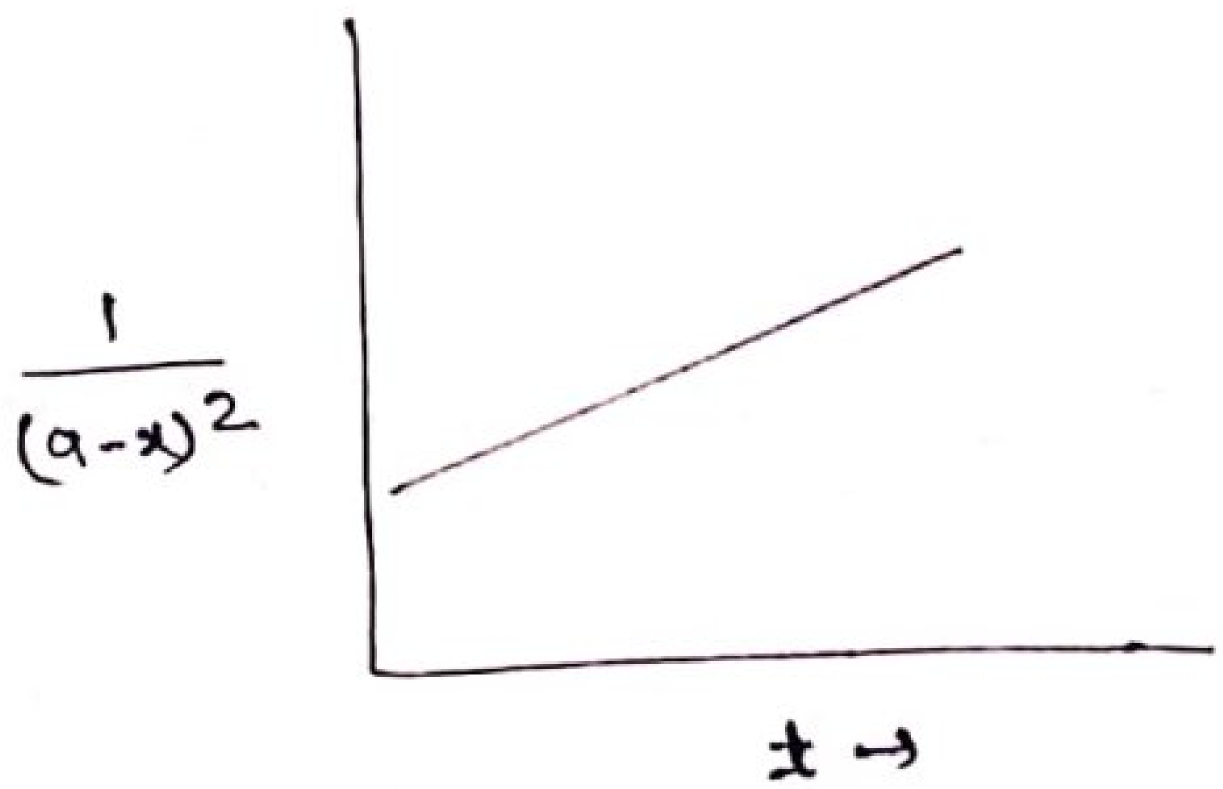
A plot of $\log \frac{(a-x)}{(b-x)}$ Vs t (when the concⁿ of both the reactant are different) gives a straight line for 2nd Order reaction.



— 2nd order reaction —

A plot of $\frac{1}{(a-x)^2}$ Vs t gives a straight line for 3rd order reaction –



— 3rd order reaction —

(3) Integration method :-

(1) for 1st order reaction –

$$K = \frac{1}{t} \times 2.303 \log \frac{a}{(a-x)}$$

(2) for 2nd order reaction –

$$K = \frac{1}{t} \frac{x}{a(a-x)}$$

& $$K = \frac{2.303}{t(a-b)} \log \frac{b(a-x)}{a(b-x)}$$

(3) for 3rd order reaction –

$$K = \frac{1}{t} \frac{x(2a-x)}{2a^2(a-x)^2}$$

*. Temperature dependence of rate of a chemical reaction. :-

$$\gamma = \frac{K_{T+10}}{K_T}$$

Where γ = Temperature Coefficient.

The value of γ is found to be ranging between 2-3. So, the rate of reaction is doubled or trippled for many reaction with 10°C (≈ 10 K) rise in temperature.