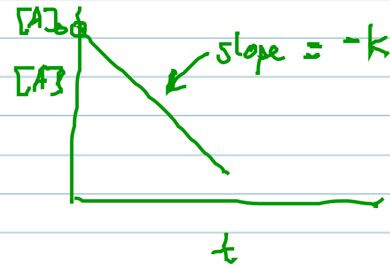
III ZERO ORDER $A \rightarrow$ products

rate $= k[A]^0 \Rightarrow$ rate $= k$ rate is constant



$y = mx + b$

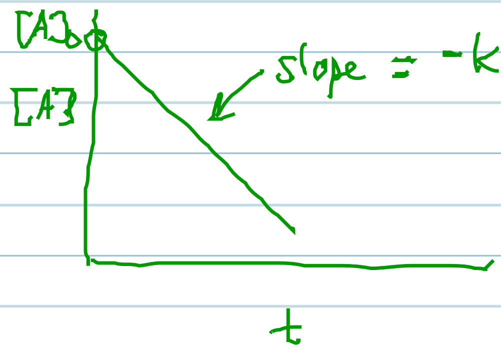
$$\boxed{[A] = -kt + [A]_0}$$

$$t_{\frac{1}{2}} = \frac{[A]_0}{2k}$$

ORDER	RATE LAW	[ ] vs t eqn	$t_{\frac{1}{2}}$	linear graph
0	rate $= k[A]^0$	$[A] = -kt + [A]_0$	$t_{\frac{1}{2}} = \frac{[A]_0}{2k}$	[A] vs t (−) slope
1	rate $= k[A]$	$\ln \frac{[A]}{[A]_0} = -kt$ $\ln[A] = -kt + \ln[A]_0$	$t_{\frac{1}{2}} = \frac{0.693}{k}$	ln[A] vs t (−) slope
2	rate $= k[A]^2$	$\frac{1}{[A]} = kt + \frac{1}{[A]_0}$	$t_{\frac{1}{2}} = \frac{1}{k[A]_0}$	$\frac{1}{[A]}$ vs t (+) slope

III ZERO ORDER $A \rightarrow$ products

$rate = k[A]^0 \Rightarrow rate = k$ rate is constant



$y = mx + b$

$$\boxed{[A] = -kt + [A]_0}$$

$$t_{\frac{1}{2}} = \frac{[A]_0}{2k}$$

ORDER	RATE LAW	[ ] vs t eqn	$t_{\frac{1}{2}}$	linear graph
0	$rate = k[A]^0$	$[A] = -kt + [A]_0$	$t_{\frac{1}{2}} = \frac{[A]_0}{2k}$	$[A]$ vs t (-) slope
1	$rate = k[A]$	$\ln\frac{[A]}{[A]_0} = -kt$ $\ln[A] = -kt + \ln[A]_0$	$t_{\frac{1}{2}} = \frac{0.693}{k}$	$\ln[A]$ vs t (-) slope
2	$rate = k[A]^2$	$\frac{1}{[A]} = kt + \frac{1}{[A]_0}$	$t_{\frac{1}{2}} = \frac{1}{k[A]_0}$	$\frac{1}{[A]}$ vs t (+) slope

COLLISION THEORY

rate $\propto$ # collisions/sec

- CORRECT ORIENTATION
- MUST BE A TOTAL KE greater than or equal to SOME $\underbrace{\text{MINIMUM AMOUNT}}_{\text{ACTIVATION ENERGY } (E_a)}$

$$A + B \longrightarrow C + D$$

reactants $\xrightarrow{\text{collision}}$ activated complex (transition state) $\Longrightarrow$ products

reaction intermediates

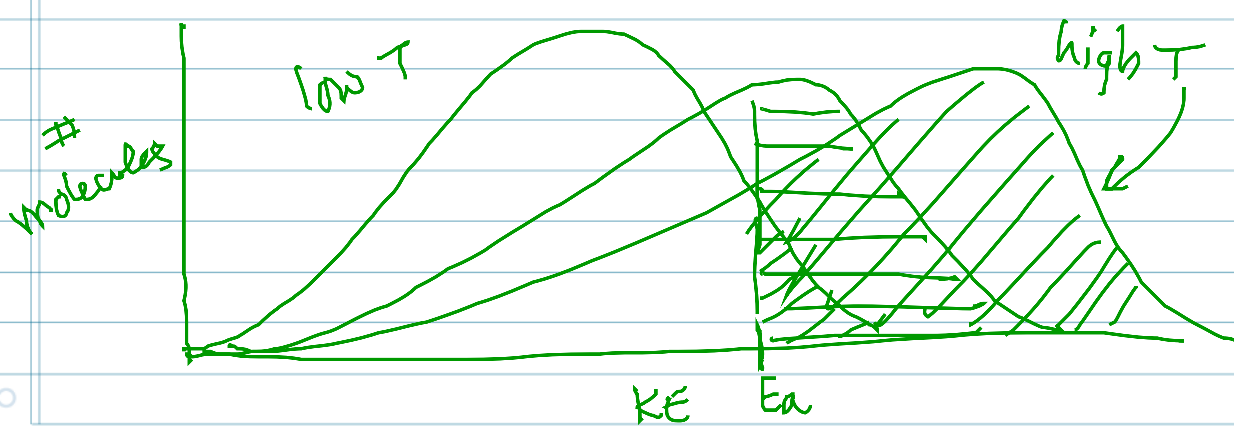
$$H_{2(g)} + I_{2(g)} \longrightarrow 2HI_{(g)}$$

H–H   I–I

H   I
| |
H   I

---

at a ↑ T, more of the molecules will possess $E \geq E_a$



Arrhenius Equation relates k, E_a, T

$$k = A e^{-\frac{E_a}{RT}}$$

A = frequency factor ~ constant

$$\ln k = \ln\left(A e^{-\frac{E_a}{RT}}\right)$$

$$\ln k = \ln A - \frac{E_a}{RT}$$

$$\boxed{\ln k = -\left(\frac{E_a}{R}\right)\left(\frac{1}{T}\right) + \ln A}$$

$$y = m x + b$$

slope = $-\frac{E_a}{R}$ graphically determine

$R = 8.31\ J/mol \cdot K$

if comparing T_1 & T_2

$$\ln k_1 = \ln A - \frac{E_a}{RT_1}$$

$$-\quad \ln k_2 = \ln A - \frac{E_a}{RT_2}$$

$$\ln k_1 - \ln k_2 = \frac{E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

$$\boxed{\ln\left(\frac{k_1}{k_2}\right) = \frac{E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)}$$