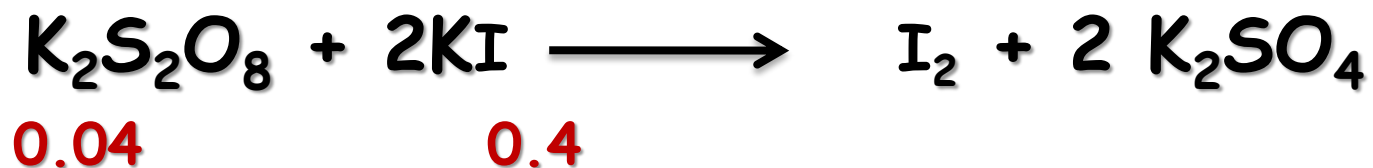


Lab.343

Experiment (5)

Determination of the rate constant and energy of activation of the reaction between $(\text{K}_2\text{S}_2\text{O}_8 + \text{KI})$

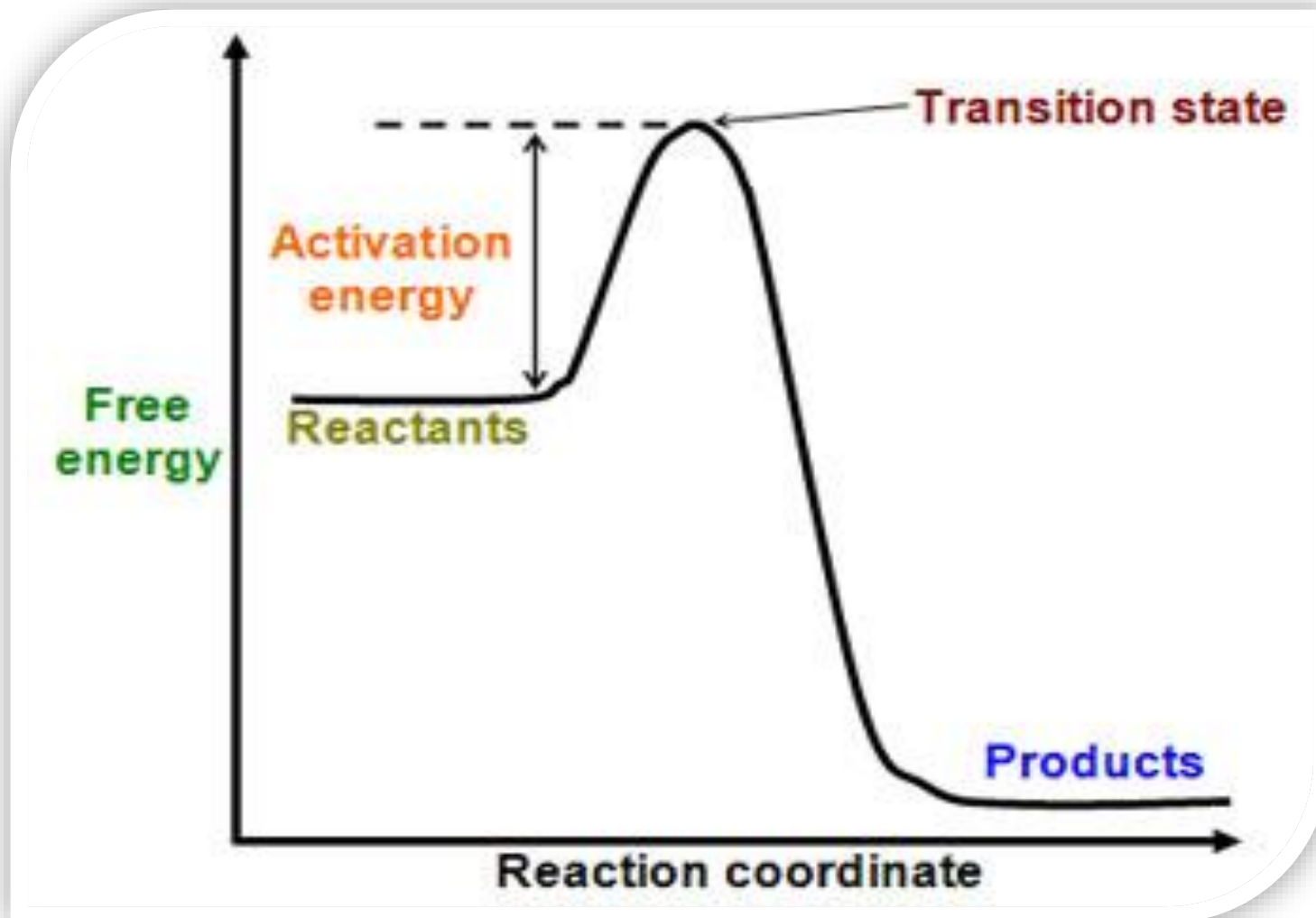




- Second order of reaction
- Pseudo first order reaction

$$\log (a-x) = -K t / 2.303 + \log a$$

To calculate E_a



Activation energy

The minimum energy, which the molecules must absorb before the reaction can take place.

$$K = A e^{-E_a/RT} \quad \underline{\text{Arrhenius equation}}$$

Where

A = frequency factor

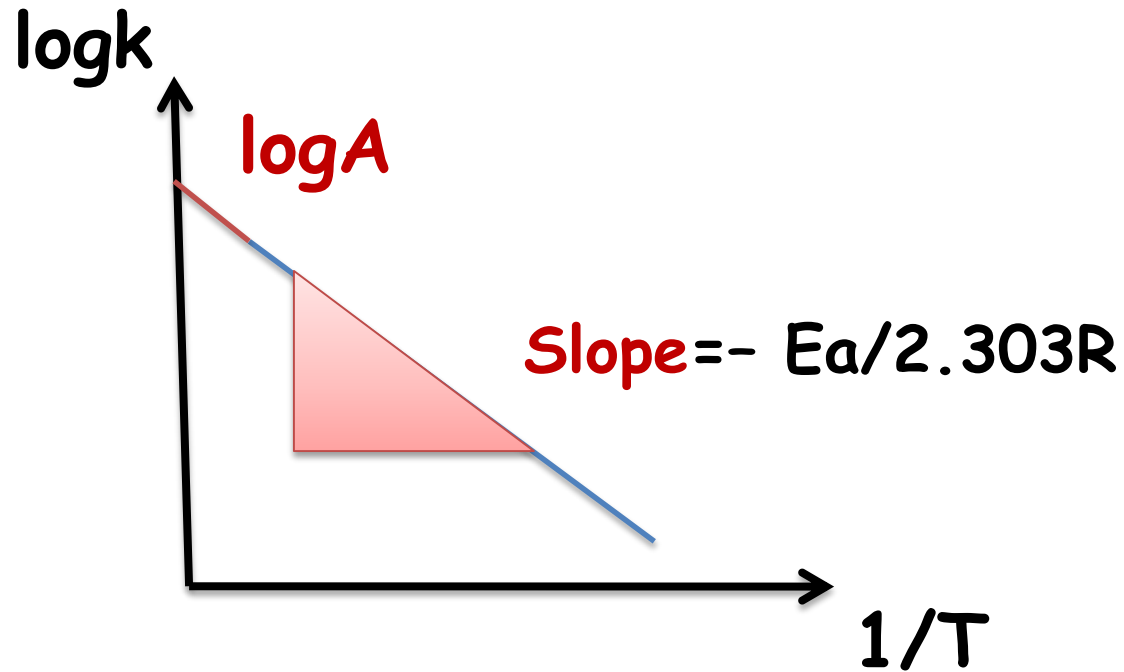
R = molar gas constant (8.314 J/K.mole)

E_a = activation energy (J /mole)

T = absolute temp.(kelvin= $C^\circ + 273$)

K = rate constant

$$\log K = \log A - E_a / 2.303RT$$



- $T_1=25^\circ\text{C}$ $\log K_1 = \log A - Ea/2.303RT_1$

- $T_2=35^\circ\text{C}$ $\log K_2 = \log A - Ea/2.303RT_2$

$$\log K_2 - \log K_1 = - Ea/2.303RT_2 - (- Ea/2.303RT_1)$$

$$\log K_2 / K_1 = Ea/2.303R (-1/T_2 + 1/T_1)$$

$$\log K_2 / K_1 = Ea/2.303R (1/T_1 - 1/T_2)$$

$$\log K_2 / K_1 = Ea/2.303R (T_2 - T_1 / T_1 \cdot T_2)$$

Prepare:

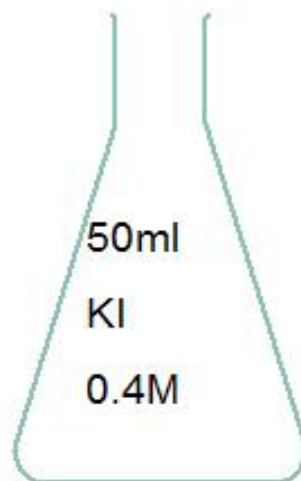
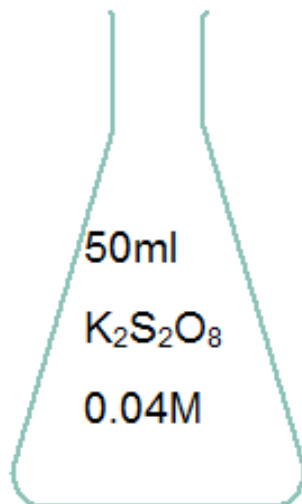
1. KI (0.4M) \longrightarrow 250ml

2. $K_2S_2O_8$ (0.04M) \longrightarrow 100ml

3. $Na_2S_2O_3$ (0.01M) \longrightarrow 500ml

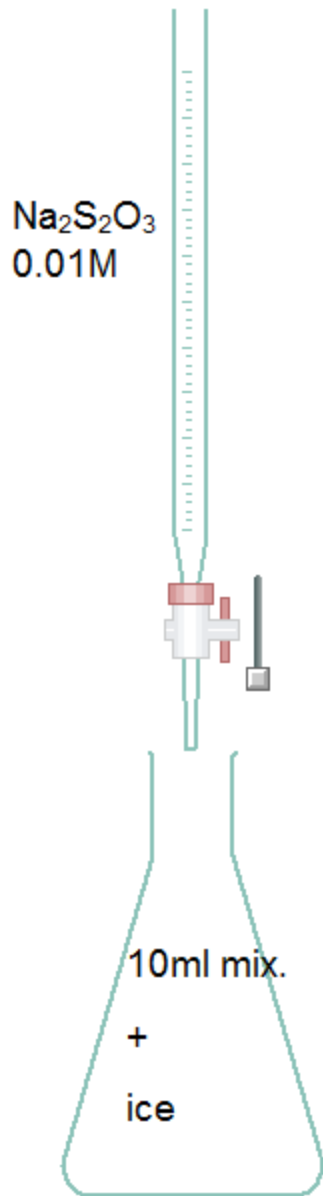
Procedure:

1-



2- Take room temperature
10 minutes

3- KI added to $K_2S_2O_8$, open the
stop watch.



Titration
→
Pale yellow

Starch 1ml

Blue
→
titration

Colour less
(e.p)

- Starch is added near the end point and not at the beginning of the titration ??

because starch forms insoluble complex with Iodine(I_2) thus preventing it from reacting.

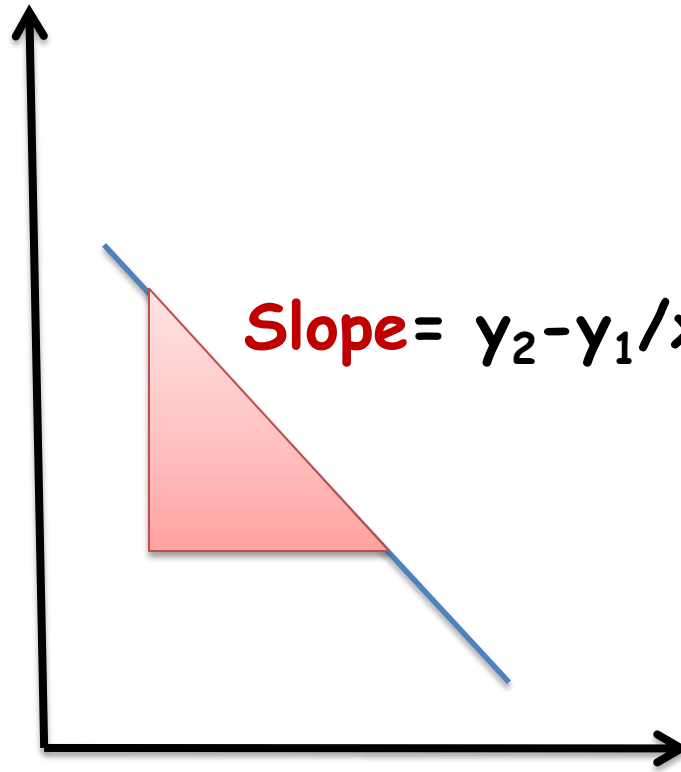
- Excess KI (2g) is added..

because Iodine I_2 is volatile, however in the presence of KI it forms KI_3 complex which is non-volatile and acts exactly like I_2

$T_1=25^\circ\text{C}$, $T_2=35^\circ\text{C}$

time	$V_{\text{Na}_2\text{S}_2\text{O}_3} \equiv X$	a-x	Loga-x
3			
6			
10			
15			
20			
25			
32			

$\text{Log}(a-x)$



Slope = $y_2 - y_1 / x_2 - x_1$

K = **-Slope** × 2.303

time