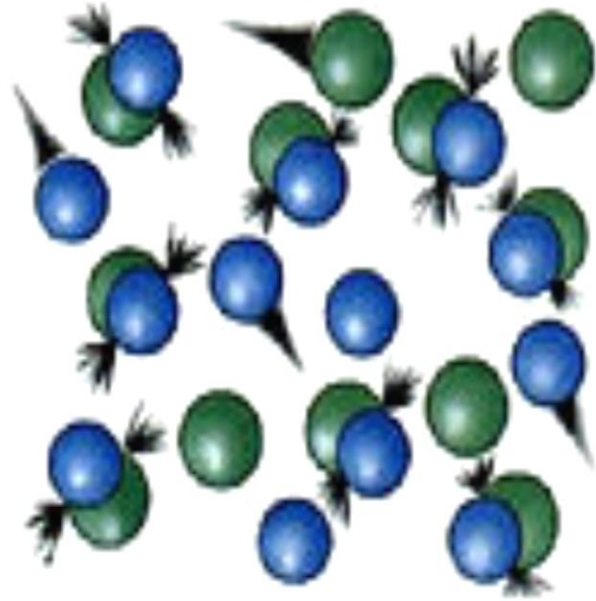Lab.343

Experiment (5)

Determination of order of the reaction and rate constant for the hydrolysis of methyl acetate
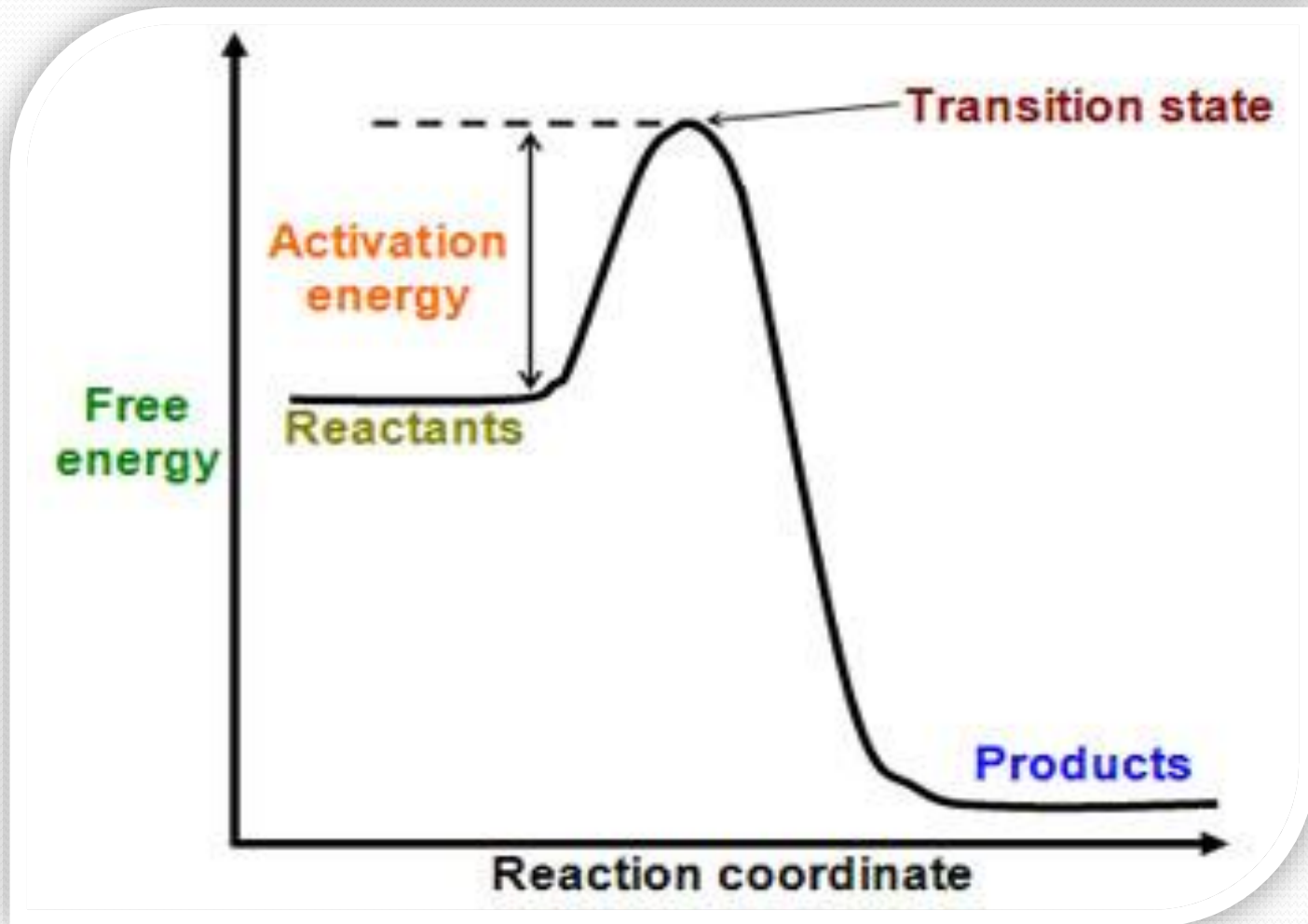
Low concentration = Few collisions

High concentration = More collisions

Order of reaction

- Zero order reaction

  $n = 0$, $R = K$

- First order reaction

  $n = 1$, $R = K [A]$

- Second order reaction

  $n = 2$, $R = K [A] [B]$

A + B $\longrightarrow$ C + D

- -dA/dt
- -dB/dt
- dC/dt
- dD/dt

Factors influencing reaction rates:

- Concentration of reactants, products and catalysts.

- Physical condition such as temperature and pressure.

- For solution: properties of solvent such as viscosity, dielectric constant and ionic strength.

Hydrolysis of methyl acetate

$$CH_3COOCH_3 + H_2O \xrightarrow{\ H^+\ } CH_3COOH + CH_3OH$$

t= o   a   b   o   o

t= t   a-x   x   x

$$R = dx/dt = K\,[CH_3COOCH_3\,]$$
$$= K\,[\,a\text{-}x]$$

Half life time ($t_{1/2}$)

➤ The time required to complete exactly 50% of reaction.

Or

➤ The time required to convert half life of reactant to product.

$$x = ½ a \longrightarrow x = a/2$$

Equation for first order reaction

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

a : initial concentration.

(a-x): concentration after time t.

t : time.

K : rate constant.
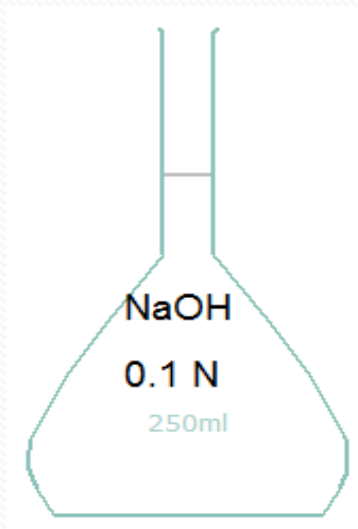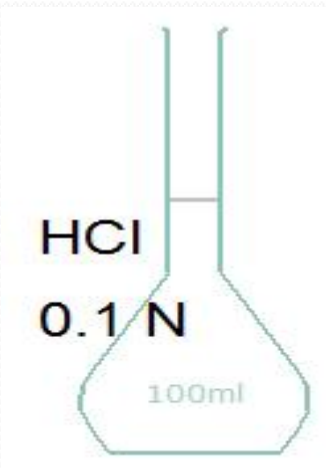
Prepare:

Solid

$$Wt = (N * V * eqwt)/1000$$

Liquid

$$N * V = N` * V`$$

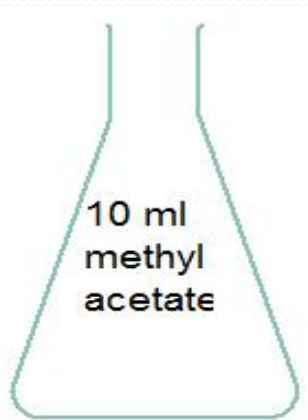$$N = (\% * d * 1000) / eqwt$$

Procedure:

1-

HCl
0.1 N
100ml

NaOH
0.1 N
250ml
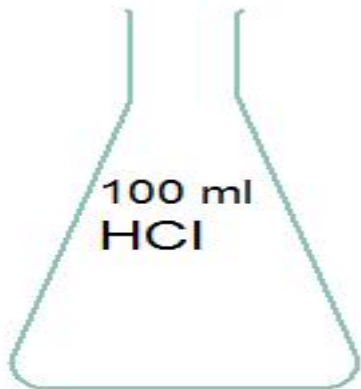
2-

HCl
0.1 N
100ml

10 ml
methyl
acetate
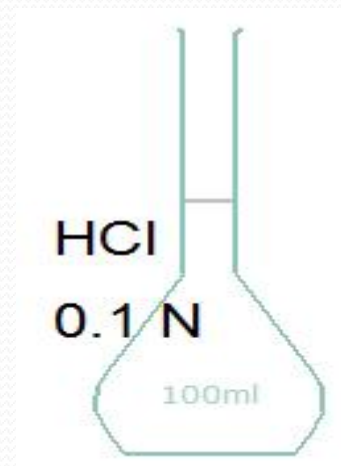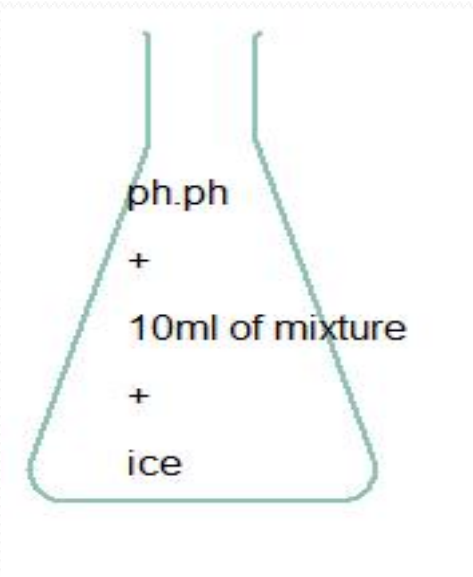
Take room temperature 10 minutes

3- + **5 ml of methyl acetate by pipet** + **Open the stop watch**
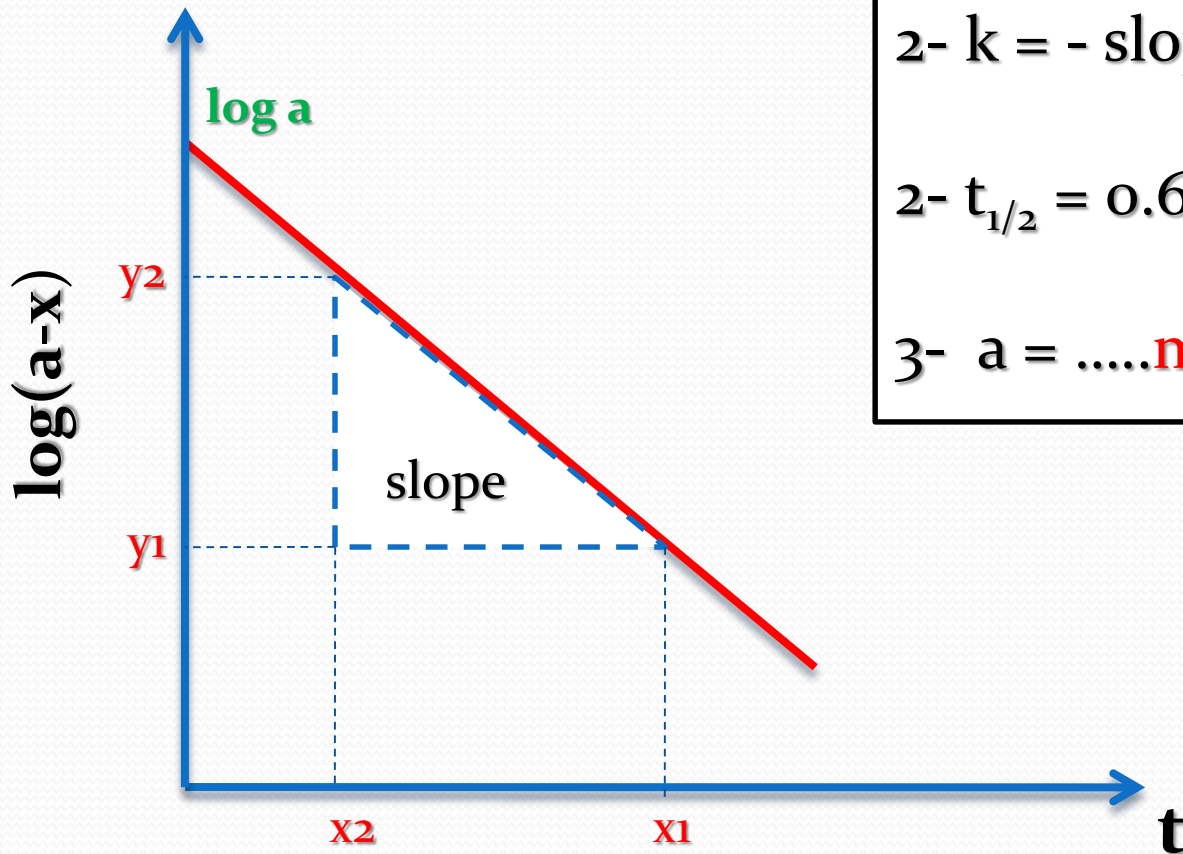
4- At time = 5,10,15,… take 10 ml of mixtre

0.1 N NaOH

ph.ph

+

10ml of mixture

+

ice

Results

Time	X=V (NaOH)	a	a-x	Log(a-x)
5		Volume of		
15		NaOH after		
25		24h		
35				
45				
55				
65				
75				

1- slope $=(y2-y1)/(x2-x1)$

2- $k = -$ slope $\times 2.303$ (min^{-1})

2- $t_{1/2} = 0.69327/k$ (min)

3- $a = ...mol/l$