Lab.4: Hydrolysis of Acetyl Salicylic Acid Solution in Sorenson Phosphate Buffer at pH 8

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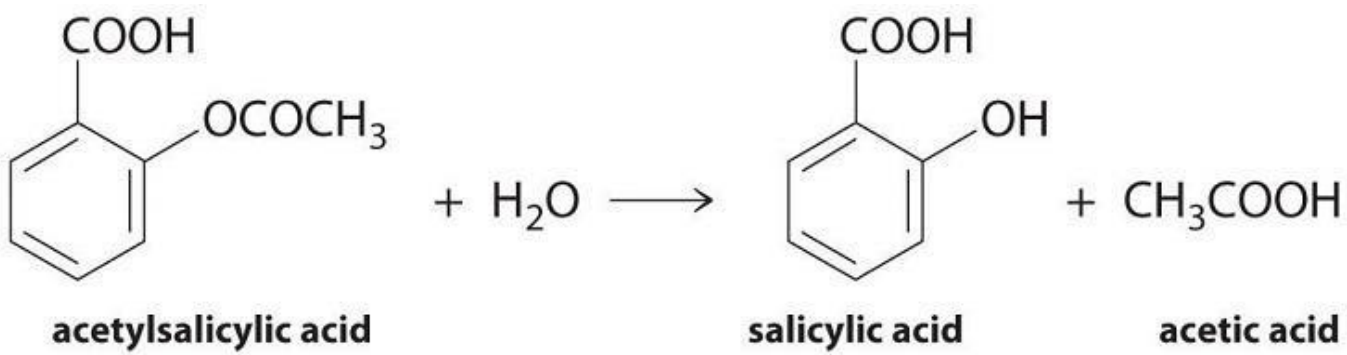
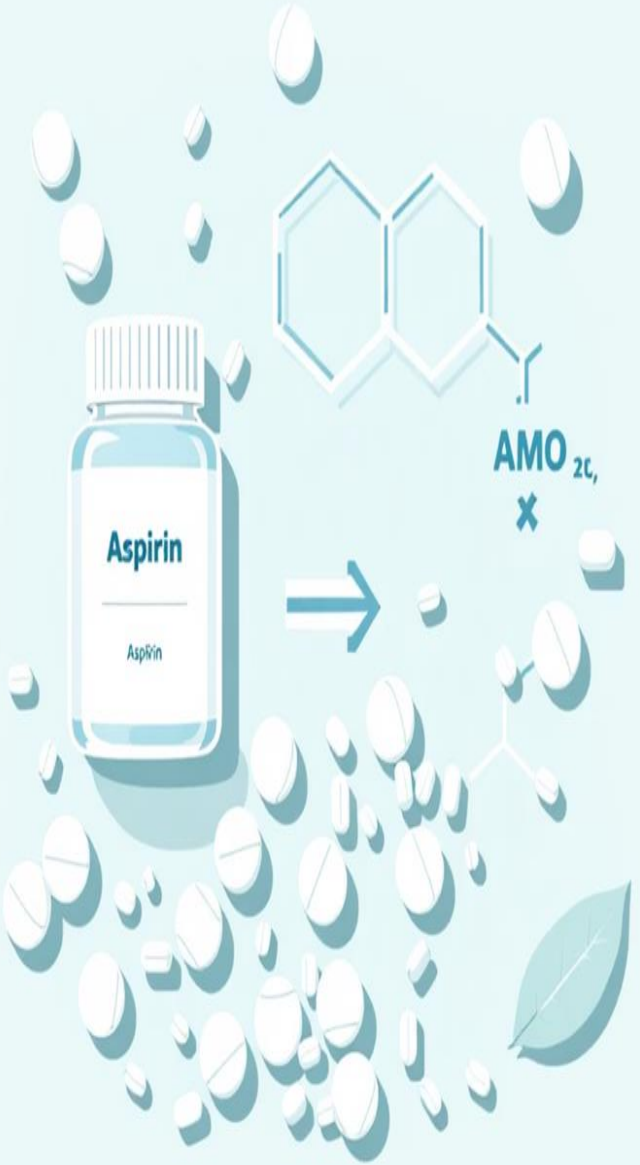
Introduction

- Aspirin is a weak acid.it is soluble at 20 C° in 300 parts of water.
- It is unstable in aqueous solutions, degrading to salicylic acid and acetic acid



- Aspirin also degrades in solid dosage forms when exposed to moisture and therefore ,should be stored in tightly closed containers and kept in a dry environment .

The hydrolysis reaction is critical as it directly impacts the drug's effectiveness and shelf life.



Aim of Experiment

- To study the effect of temperature on the hydrolysis of aspirin, and to calculate the shelf life of aspirin.

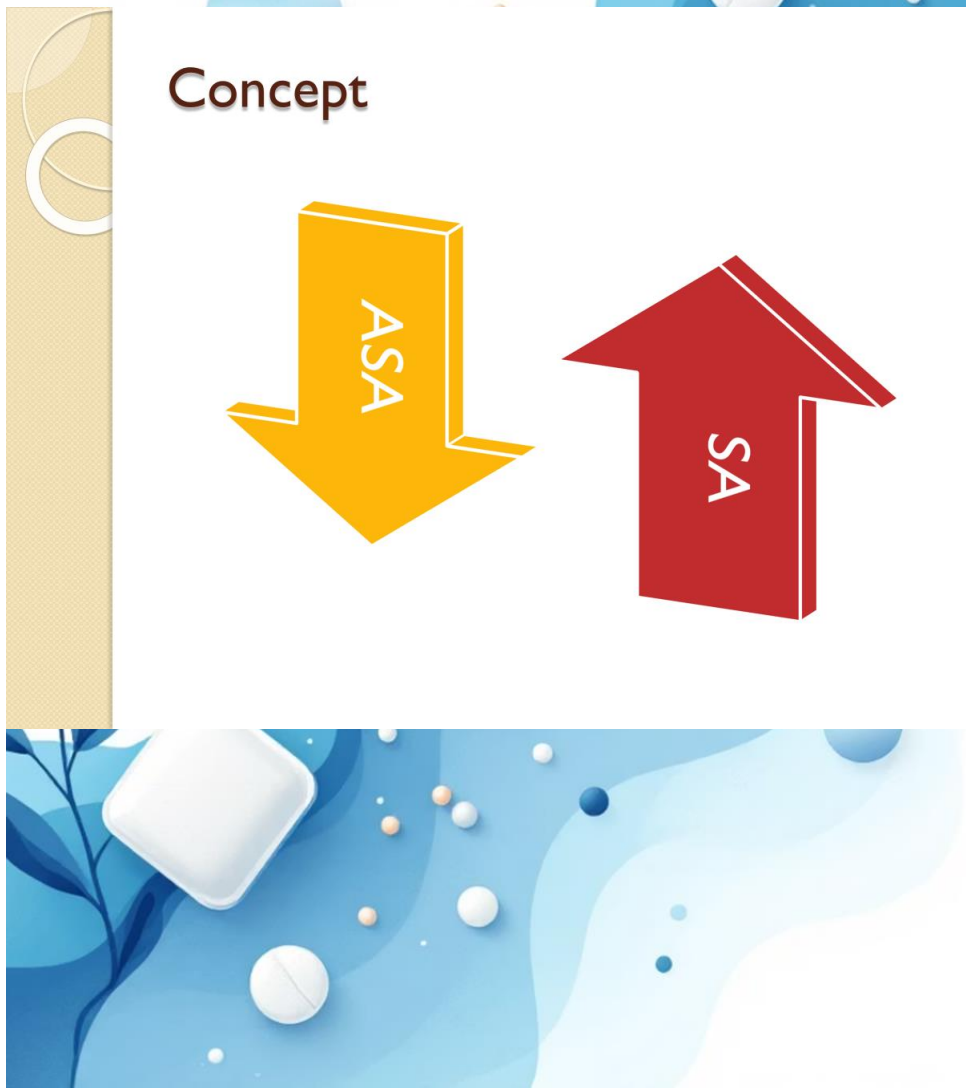
- **Shelf life** of any drug: it is the **time** required for the drug to **lose** 10% of its effectiveness.

Procedure :

- 1. Dissolve 0.695 g of aspirin in 250 ml of phosphate buffer (use a volumetric flask)
- 2. place 200 ml of this solution in an erlenmeyer flask , then keep the flask in a water bath for (30 min) at required temperature. the temperature that will be used are(40, 60, 80 ℃)
- Withdraw (**5** ml) sample at the end of 30 mins , then continue withdrawing (**5** ml) sample at 15 min interval for 90 min.

Notes:

- absorbance increases with time.
- Concentration of S.A at zero time is **ZERO** since ASA is not hydrolyzed yet , however , the initial concentration of ASA is 2.78 mg/ml ??



Is the initial conc. of ASA 2.78 mg/ml?

- We dissolved 0.695 **g** of Aspirin in 250 ml

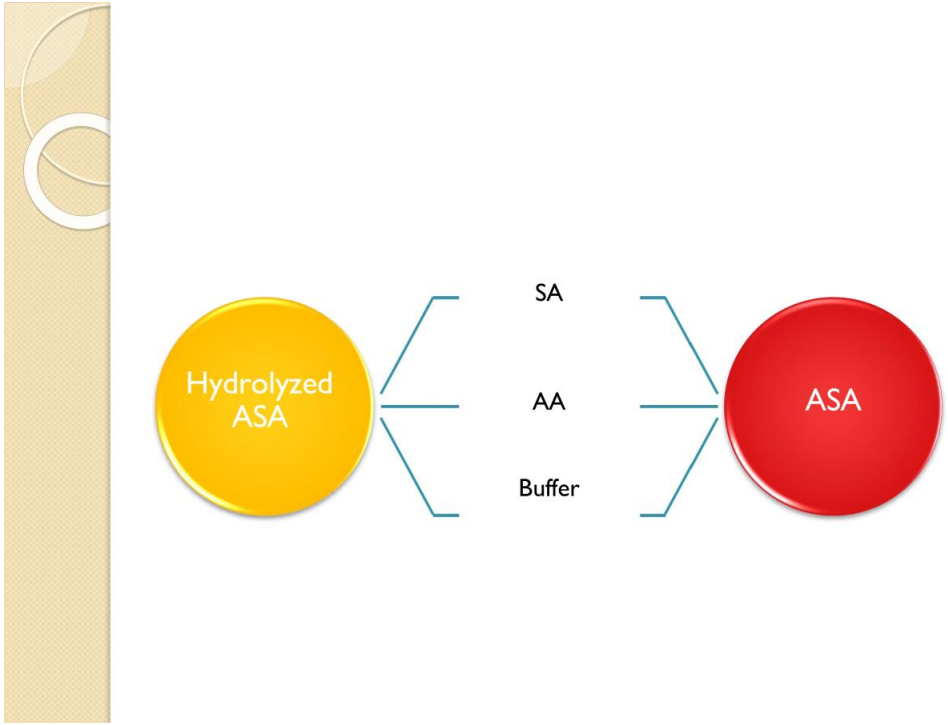
Therefore :

$\frac{0.695\ gram}{250\ ml}$ = 0.00278 gram per ml

Since 1 gm = 1000 mg

So :

0.00278 * 1000 = 2.78 mg / ml



Sorenson phosphate buffer (pH 8)

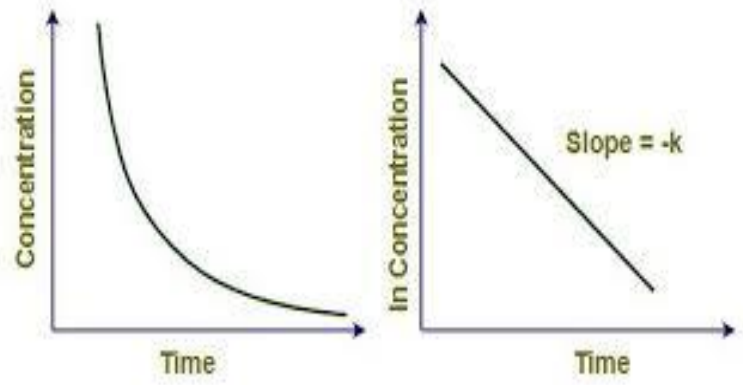
Consists of two solutions

A-1/15 M Monopotasium phosphate KH2PO4

B- 1/15 M Disodium phosphate Na2HPO4.2H2O

- The rate of ASA hydrolysis follows a first-order reaction

- **Use the calibration curve equation**
- **Y= C + bX**



We are seeking ASA, not SA

Since each MOLE of aspirin give 1 mole of salicylic acid and 1 mole of acetic acid

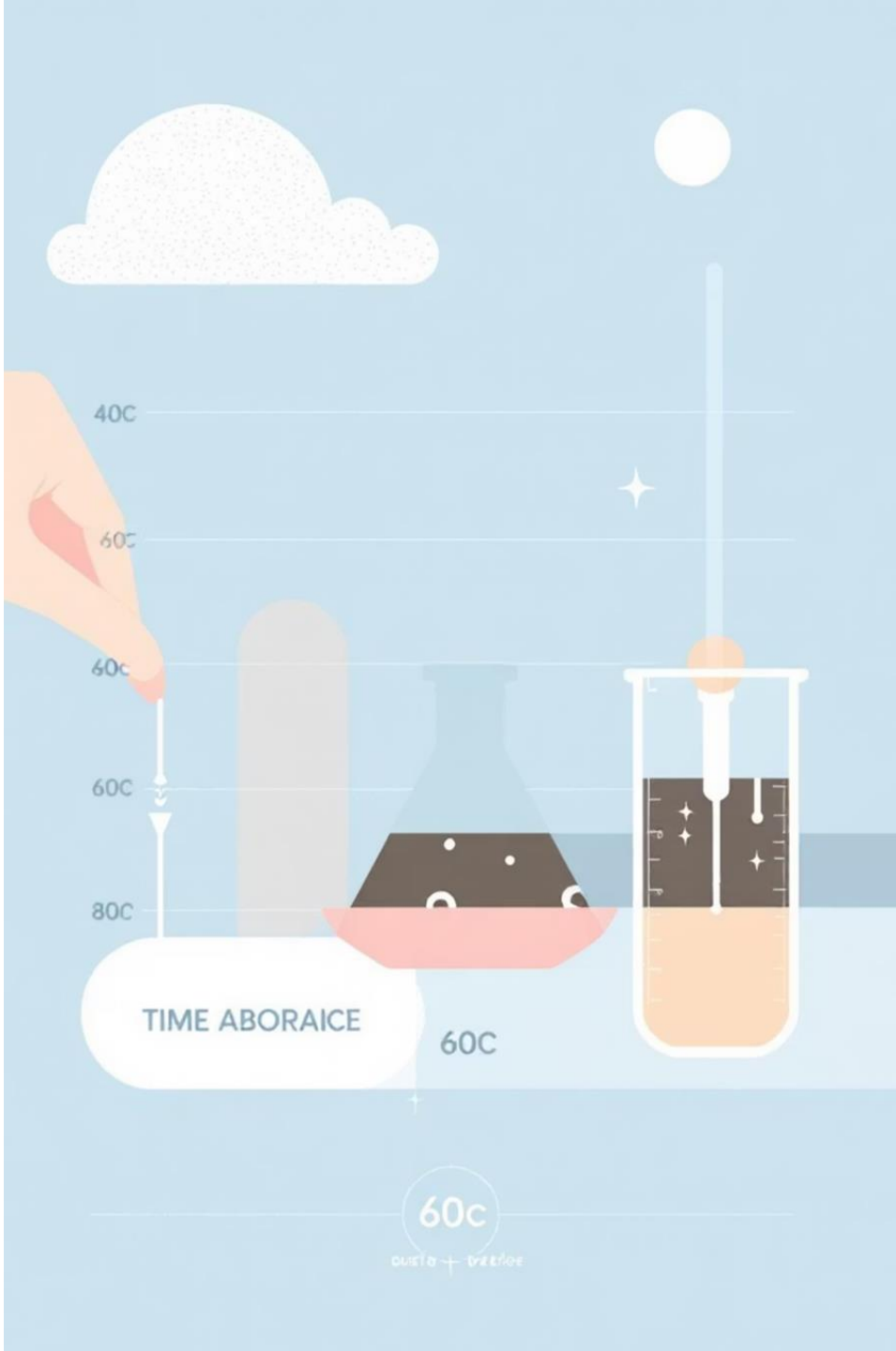
$$\text{Mole} = \frac{Wt}{M\,Wt}$$

Therefore

$$\frac{wt\ of\ SA}{M\ wt} = \frac{Wt\ of\ ASA}{M\ wt}$$

So : 0.35 (from the example) * 180 =X * 138

X= 0.456 ≈ 0.46



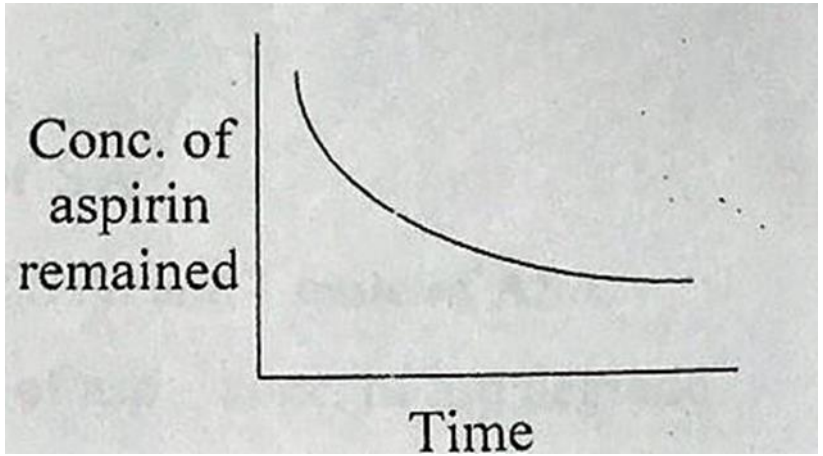
- Calculate remaining ASA from Initial conc. Of ASA – conc. Of ASA degraded

2.78 – 0.46 = 2.38 mg

Time	Absorbance	Conc. of S. A	Conc. of aspirin hydrolyzed	Conc. Of aspirin remined (ct)	Log ct
0	0	0	0		
30		Y= c + bx	X *180/138	2.78 - Ct	
45					
60					
75					
90					

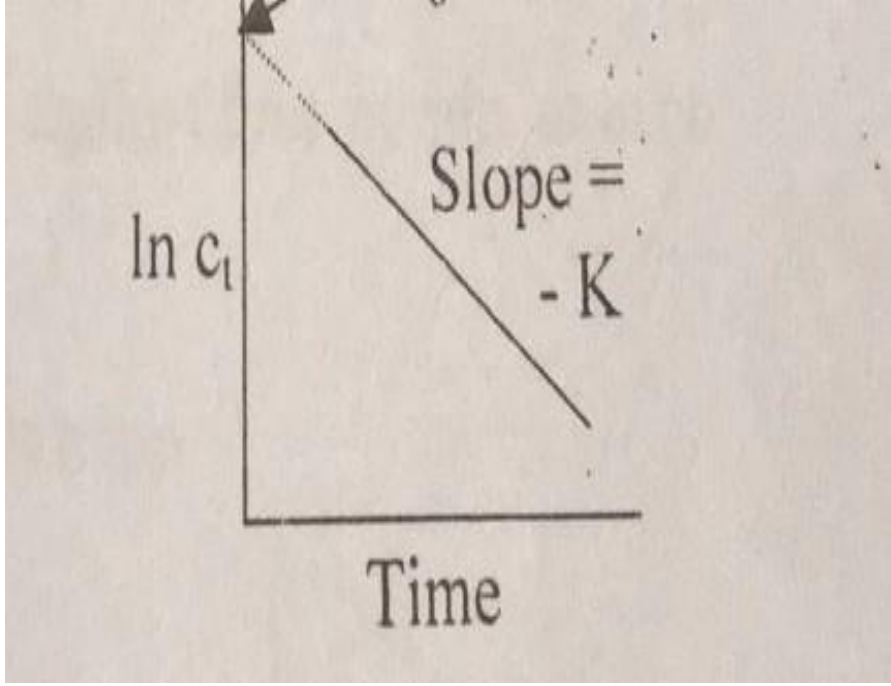
First order Kinetics

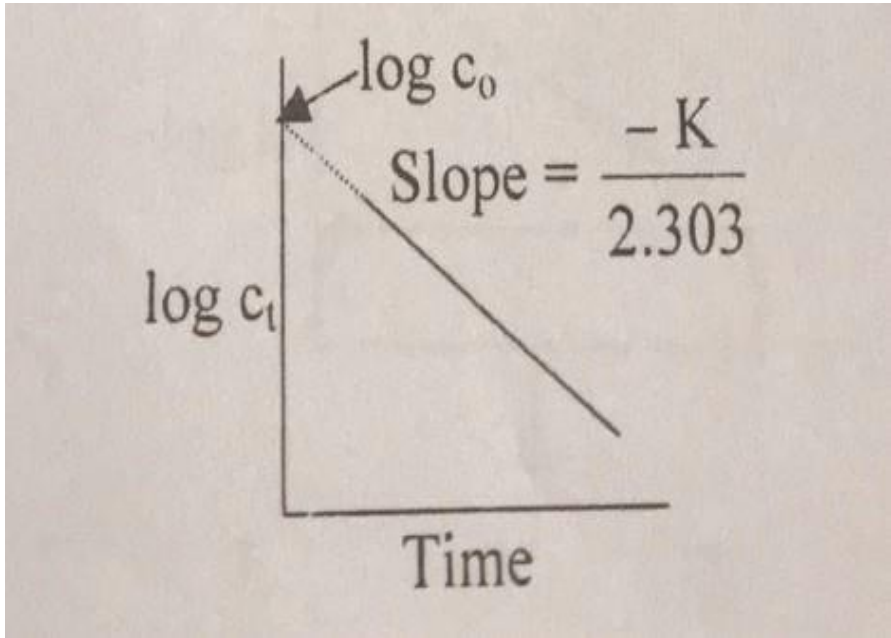
- $\frac{dc}{dt} \propto C$
- $-\frac{dc}{dt} \propto C$ (since conc. Of aspirin decrease with time as hydrolyzed)
- $-\frac{dc}{dt} = KC$



Data Analysis: Plotting and Calculating :

- $\int_{c0}^{ct} \frac{dc}{c} = -k \int_0^t dt$
- $-(\ln Ct - \ln Co) = kt(t-0)$
- $\ln Ct - \ln Co = -kt$
- $\ln Ct = \ln Co - kt$
- Since $\ln = \log \times 2.303$
- $\log Ct * 2.303 = \log Co * 2.303 - kt$
- $\log Ct = \log Co - kt/2.303$





What to do with data ?

1-take the Log, or Ln, for each calculated conc.

2-Plot the log/ ln of conc. against time in min for each temp.

You will have 3 plots

3-Calculate K for each temp.

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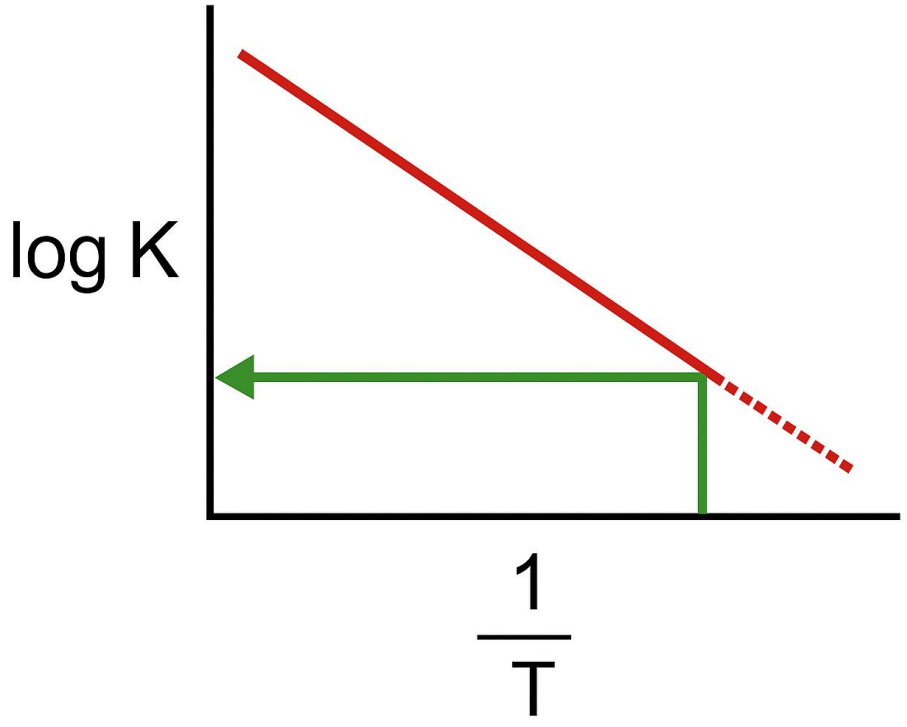
4-Take log K and plot $1/T$

5-(draw Arrhenius plot) to find K at 25 °C

- Arrhenius equation :
- Log K= logA - $(Ea)/(2.303\ R)*1/T$
- WhereA= frequency factor ,
- Ea = energy of activation ,T= absolute temp.(temp.+273)
- R= gas constant .
- **t10%= 0.105/ K25℃**



Repot to have done according to the results

1- Calculate K for each temp.

2- Calculate the Aspirin shelf life


Best Regards!
Thank you!