

EXPERIMENT No. ~ 03NAME OF THE EXPERIMENT :-

To find the ~~viscosity~~ surface tension of the given organic liquid by using Stalagmometer.

APPARATUS REQUIRED :-

Stalagmometer, Specific gravity bottle, Stopwatch, thermometer, etc.

THEORY :-

If  $\gamma_1$  and  $\gamma_2$  are the surface tension of two liquids respectively and  $w_1$  and  $w_2$  are the weight of the liquids respectively. Then,

$$\left[ \frac{\gamma_1}{\gamma_2} = \frac{w_1}{w_2} \right]$$

If  $V$  is the volume of the container,  $d_1$  and  $d_2$  are the densities of two liquids respectively.  $n_1$  and  $n_2$  be the total no. of drops respectively of the two liquids. Then,

$$\left[ w_1 = \frac{V}{n_1} d_1 \right] \quad \text{and} \quad \left[ w_2 = \frac{V}{n_2} d_2 \right]$$

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Procedure :-

The Stalagmometer was filled to the point 'A' as marked from the bottom. The whole setup was such that 10-15 drops of the liquid fall in a minute.

The total number of drops of the liquid, from mark B to C is counted. After the point 'B', the upper mark was calculated, similarly, before the point 'C', the lower mark was also calculated. The similar procedure was repeated 2-3 times.

The same process was repeated with water.

OBSERVATION :-(a) For BenzeneAt upper mark :-

$$3 \text{ div} = 1 \text{ drop}$$

$$1 \text{ div} = \frac{1}{3} \text{ drop}$$

At lower mark :-

$$3 \text{ div} = 1 \text{ drop}$$

$$1 \text{ div} = \frac{1}{3} \text{ drop}$$

(b) For waterAt upper mark :-

$$8 \text{ div} = 1 \text{ drop}$$

$$1 \text{ div} = \frac{1}{8} \text{ drop}$$

At lower mark :-

$$8 \text{ div} = 1 \text{ drop}$$

$$1 \text{ div} = \frac{1}{8} \text{ drop}$$

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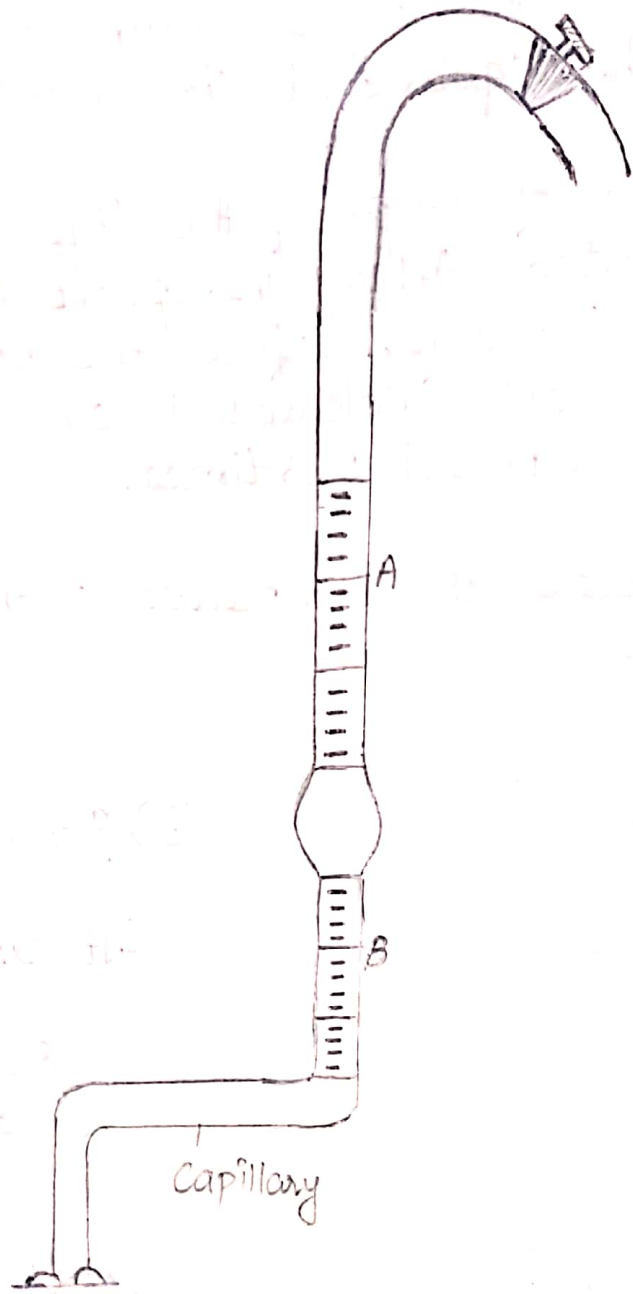


Fig:- Stalagmometer



OBSERVATION TABLE :-Room Temperature =  $29^{\circ}\text{C}$ For Benzene

Obs. No.	No. of full drops (Z)	Upper Mark (a/x)	Lower Mark (b/y)	Total No. of drops (Z + a/x + b/y)	Avg. No. of drops ( $n_1$ )
1.	102	$2 \times \frac{1}{3}$	$1 \times \frac{1}{3}$	103	
2.	102	$2 \times \frac{1}{3}$	$2 \times \frac{1}{3}$	103.33	102.77
3.	101	$2 \times \frac{1}{3}$	$1 \times \frac{1}{3}$	102	

For Water

Obs. No.	No. of full drops (Z)	Upper Mark (a/x)	Lower Mark (b/y)	Total No. of drops (Z + a/x + b/y)	Avg No. of drops ( $n_2$ )
1.	44	$4 \times \frac{1}{8}$	$5 \times \frac{1}{8}$	45.12	
2.	44	$4 \times \frac{1}{8}$	$5 \times \frac{1}{8}$	45.12	45.12
3.	44	$4 \times \frac{1}{8}$	$5 \times \frac{1}{8}$	45.12	

Thus, no. of drops ( $n_1$ ) for benzene = 102.77  
 no. of drops ( $n_2$ ) for water = 45.12

CALCULATION :-

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Weight of empty specific gravity bottle = 13.7 g  
 Weight of specific gravity bottle with benzene = 41.21 g  
 Weight of specific gravity bottle with water = 45.01 g

$$M_1 = \text{Weight of Benzene} = 41.21 \text{ g} - 13.7 \text{ g} = 27.55 \text{ g}$$

$$M_2 = \text{Weight of Water} = 45.01 \text{ g} - 13.7 \text{ g} = 31.31 \text{ g}$$

From the formula,

$$\left[ \frac{\gamma_1}{\gamma_2} = \frac{M_1}{M_2} \times \frac{n_2}{n_1} \right]$$

$\Rightarrow \gamma_1 = \text{Surface tension of benzene}$

$$\left[ \gamma_1 = \frac{M_1}{M_2} \times \frac{n_2}{n_1} \times \gamma_2 \right]$$

$$\text{or, } \gamma_1 = \frac{27.55}{31.31} \times \frac{45.12}{102.77} \times \gamma_2$$

$$\left[ \gamma_2 \text{ at } 29^\circ\text{C} = 72 \text{ dyne/cm} \right]$$

$$\text{or, } \gamma_1 = \frac{27.55}{31.31} \times \frac{45.12}{102.77} \times 72 \text{ dyne/cm}$$

$$\text{or, } \gamma_1 = 27.91 \text{ dyne/cm}$$

RESULT :- The surface tension of benzene at room temperature  $29^\circ\text{C}$  was found to be 27.91 dyne/cm.  
 Theoretical value of the same is 27.56 dyne/cm.

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