Experiment-9

Aim- To determine the surface tension of a given liquid by drop number method using stalagmometer.

Formula Used:

$$\frac{\gamma_1}{\gamma_2} = \frac{n_2}{n_1} \times \frac{d_1}{d_2}$$

where γ_1 = surface tension of given liquid

γ_2 = surface tension of water

n_1 = no. of drops counted for given liquid

n_2 = no. of drops counted for water

d_1 = density of given liquid

d_2 = density of water.

Dated 15-01-2021

Experiment - 9

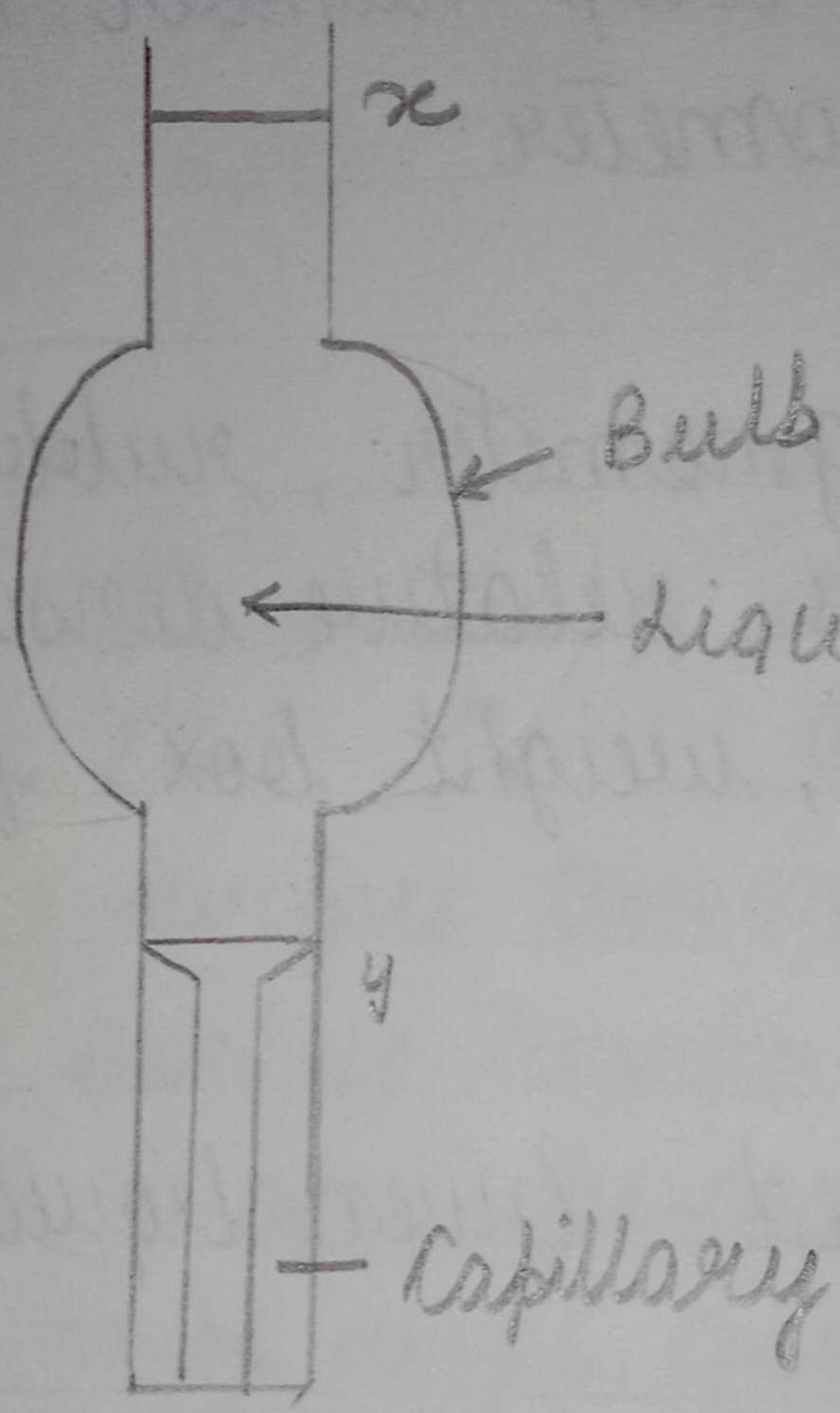
Aim - To determine the surface tension of a given liquid by drop number method using stalagmometer.

Apparatus - Stalagmometer, rubber tubing, pinch cock, beakers, relative density bottle, thermometer, stand, weight box, fractional weights etc.

Chemicals Required - Given liquid, distilled water

Theory :- Surface tension is the property of a liquid due to which its free surface behaves as a stretched membrane and tends to have minimum surface area. It is defined as the force in dynes along the surface of liquid at right angles to a line of 1cm.

When a liquid is allowed to flow through a capillary tube, a drop is formed at its lower end. The drop increases to a certain size and then falls off. The size of the drop depends on the radius of capillary and the surface tension of the liquid. The surface



Stalagmometer

tension acting along the circumference of the capillary tube supports the drop in upward direction. The measurement of the surface tension of a liquid is based on the fact that the drop of the liquid at the lower end of the capillary tube falls down when weight of the drop just becomes equal to the surface tension.

Consider two liquids of densities d_1 and d_2 having the surface tension γ_1, γ_2 respectively. Let the number of drops counted for the same volume V of the two liquids be n_1 and n_2 respectively. Then,

$$\frac{\gamma_1}{\gamma_2} = \frac{n_2}{n_1} \times \frac{d_1}{d_2}$$

Procedure -

1. Clean the statagmometer first with NaOH solution, then with chromic acid solution and finally a number of times with distilled water. Rinse it with acetone and dry by passing hot air or in an oven.
2. Attach a small piece of clean rubber tubing provided with a screw pinch cock to the top of stalagmometer.

Teacher's Signature.....

Observation table -

Room temperature = 21°C

S.No.	Water		given liquid	
	No. of drops	Mean (n_2)	No. of drops	Mean (n_1)
1.	41	44	38	41
2.	45		41	
3.	46		44	

Calculations:

By applying formula,

$$\frac{\gamma_1}{\gamma_2} = \frac{n_2}{n_1} \times \frac{d_1}{d_2}$$

$$\gamma_1 = \frac{n_2}{n_1} \times \frac{d_1}{d_2} \times \gamma_2$$

$$\gamma_1 = \frac{44}{41} \times \frac{1.59}{1} \times 75.64$$

$$= 129.067 \text{ dynes cm}^{-1}$$

∴ Surface tension of given liquid is 129.067 dynes/cm

3. Now open the pinch cock and immerse the lower end of stalagmometer in a beaker containing distilled water. Suck up the water about 2 cm above the mark X on stalagmometer and close the pinch cock.
4. Control the rate of flow of water by adjusting the pinch cock so that numbers of drops per minute is 10-15.
5. Clamp the stalagmometer in the stand. Refil it with water above the mark X. Start counting the number of drops when water meniscus crosses the upper mark X and stop counting when water meniscus passes the lower mark Y.
6. Repeat the experiments to get three readings.
7. Rinse the stalagmometer with alcohol and dry it again.
8. Fill it in the same way with the guien liquid and find out the number of drops formed in falling of liquid between marks X and Y on stalagmometer. Repeat to get three readings.
9. Fill it with water and weight it again.
10. Remove water, rinse with alcohol and dry the density water. Fill it with the guien

Result = Surface tension of given liquid is 129.067 dynes/cm.

11. Note the room temperature with a thermometer.

Precautions :- 1. Stalagmometer should be cleaned thoroughly as surface tension is greatly effective by minute traces of impurities.
2. Stalagmometer should be held in a vertical position throughout counting period
3. Drop formation should not exceed 15 drops per minute.
4. The rubber tubing attached to stalagmometer should be perfectly dry and the liquid sucked should not touch the rubber tube.
5. The drops should fall from the tip of the stalagmometer under their own weight and should not be pushed by force.

Result - Surface tension of the given liquid is 129.067 dynes cm^{-1}.