EXPERIMENT no. 5

Aim: To find out relative and absolute viscosity of a given liquid by Ostwald's Viscometer.

Apparatus required: Ostwald's viscometer, R.D.bottel, stop watch, rubber tube.

Chemicals: Distilled water, Given liquid (Unknown)

Theory: Coefficient viscosity is the force per unit area required to maintain a velocity difference of unity between two parellel layers in the liquid unit distance apart.

The measurement of viscosity by the Ostwald's Viscometer method-

By the equation-

$$\eta = \frac{\pi \ r4 \ t \ P}{8 \ V \ l}$$

η = Coefficient of viscosity

P = Hydrostatic pressure of liquid

V = Volume of the liquid

t = Time taken for the flow

r = Radius of the capillary tube

l = Length of the capillary tube

Procedure:

1. The viscometer is cleaned with chromic acid ($K_2Cr_2O_7$ + con.H_2SO_4) ,then wash with distilled water and dried.
2. Now attach the rubber tube to the end of the upper bulb .
3. Given liquid is poured in the viscometer.
4. The liquid is sucked up, it reaches the upper mark of the upper bulb.
5. Now liquid is allowed to fall freely from the upper mark to lower mark of the bulb and stop watch is used to measure the time.
6. The liquid is now removed and apparatus is cleaned.
7. Another unknown liquid is poured and the above process is repeated.
8. Both of the liquid is weighed.

Observations –

Liquid samples	Time of flow(sec.)			Mean time(t) in sec.
	1	2	3	
Distilled water(Known)	21.94	21.37	21.13	t_1 = 21.48

Unknown liquid(Ethenol)	26.33	25.91	25.75	t_2 = 25.75

Calculations :

Weight of empty specific gravity bottle (w_1) = 21.66 g

Weight of bottle + Distilled water (known) (w_2) = 45.92 g

Weight of bottle + Ethenol (Unknown) (w_3) = 45.31 g

Density of Ethenol (unknown liquid) = Mass of liquid/ Mass of equal volume of water

Density of ethenol (ρ_2) = $\frac{w3-w1}{w2-w1}$

(ρ –row) &(η- eta)

$$= \frac{45.31-21.66}{45.92-21.66}$$

ρ_2 = 0.976 g/ml.

Density of ethenol (ρ_2) = 0.976 g/ml. (we have to calculate this value)

Density of water at room temprature (ρ_1) = 0.997 g/ml (This is the standard value)

Viscosity of distilled water = 1 pas.

So, determine the viscosity of distilled water (η_1) α t_1 ρ_1

determine the viscosity of Ethenol (η_2) α t_2 ρ_2

(η_1) = k t_1 ρ_1 (k=constent)

(η_2) = k t_2 ρ_2

Where, η_1 = Viscosity distilled water

η_2 = Viscosity of ethenol

t_1 = Mean time of flow of water

t_2 = Mean time of flow of ethanol

ρ_1 = Density of distilled water

ρ_2 = Density of Ethenol

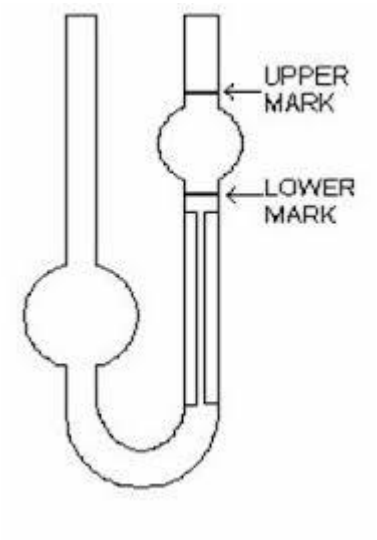
So, $\frac{\eta 1}{\eta 2} = \frac{t1\ \rho 1}{t2\ \rho 2}$

$\eta_2 = \frac{t2\ \rho 2}{t1\ \rho 1}$ x η_1

$$\eta_2 = \frac{25.75 \times 0.976}{21.48 \times 0.997} \times 1.0$$

η_2 = 1.15 pas. (Absolute viscosity of the given liquid)

Viscometer (Figure I)



Relative Density Bottle (Figure II)

Result:

The absolute Viscosity of given solution = 1.15 pascal second.

Precautions:

1. Viscometer must be held in vertical position.

No air bubble should be formed while sucking the liquid from tube.

2. The viscometer should be cleaned and dry.
3. The viscometer should not be disturbed during measurements of time of flow.