EXPERIMENT-6

OBJECT: To determine the coefficient of viscosity of the given sample solution by Ostwald's viscometer.

REQUIREMENTS:
APPARATUS: Relative density bottle, Chemical Balance, Weight Box, Ostwald's viscometer.
CHEMICALS: Given sample solution, distilled water.
PRINCIPLE:

- Viscosity is the reciprocal of fluidity.
- It is the frictional force between the layers of liquid which resist the liquid to flow.
- It is represented by Greek word η.
- The frictional force is measured in terms of tangential force.

$F \alpha A$ (Surface area contact)

$F \alpha du$ (Velocity difference between layers)

$F \alpha 1 / dx$ (Distance between the layers)

$F \alpha A\, du/dx$

$F = \eta A\, du/dx$
$\eta = F/A\, dx/du$ ($F = 1\ cm^2$, $dx = 1$, $du = 1$, then $\eta = F$)

Thus,
Viscosity is defined as the tangential force per unit area required to maintain the velocity difference of unity between two parallel layers of liquid which are unit distance apart.

$\eta \alpha$ 1/T (temperature)
$\eta \alpha$ Intermolecular hydrogen bonding
$\eta \alpha$ Pressure
$\eta \alpha$ Molecular mass
$\eta \alpha$ d (density)

The unit of viscosity in **CGS** system is poise and **SI** system is Pascal second.
Coefficient of viscosity is determined by using following formula

$\eta_2 = d_2 X\, t_2$

$\eta_1 = d_1 X\, t_1$
$\eta_1 / \eta_2 = d_1/d_2 X\, t_1/t_2$
$\eta_1 = \eta_2\, (d_1/d_2 X\, t_1/t_2)$
Where,
d_1 = density of the given sample solution
d_2 = density of distilled water
t_1 = flow time of sample solution
t_2 = flow time of distilled water

η_1 = viscosity of given solution
η_2 = viscosity of distilled water. (0.0101 poise at 25 ^{0} C.)

PROCEDURE:

RELATIVE DENSITY MEASUREMENT:

First weigh empty R D bottle and note down the reading.

Fill it with sample solution and then weigh it again.

Now remove the sample solution from it and fill it with distilled water, weigh it and note down the reading.

FLOW TIME MEASUREMENT:

Flow time is the time taken by the liquid to flow freely from Mark X to Mark Y on the upper bulb of viscometer.

Rinse the viscometer with water and take sufficient volume of sample solution in the lower bulb of viscometer.

Now, suck up the liquid until it reaches the mark X.

There should be no air bubbles inside the capillary of Ostwald's viscometer.

Now, allow the liquid to flow freely through the capillary from mark X to mark Y.

Note down the time taken with the help of stop watch.

Repeat the process with distilled water.

OBSERVATIONS

RELATIVE DENSITY MEASUREMENT

Empty weight of R D bottle = x gm.
Empty weight of R D bottle + sample solution = y gm
Empty weight of R D bottle + distilled water = z gm
Then
Density of sample solution (d_1) = y – x gm.
Density of distilled water (d_2) = z – x gm.

FLOW TIME MEASUREMENT

S No	FLOW TIME FOR SAMPLE	T_1 sec.	FLOW TIME FOR DISTILLED WATER	T_2 sec.
1				
2				
3				

CALCULATIONS:

$$\eta_1 = \eta_2 \, (d_1/d_2 \, X \, t_1/t_2)$$

= ----------poise.

RESULT: The coefficient of viscosity is ---------- poise.

PRECAUTIONS:

1.There should be no air bubbles inside the capillary of viscometer
2.Take equal volume of water and sample in the lower bulb.