**Model Procedure /Flow Chart:**

Take a clean and dry viscometer and fix it to a stand. Using graduated pippete, transfer known volume of given liquid into it. Then place it in water used bath such that it's big bulb is completly immersed in water. Suck the liquid above the upper mark of the small bulb of the viscometer and allow it to flow through the capillary. When the liquid just crosses the upper mark, start the stop watch. stop it as soon as it reaches the lower mark and note down the readings.

Repeat the experiment 3-4 times and calculate the average time of flow.

After discard the liquid and clean well with acetone. Dry it using oven and cool it down. Similar to the above, take readings using water and calculate average time. since the density of water & liquid and viscosity of water is known we can find the viscosity of liquid using formula

**Model Calculation:**

$$\eta_l \text{ (viscosity) of liquid} = \frac{t_l d_l \eta_w \pi \rho^4 t}{t_w \cdot d_w \quad 8 V l}$$

$$\frac{\eta_l}{} = \frac{t_l d_l}{t_w d_w} \eta_w$$

$t_l$ -> time of flow of liquid

$d_l$ -> density of liquid

$t_w$ -> time of flow of water

$d_w$ -> density of water

$\eta_w$ = viscosity of water

**Observation:**

| Liquid | Time of Flow | | |
|---|---|---|---|
| | in min: sec | in seconds | Average in seconds |
| Test liquid | 1:31:22 | 91:22 | $t_l$ = 91.02 |
| | 1:31:00 | 91:00 | |
| | 1:30:84 | 90:84 | |
| Water | 2:10:19 | 130:19 | $t_w$ = 127.28 |
| | 2:07:53 | 127:53 | |
| | 2:07:03 | 127.03 | |

**Calculation:** Temperature of water = 24°C

Density of water ($d_w$) = 0.9974

Coefficient of viscosity of water ($\eta_w$) = 9.142

Density of liquid ($d_l$) = 0.8632

Time of flow of water ($t_w$) = 127.28 sec

Time of flow of liquid ($t_l$) = 91.02

$$\eta_l = \frac{t_l}{t_w} \times \frac{d_l}{d_w} \times \eta_w = \frac{91.02}{127.28} \times \frac{0.8632}{0.9974} \times 9.142 \times 10^{-4} = 5.83001 \times 10^{-4}$$

$$= 5.83 \times 10^{-4}\ Nsm^{-2}$$

**Inference:**

- This experiment implies $\eta_l$ at room temperature, $\eta_l$ is in millipoise
- This also tells the viscosity is directly proportional to the time of flow & also the density of liquid

**Relevance to Society & Environment:**

- This method can be used for selection different oils and substances that are suitable for certain processes
- Could also be used in medical industry to analyse the samples and also used in pharmaceutical industries

**Report:** The coefficient of viscosity of the given liquid at 24.0°C = 5.83 $X10^{-4}$ $Nsm^{-2}$

| Evaluation of experiment - 9 | | |
|---|---|---|
| **Components** | **Marks** | |
| | **Max** | **Obtained** |
| Model Procedure, Model Graph & Calculation | 20 | 20 |
| Expected Value & Execution | 16 | 16 |
| Inference & Societal Relevance | 04 | 03 |
| Total | 40 | 39 |
| Signature of Teacher | | |