Medical Physics

Viscosity of liquid

Experiment Three

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Purpose:

To determine the viscosity of medium by using a small sphere falls with a constant velocity.

Theory:

The viscosity of liquid is a resistance to flow of a liquid. All liquids appear resistance to flow change from liquid to another, the water faster flow than glycerin, subsequently the viscosity of water less than glycerin at same temperature. Viscosity occurs because of contact liquid layers with each other.

The factors effect on the viscosity:

1. Effect of Temperature: the temperature of the liquid fluid increases its viscosity decreases. In gases its opposite, the viscosity of the gases fluids increases as the temperature of the gas increases.

2. Molecular weight: the molecular weight of the liquid increases its viscosity increases.

3. Pressure: when increase the pressure on liquids, the viscosity increase because increase the attraction force between the molecules of liquid.

Apparatus:

1. A long glass tube about (50 cm) long closed at one end.

2. Glycerin.

3. Meter scale.

4. Small sphere.

5. Rubber bands.

6. Magnet.

7. Stop-Watch.

Method:

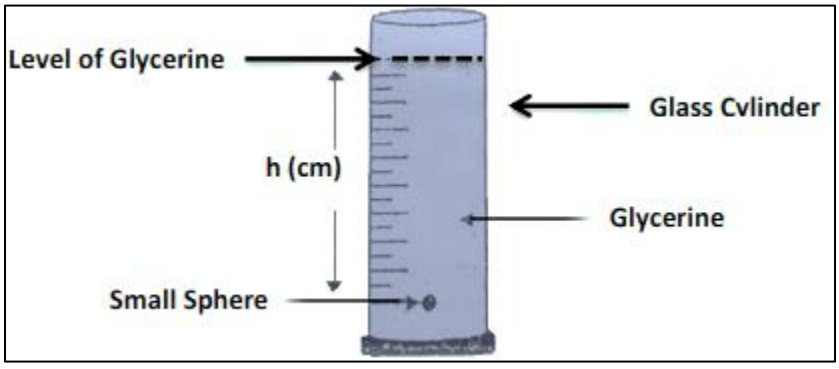
1. Adjust the distance between the rubber bands.

2. Record the distance (h) between them (About 30 cm).

3. Drop a sphere centrally down the tube and with stopwatch find the time it takes to traverse the distance between the rubber bands.

4. Obtain two values of the time of fall.

5. Repeat the experience for the different values of (h) and obtain two values of the time of fall for each new distance apart.



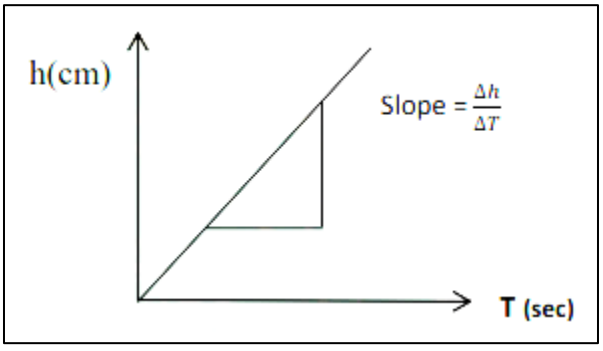
Readings:

Distance between the rubber bands h (cm)	Time of fall		
	T_1 (sec)	T_2(sec)	T_{ave}(sec)
20	3	2.9	
25	4.1	3.8	
30	5.5	5.9	
35	6.5	6.7	

Plot a graph with value of (h cm) as ordinates against the corresponding values of T (Sec).

From the graph, calculate the velocity.

Slope = h/T = velocity (cm/sec).



To calculate the viscosity (η) for liquid, use the following equation:

$$\eta = \frac{g(\rho - \sigma) * d^2}{18 * v} \quad \text{(g/cm. sec)}$$

$g = 980\ cm/sec^2$

ρ = Density of sphere = $7.8\ gm/cm^3$

σ = Density of liquid = $1.231\ gm/cm^3$

d = Diameter of sphere (1cm)

v = Velocity = (slope).