The background of the slide is white and features several translucent, 3D-rendered bubbles of various sizes scattered across the surface. The bubbles have a soft, glowing appearance with highlights and shadows, giving them a realistic, spherical look. They are positioned around the central text, with some near the top and others near the bottom corners.

# VISCOSITY

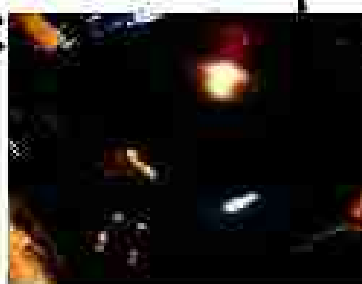
# Viscosity

- The resistance to flow. The thicker a liquid, the higher the viscosity (the slower a liquid moves).



What has higher viscosity, water or honey?

- Viscosity usually decreases when a liquid is heated.



What is more viscous, oil in a hot wok or oil in a cold wok?

# Viscosity

- **Blood viscosity can be described as the thickness and stickiness of blood.**
- **It is a measure of the resistance of blood to flow.**
- **The viscosity of blood is 5 times more than that of water**  
**(based on time taken for the flow of both in a tube)**
- **It depends on :**
  - **RBCs**
  - **Plasma proteins**

## Measurement units of viscosity

- pascal seconds (Pa·s)
- millipascal second (mPa·s)
- centipoise (cP)

$$\begin{array}{ccccc} \mathbf{0.001 \text{ Pa}\cdot\text{s}} & = & \mathbf{1 \text{ mPa}\cdot\text{s}} & = & \mathbf{1 \text{ cP}} \\ \text{pascal seconds} & & \text{millipascal seconds} & & \text{centipoise} \end{array}$$

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# Viscosity of liquid

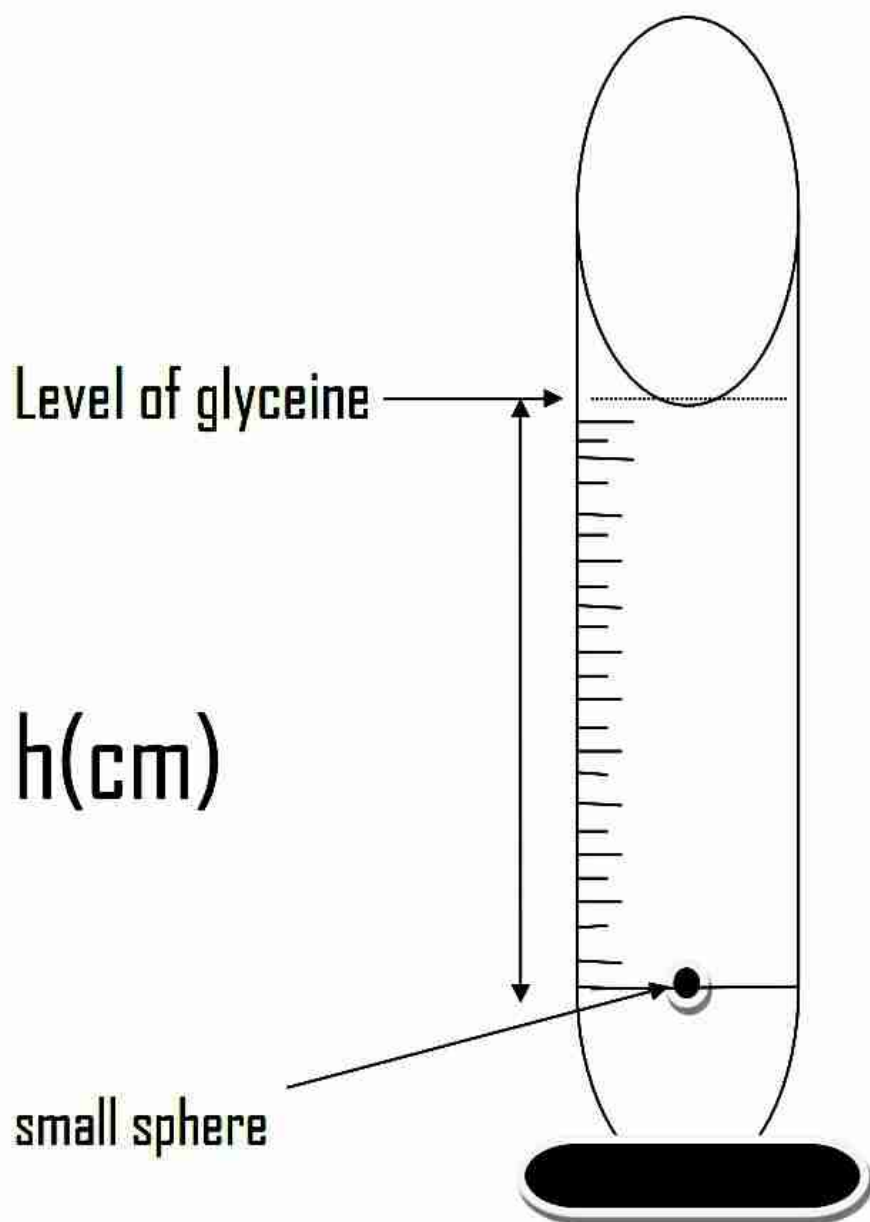
Purpose : To determine the viscosity of medium by using a small sphere falls with a constant terminal velocity

## Apparatus:

- 1- A long glass tube about 50cm long closed at one end
- 2- Glycerin
- 3- Meter scale
- 4- small sphere
- 5- Rubber bands
- 6- Manget
- 7- Stop-watch

## Method:

- 1- Adjust the distance between the rubber bands.
- 2- Record the distance ( $h$ ) between them (about 30cm)
- 3- Drop a sphere centrally down the tube and with stop-watch 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



## reading:

Distance between the rubber $h(\text{cm})$	(time of fall) $T(\text{Sec})$

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

Slope= $h/T$ =Velocity (cm/sec)

To deduce the velocity ( $\eta$ ) for liquid ,use the following equation

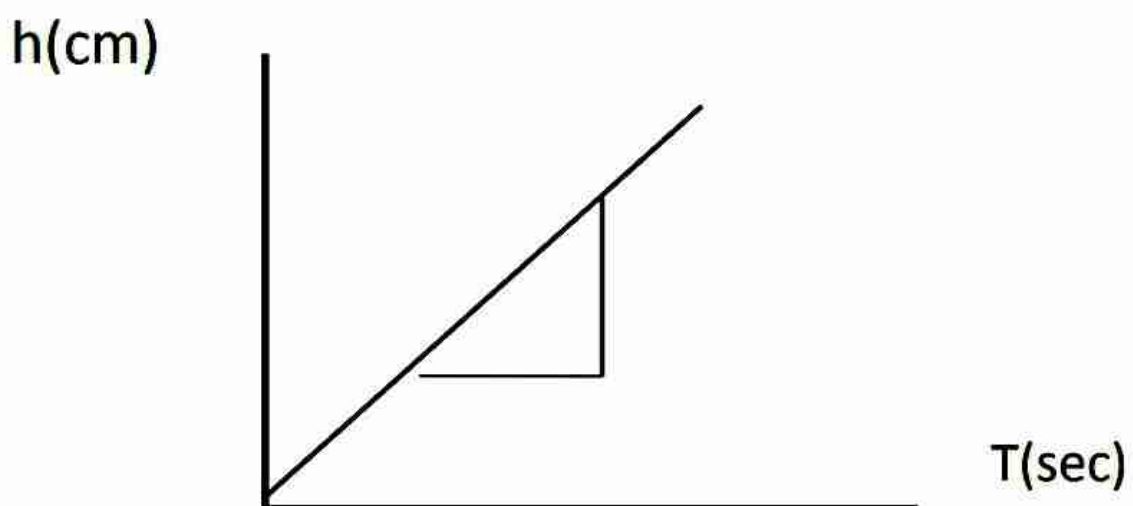
$$\eta = \frac{g(\rho - \sigma)d^2}{18.V}$$

$$g = 980 \text{ cm/sec}^2$$

$\rho$ =density of sphere  $\rho = \frac{m}{\frac{4}{3}\pi r^3}$

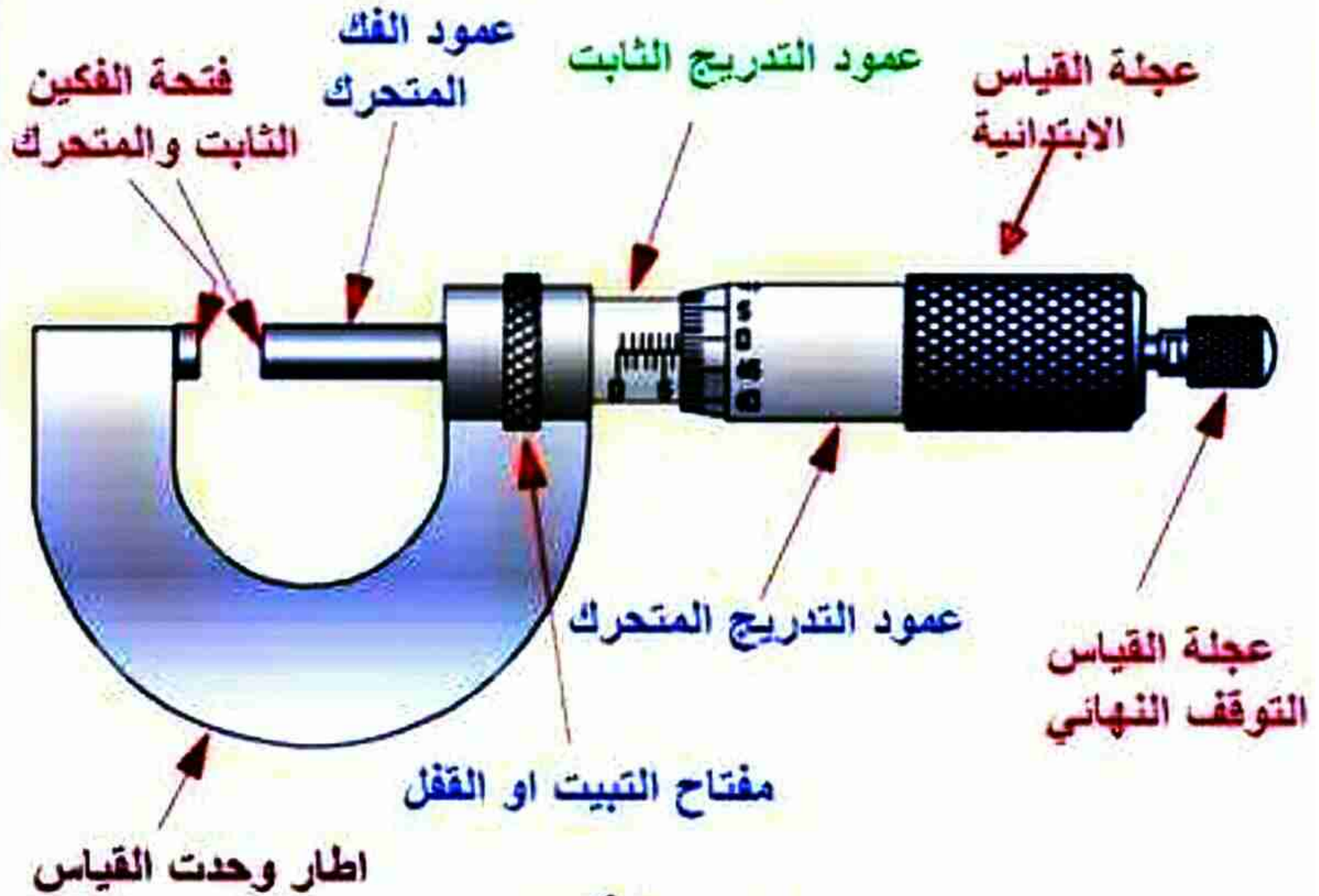
$\sigma$ =density of liquid =  $1.231 \text{ gm/cm}^3$

$V$ =Velocity (slope)





# Micrometer



## اجزاء الميكرو ميتر