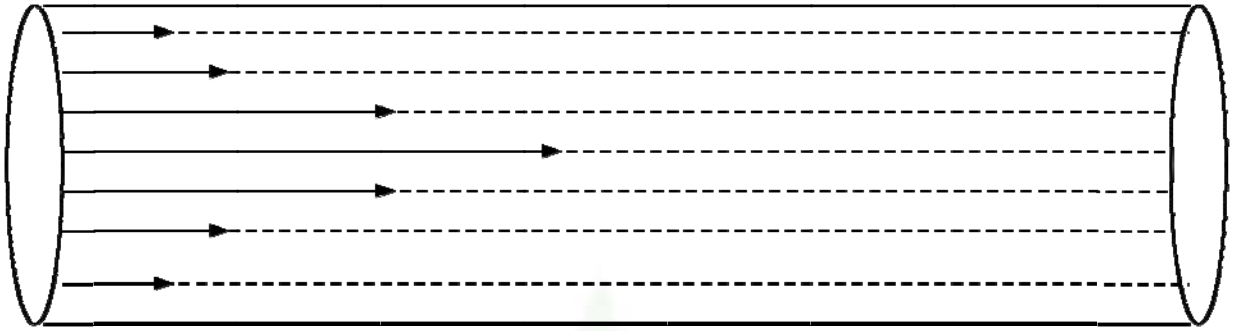

Let us consider a liquid flowing in stream line motion through a capillary tube shown magnified in the figure. If we imagine the liquid tube to be made up of a large no of co-axial cylindrical layers it is found that the velocity of flow of the layers are not same, the layer along the axis has maximum velocity and as the radius of the layer increases velocity decreases and is zero for the layer in the contact with the wall of the tube. This decrease in velocity can be explained by assuming a force acting parallel to the surface and opposite to the direction of motion. This hypothetical force which is frictional in nature is known as viscous force and the phenomenon is known as viscosity.

Newton's law of viscosity:

Let A = surface of the liquid layer

$\frac{du}{dr} =$ Velocity gradient

F = viscous force on the liquid layer

According to Newton's law:

$$F \propto A, F \propto \frac{du}{dr}$$

$$\therefore F \propto A\frac{du}{dr}$$

$$F = \eta A\frac{du}{dr}$$

Where η is constant of proportionality and is known as co-efficient of viscosity.

If A = $1m^2$ $\frac{du}{dr} = 1$ then $F = \eta$

The co-efficient of viscosity of a liquid can be defined as the viscous force acting on a liquid layer of unit surface area having unit velocity gradient.

Dimension of η:

$$[\eta] = \frac{[F][r]}{[A][u]}$$

$$[\eta] = \frac{MLT^{-2}L}{L^2LT^{-1}} = \left[ML^{-1}T^{-1}\right]$$

Unit in C.G.S = gm cm^{-1} sec^{-1} = Poise , SI = Kg m^{-1} sec^{-1}