Mechanical Properties of Fluid

Stoke's Law

Backward dragging force on a spherical body,

$$F = 6\pi\eta rv$$

Poiseuille's Formula

Flow rate

$$Q = \frac{\pi P r^4}{8\eta l}$$

Reynold's Number

Determines nature of fluid flow

$$R = \frac{\rho v d}{\eta}$$

Basic Results on Viscosity

Fluids in motion

Viscocity

Coefficient of viscosity:-

$$n = \frac{F}{A(-\frac{dv}{dx})}$$

Where $(-\frac{dv}{dx})$ is the velocity gradient between two layers of liquid.

Bernoulli's Theorem

For the streamline flow of an ideal liquid, the total energy per unit volume remains constant.

$$P+\rho gh+\frac{1}{2}\rho v^2=\text{Constant}$$

Properties of Fluids

Pressure

Pascal's Law: The preassure is same at all point inside the liquid lying at the same depth in a horizontal plane.

Guage pressure:

$$P-P_o=h\rho g$$

Archimedes' Principle

When a body is immersed fully or partly in a liquid at rest, it loses some of it's weight, which is equal to the weight of the liquid displaced by the immersed part of the body.

$$\text{Apparent weight} = mg(1-\frac{\rho^1}{\rho})$$

(for fully immersed body)

Fluids at rest

Surface Tension

The property by which the free surface of liquid at rest tends to have minimum surface area.

Surface energy: Work done against the force of surface tension in forming the liquid surface

Capillarity

The pheomenon of rise or fall of liguid in a capillary tube is called capillarity.

Height of the liquid within capillary tube.

$$h = \frac{2s\cos\theta}{a\rho g}$$

Excess pressure

In an air bubble

$$\Delta P = \frac{2s}{R}$$

Inside a soap bubble

$$\Delta P = \frac{4s}{R}$$

Inside a liquid drop

$$\Delta P = \frac{2s}{R}$$