

Mechanical Properties of Fluids

Fluids: Fluids are the substances which have the ability of flowing or deforming under an external force. Their molecules have comparatively less force of attraction and more intermolecular distances than the solids. Also, they do not have definite volume like that of the solids and they tend to take the volume of container. All the gases, liquids and plasmas are included under the fluids.

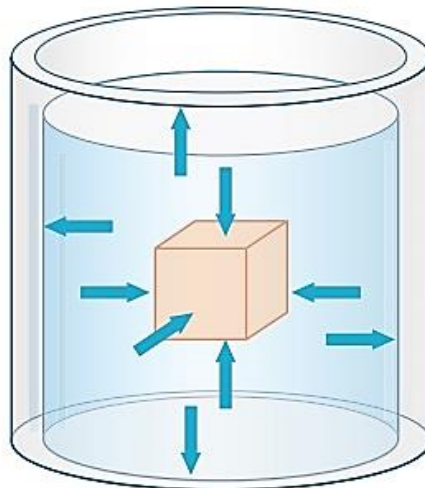
The field of science under which we study about the fluids is called **hydrodynamics**.

Mechanical Properties

Mechanical properties are the properties that substances exhibit on application of any external force. E.g., modulus of elasticity, elongation, tensile strength, ductility etc.

Mechanical Properties of Fluids

When an object is immersed in water or any liquid, it experiences a force, perpendicular to its surface. This force is called the **thrust of liquid**.



Pressure in Liquids- It is the thrust exerted by the liquid per unit area of an object at rest. It is a scalar quantity, with magnitude and no direction. Its dimensional formula is $[ML^{-1}T^{-2}]$ and unit is N/m^2 or Pascal (Pa).

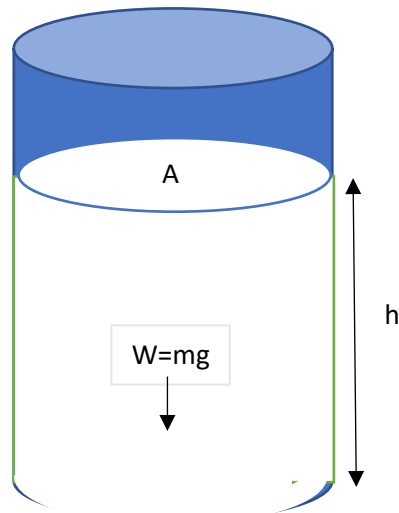
Pascals Law

It states that any force applied to a confined fluid is transmitted uniformly in all directions throughout the fluid regardless of the shape of the container. It is applicable only to the uniform liquids.

In case of a uniform fluid, there is no net force at equilibrium and thus, pressure is equal at every point of the fluid.

The movement of fluids is due to the difference in pressure, they move from a region of lower pressure to a region of higher pressure.

Variation of Pressure with Depth



Let us consider a liquid filled till height, h in a container with surface area, A . The pressure, P exerted by the liquid on the bottom of container can be expressed as:

$$P = \frac{mg}{A}$$

Now, mass of the liquid, m can be given as,

$$m = \rho V$$

Where ρ is the density of liquid and V is its volume, which can be expressed as,

$$V = Ah$$

Thus, mass of the liquid becomes,

$$m = \rho Ah$$

And the pressure can be expressed as,

$$P = \frac{(\rho Ah)g}{A}$$

$$P = h\rho g$$

P represents the pressure exerted by liquid at depth, h below its surface due to its weight.