

# Floatation

**Buoyant Force** : When a body is immersed partly or wholly in a liquid, a force acts on the body by the liquid in the upward direction. This force is called Buoyant force or force of buoyancy or up thrust. It is equal to the weight of liquid displaced by the body and acts at the centre of gravity of displaced liquid. Its study was first made by Archimedes.

**Archimedes Principle** : When a body is immersed partly or wholly in a liquid, there is an apparent loss in the weight of the body which is equal to the weight of liquid displaced by the body.

## Law of Floatation

### A body floats in a liquid if

- (i) density of material of body is less than or equal to the density of liquid.
- (ii) If density of material of body is equal to density of liquid, the body floats fully submerged in liquid in neutral equilibrium.
- (iii) When body floats in neutral equilibrium, the weight of the body is equal to the weight of displaced liquid.
- (iv) The centre of gravity of the body and centre of gravity of the displaced liquid should be in one vertical line.

**Centre of Buoyancy** : The centre of gravity of the liquid displaced by a body is called centre of buoyancy.

**Meta Centre** : When a floating body is slightly tilted from equilibrium position, the centre of buoyancy shifts. The point at which the vertical line passing through the new position of centre of buoyancy meets with the initial line is called meta centre.

Conditions for stable equilibrium of Floating body

- (i) The meta centre must always be higher than the centre gravity of the body.
- (ii) The line joining the centre of gravity of the body and centre of flotation should be vertical.

**Density** : Density is defined as mass per unit volume.

Density = mass/volume. Its SI unit is kg/m<sup>3</sup>.

Relative density = density of material / density of water at 4°C

**Since relative density is a ratio, it is unitless.**

1. Relative density is measured by Hydrometer.
2. The density of sea water is more than that of normal water. This explains why it is easier to swim in sea water.
3. When ice floats in water, it's the part remain outside the water.
4. If ice floating in water in a vessel melts, the level of water in the vessel does not change.
5. Purity of milk is measured by lactometer.