Chapter 2

Flow of Liquid

Day - 1

FLUID MECHANICS

Study the behavior of fluids at rest or in motion.

Fluids include both liquids and gases.

The science of fluids at rest is called fluid statics while that of moving fluids

Hydro – dynamics.

Contents of fluid statics: Hydrostatic pressure, floatation, Pascal’s Law and Archimedes principle.

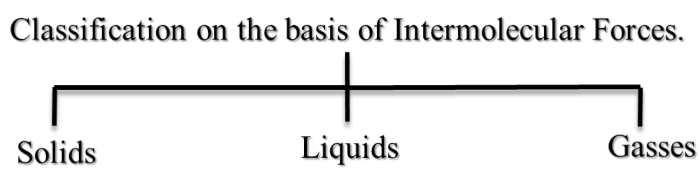
Contains of hydro-dynamics: Continuity equation, Bernoulli’s principle and Torricelli’s theorem.

FLUID

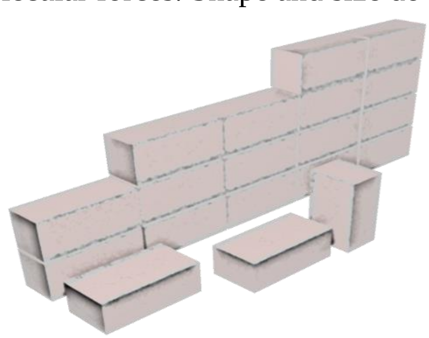
Which can flow liquids and gasses together are called fluids.

MATTER

All substance within the universe or out side the universe will be matter.



(1) Solids – Stronger intermolecular forces. Shape and size do not change easily.



(2) Liquids – Comparatively less intermolecular forces. shape can be change easily but volume can not change easily. To do so we have to change density.

(3) Gasses – Very small intermolecular forces. Shape and size (volume). Change easily because easy change in density.

ASSUMPTION FOR LIQUIDS

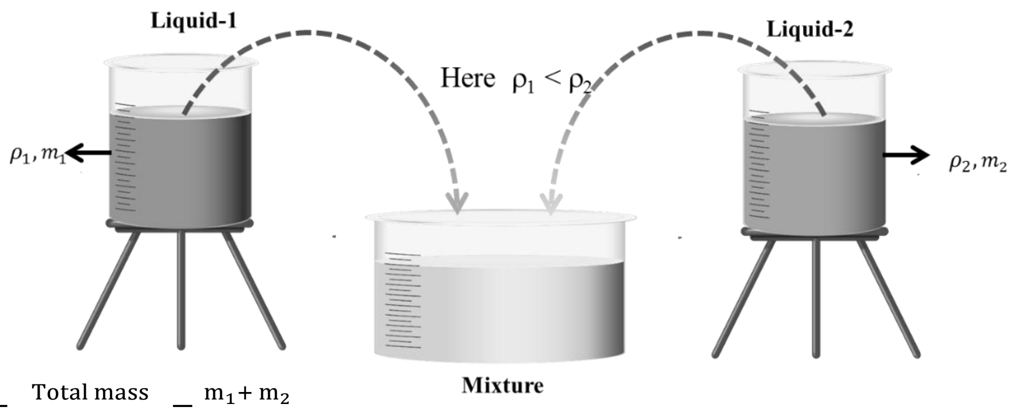
Liquids must be incompressible (density will be constant and will not change with change in pressure) and non-viscous (no tangential force only perpendicular forces between the layers of liquid also no friction between layers of liquid).

Density of a Liqiud: $\rho = \frac{\text{mass(m)}}{\text{Volume(V)}}$

Relative density (RD) $RD = \frac{\text{Density of substance}}{\text{Density of water at } 4^o c}$

Density of a Mixture of two or more Liquids

Case I



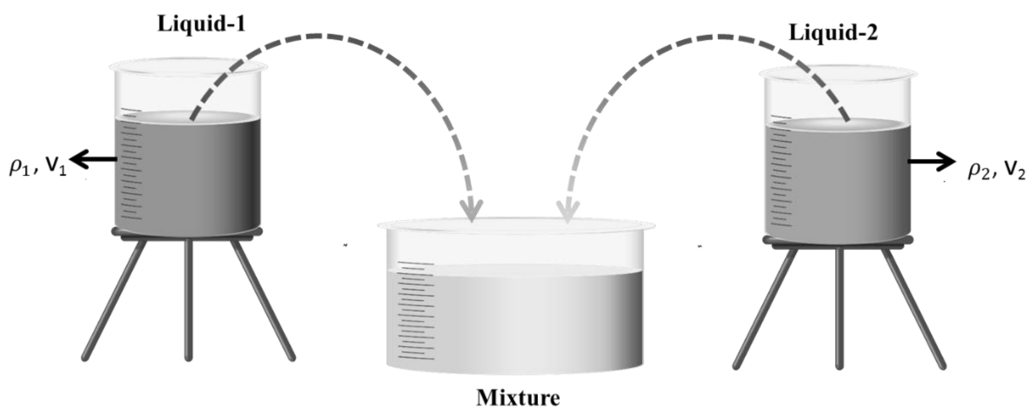
$$\rho_{Mixt} = \frac{\text{Total mass}}{\text{Total volume}} = \frac{m_1 + m_2}{V_1 + V_2}$$

$$= \frac{m_1 + m_2}{\frac{m_1}{\rho_1} + \frac{m_2}{\rho_2}}$$

If $m_1 = m_2 \rightarrow$ same mass

$$\rho_{Mixt} = \frac{2\rho_1\rho_2}{\rho_1+\rho_2}$$

Case II



$$\rho_{Mixt} = \frac{m_1 + m_2}{V_1+V_2}$$

$$= \frac{\rho_1 V_1 + \rho_2 V_2}{V_1 + V_2}$$

If $V_1 = V_2 \rightarrow$ Same Volume

$$\rho_{Mixt} = \frac{\rho_1+\rho_2}{2}$$

PRESSURE

Defined as F_{net} or thrust per unit area if liquid is at rest.

$P = \frac{F_{net}}{A}$ or $p = \frac{F_{\perp}}{A}$

Units : pascal (Pa)or newton / metre^2 (N/met^2)

1Pa = 1 N/m^2 = 10 dyne /cm^2

1 atm = 1.01 bar = 1.01 x 10^5 Pa = 760 torr (mm of Hg)

Or 1 atm ≈ 1 bar ≈ 10^5 Pa

Questions Practice Online