Unit – I

Pressure and Pressure Measurement

Session – IV

❑ Pressure

Container containing liquid of depth 'h' and 'A' is the bottom area of container. Let 'F' be force exerted by the liquid on bottom of container.

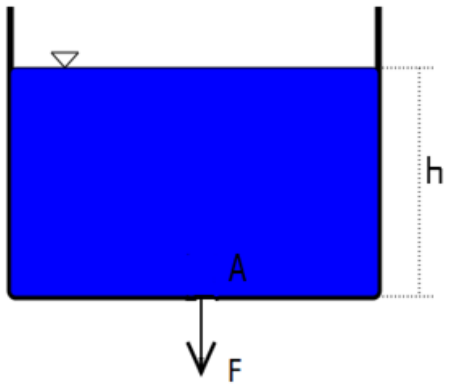
Force exerted by liquid = Sp. Weight of liquid x Volume of liquid

$$\text{i.e. } F = w \times (A \times h) = wAh$$

$$\text{Pressure, } p = \frac{F}{A} = \frac{wAh}{A}$$

$$p = wh$$

SI unit of pressure is N/m^2 or Pa



❑ Pressure head

When pressure is expressed in terms of equivalent height of liquid column, it is known as pressure head.

$$\text{As } \quad p = wh$$

$$h = \frac{P}{w}$$

Unit of pressure is m

Note –1. For any liquid,

$p = wh$ (w = sp.weight of liquid)

or

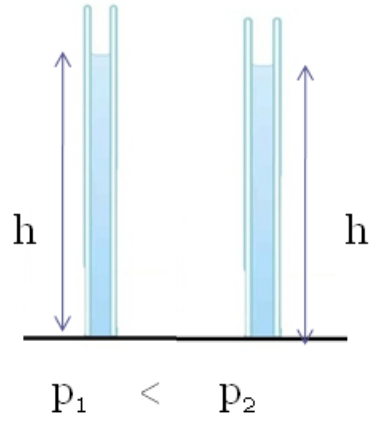
$p = swh$ (S = sp. gr. of liquid and w = sp. weight of water)

2. Pressure is expressed in two ways.

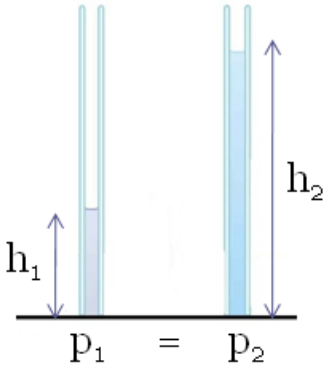
- N/m^2 - Pressure Intensity
- m - Pressure Head

❑ Conversion of pressure head of one liquid in terms of other liquid

- Lighter liquid exert less pressure as compared to heavier liquid



- For same pressure, height of lighter liquid is more as compared to heavier liquid.



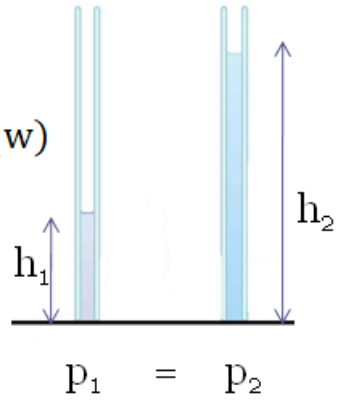
❑ Conversion of pressure head of one liquid in terms of other liquid (Contd..)

For conversing the pressure head of one liquid into equivalent height of another liquid, it is assumed that the pressure intensity at a point due to both the liquids of different height on the platform is equal.

$$P_1 = P_2$$

$$s_1 w h_1 = s_2 w h_2 \quad \left(s_l = \frac{w_l}{w} \text{ therefore } w_l = s_l \times w = s_l w\right)$$

$$s_1 h_1 = s_2 h_2 \quad \left(h_1 = \frac{s_2 h_2}{s_2}\right)$$



Problems

1. A driver works at a depth of 200 meters below the sea surface. Find the pressure intensity at this depth. Specific gravity of sea water is 1.10

Sol^n

$h = 200$ m

$s = 1.10$

pressure intensity, $p = swh$

$p = 1.10 \times 9810 \times 200$

$p = 2.158 \times 10^3$ N/m^2

$p = 2158.2$ KN/m^2

Problems

2. Convert the pressure head of 50 m of oil of specific gravity 0.8 into corresponding head of water.

Sol^n Oil – $h_1 = 50$ m and $s_1 = 0.8$

Water – $h_2 = ?$ and $s_2 = 1$

$s_1 h_1 = s_2 h_2$

$50 \times 0.8 = h_2 \times 1$

$h_2 = 40$ m of water

Assignment No 1

1. If the specific gravity of oil is 0.85, what is its specific weight in N/m^3 ?
2. At a point in a layer of fluid, the shear stress is 6 N/m^2 and the velocity gradient 0.40 m/sec/m. Calculate the coefficient of dynamic viscosity.
3. The volume of liquid was reduced by 4 % when the pressure was increased by 40 N/mm^2, What is the bulk modulus of the liquid ?
4. A liquid weighs 25 kN and occupies 3.75 m^3. Find its specific weight, mass density and specific gravity
5. Convert the pressure of 0.3 N/mm^2 in metres of liquid of specific 0.8