2. MANOMETRY

PASCAL'S LAW

The intensity of fluid at any point in a stationary fluid is same in all directions.

$$p_x = p_y = p_z$$

- Pressure varies ***only with depth*** in stationary fluids, whereas if fluids is in motion pressure may vary in horizontal direction also.
- Fluid pressure is measured in Force/Area and it is expressed in Pascal (N/m^2) or Bar.

$$1 \text{ Bar} = 10^5 \text{ N/m}^2$$

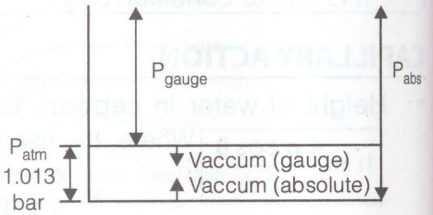
$$1 \text{ MPa} = 10 \text{ Bar}$$

- Barometer shows ***atmospheric*** pressure.
- 1 kgf = 9.81 Newton.
- Pressure is a scalar quantity.

ABSOLUTE PRESSURE

Pressure measured with reference to absolute zero. Absolute pressure cannot be negative

Absolute pressure = gauge pressure + local atmospheric pressure



- $P_{gauge} = \rho gh$

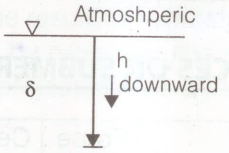
Here, ρ = Density of fluid
g = Acceleration due to gravity
h = Height

- ***Gauge*** pressure can be positive, negative or zero.
- Atmospheric pressure varies with ***altitude***, ***temperature*** and ***local*** conditions.
- At ***mean sea level*** atmospheric pressure is 1.01×10^5 Pascal or 1 Bar or 10.3 mts. of height of water or 76 cm height of ***mercury***.

HYDROSTATIC LAW

- For downward 'h'

$$\frac{dP}{dh} = \omega$$



- For upward 'h'

$$\frac{dP}{dh} = -\omega$$

CONVERSION OF ONE FLUID COLUMN TO ANOTHER FLUID COLUMN

$$\rho_1 h_1 = \rho_2 h_2 \qquad s_1 h_1 = s_2 h_2$$

Here, ρ = Density of fluid
s = Relative density

- Piezometer is suitable for ***small*** and ***positive*** pressure measurement.
- The manometric liquid should have ***high density*** and ***vapour pressure***.

- Simple manometer/U-tube manometer can measure both ***positive*** and ***negative*** pressure.
- Aneroid/Mercury barometer used to measure ***local*** atmospheric pressure on ***absolute*** scale.
- Density of mercury = 13.6×10^3 kg/m^3
  Density of air = 1.24 kg/m^3

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