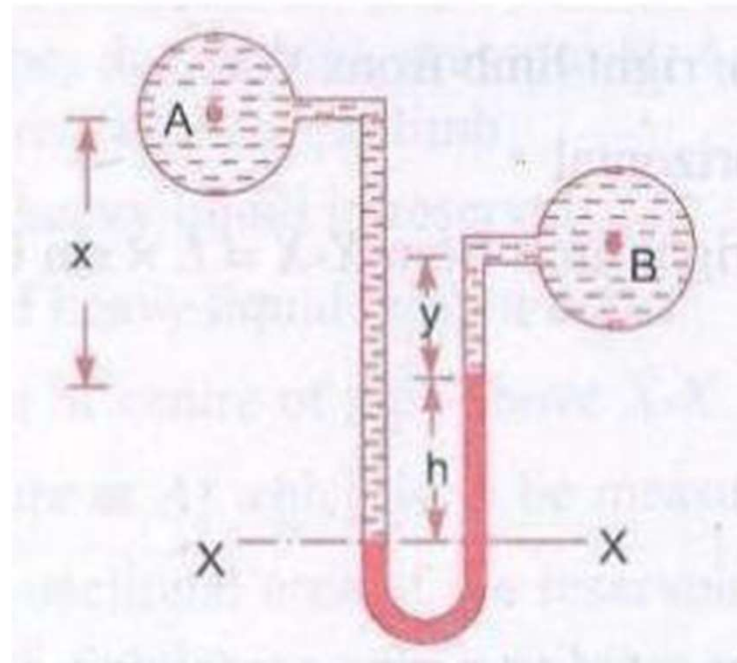


DIFFERENTIAL MANOMETERS

- Differential manometers are the devices used for measuring the difference of pressure between two points in a pipe or in two different pipes.
- A differential manometer consists of a U-tube, containing heavy liquid, whose two ends are connected to the points, whose difference of pressure is to be measured.
- The common types of U- tube differential manometers are:
 1. U- Tube differential manometer
 2. Inverted U- tube differential manometer.

U- Tube differential manometer

When two points A and B are at different levels and also contains liquids of different sp.gr.



Taking datum line at X – X

Pressure above X – X in the left limb

$$= \rho_1 g (h + x) + p_A \quad (\text{where } p_A = \text{Pressure at A})$$

Pressure above X – X in the right limb

$$= \rho_{\text{Hg}} g h + \rho_2 g y + p_B \quad (\text{where } p_B = \text{Pressure at B})$$

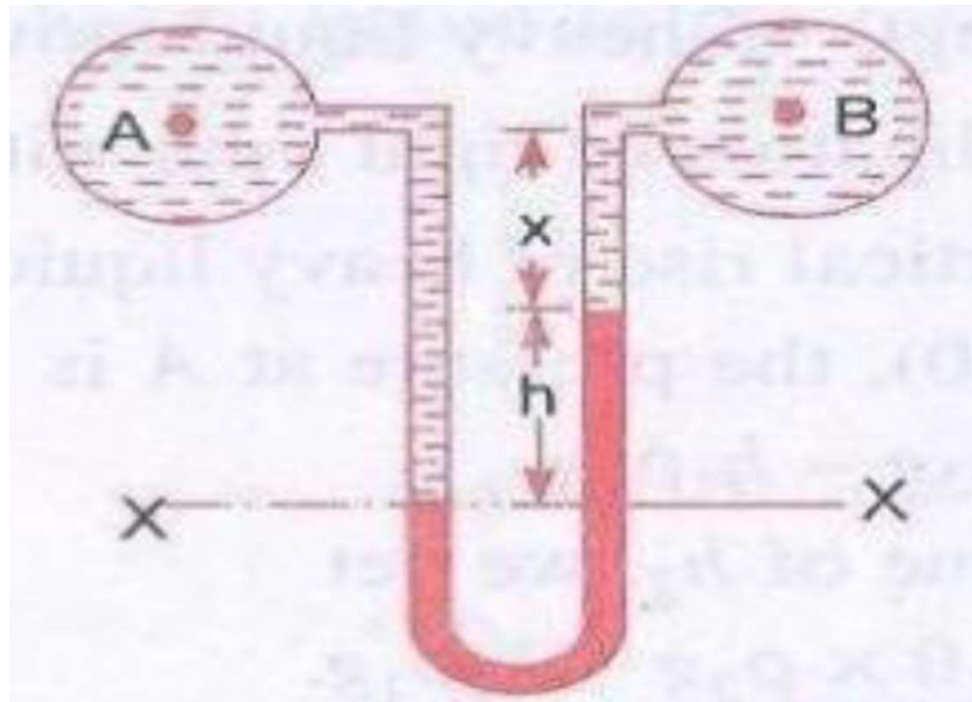
Equating the above two pressures, we have

$$\rho_1 g (h + x) + p_A = \rho_{\text{Hg}} g h + \rho_2 g y + p_B$$

$$p_A - p_B = \rho_{\text{Hg}} g h + \rho_2 g y - \rho_1 g (h + x)$$

$\therefore \text{Difference of Pressures at A and B} = h g (\rho_{\text{Hg}} - \rho_1) + \rho_2 g y - \rho_1 g x$

When two points A and B are at the same level and contains the same liquid of density ρ_1



Let the two points A and B are at the same level and contains the same liquid of density ρ_1

Then pressure above X – X in the right limb

$$= \rho_{Hg} g h + \rho_1 g x + P_B$$

Pressure above X—X in the left limb

$$= \rho_1 g (h + x) + P_A$$

Equating the two pressures

$$\rho_{Hg} g h + \rho_1 g x + P_B = \rho_1 g (h + x) + P_A$$

$$P_A - P_B = \rho_{Hg} g h + \rho_1 g x - \rho_1 g (h + x)$$

$$\text{Difference of pressure at A and B} = g h (\rho_{Hg} - \rho_1)$$

Inverted U – Tube differential manometer –

It consists of a inverted U – tube, containing a light liquid. The two ends of the tube are connected to the points whose difference of pressure is to be measured. It is used for measuring difference of low pressures.

Let an inverted U – tube differential manometer connected to the two points A and B. Let pressure at A is more than pressure at B.

h_1 = Height of the liquid in the left limb below the datum line X-X
 h_2 = Height of the liquid in the right limb.

- h = Difference of height of liquid
- ρ_1 = Density of liquid A
- ρ_2 = Density of liquid B
- ρ_s = Density of light liquid
- p_A = Pressure at A
- p_B = Pressure at B