(2-8) U-tube Manometer

A U-tube manometer measures the gauge pressure of a gas. It containing a liquid (like Mercury), with one side open to the atmosphere and the other connected to a vessel containing a gas whose pressure we went to measure. Figure (2-6a) shows the manometer before it is connected to such a vessel. When both sides of the manometer are open to the atmosphere, the mercury levels are the same.

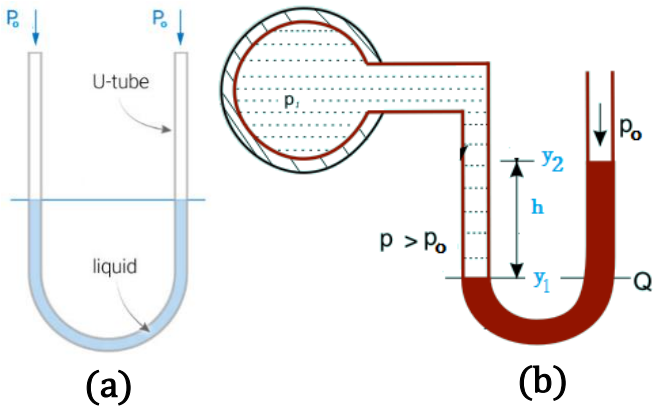
Now we connect an inflated balloon to the left side of the U-tube (figure 2-6b). If the gas in the balloon is at a higher pressure than the atmosphere, the gas pushes the mercury down on the left side and forces it up on the right side. The gauge pressure can be positive or negative, depending on whether $P > P_o$ or $P < P_o$.

By using the equation

$$P_o - P = -\rho g (y_2 - y_1)$$

$$-P_{gauge} = -\rho g h$$

$$P_{gauge} = \rho g h$$



(a) (b)

Figure 2-6

Example 15: A manometer is attached to a container of gas to determine its pressure. Before the container attached, both sides of the manometer are open to the atmosphere. After the container is attached, the Mercury on the side attached to the gas container rises **12 cm** above its previous level.
a) What is the gauge pressure of the gas in Pa?
b) What is the absolute pressure of the gas in Pa?

Example 16: A U-tube in which both ends are open to the atmosphere, is partly filled with water. Oil which does not mix with water is poured into one side until it stands a distance **12.3 mm** above the water level on the other side which has meanwhile risen a distance **67.5 mm** from its original level. Find the density of the oil?

Example 17: An open U-tube is partly filled with water. Oil with density **800 kg/m³** which does not mix with water is poured into one side of the tube. Find the length of water column which is in equilibrium with the oil column **30 cm** in length.

-0.24 m