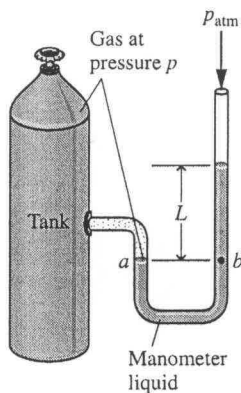


PROBLEM 1.32



(a) We have $P_a = P_{\text{gas}}$ and $P_a = P_b$. P_b is evaluated using Eq. 1.11. Collecting results,

$$\Rightarrow P_{\text{gas}} = P_{\text{atm}} + \rho_w g L$$

where $\rho_w = 997 \text{ kg/m}^3$ and $g = 9.81 \text{ m/s}^2$.

Solving for L

$$L = \frac{(P_{\text{gas}} - P_{\text{atm}})}{\rho_w g} = \frac{(1.5 - 1) \text{ bar}}{(997 \frac{\text{kg}}{\text{m}^3})(9.81 \frac{\text{m}}{\text{s}^2})} \left| \frac{10^5 \text{ N/m}^2}{1 \text{ bar}} \right| \left| \frac{1 \text{ N}}{1 \text{ kg} \cdot \text{m/s}^2} \right|$$

$$= 5.11 \text{ m} \quad \leftarrow$$

(b) Following the approach of part (a) with $\rho_m = 13.59 \frac{\text{g}}{\text{cm}^3}$, $P_{\text{atm}} = 750 \text{ mm Hg} = 10^5 \text{ N/m}^2$ (see "For Example" on p. 16)

$$L = \frac{P_{\text{gas}} - P_{\text{atm}}}{\rho_m g} = \frac{(1.3 - 1) \times 10^5 \text{ N/m}^2}{(13.59 \frac{\text{g}}{\text{cm}^3}) \left| \frac{1 \text{ kg}}{10^3 \text{ g}} \right| \left| \frac{10^2 \text{ cm}}{1 \text{ m}} \right|^3 (9.81 \frac{\text{m}}{\text{s}^2}) \left| \frac{1 \text{ N}}{1 \text{ kg} \cdot \text{m/s}^2} \right|}$$

$$= 0.225 \text{ m} \left| \frac{100 \text{ cm}}{1 \text{ m}} \right| = 22.5 \text{ cm} \quad \leftarrow$$

PROBLEM 1.33

Considering a manometer like that shown in Fig. 1.7 connected to the storage tank by a line filled with gas, we have $P_a = P_{\text{gas}}$ and $P_a = P_b$. P_b is evaluated using Eq. 1.11. Collecting results,

$$P_{\text{gas}} = P_{\text{atm}} + \rho g L$$

$$= 101 \text{ kPa} + (13.59 \frac{\text{g}}{\text{cm}^3}) \left| \frac{1 \text{ kg}}{10^3 \text{ g}} \right| \left| \frac{10^2 \text{ cm}}{1 \text{ m}} \right|^3 (9.81 \frac{\text{m}}{\text{s}^2}) (1 \text{ m}) \left| \frac{1 \text{ N}}{1 \text{ kg} \cdot \text{m/s}^2} \right| \left| \frac{1 \text{ kPa}}{10^3 \text{ N/m}^2} \right|$$

$$= 101 \text{ kPa} + 133.3 \text{ kPa}$$

$$= 234.3 \text{ kPa} \quad \leftarrow$$