

2.24

2.24 A U-tube manometer is connected to a closed tank containing air and water as shown in Fig. P2.24. At the closed end of the manometer the air pressure is 16 psia. Determine the reading on the pressure gage for a differential reading of 4 ft on the manometer. Express your answer in psi (gage). Assume standard atmospheric pressure, and neglect the weight of the air columns in the manometer.

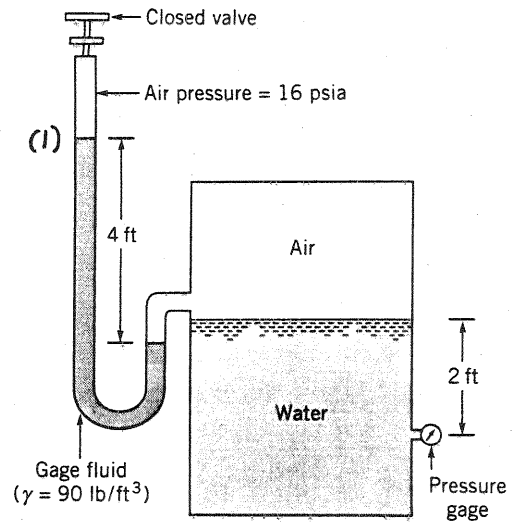


FIGURE P2.24

$$p_i + \gamma_{gf} (4 \text{ ft}) + \gamma_{H_2O} (2 \text{ ft}) = p_{\text{gage}}$$

Thus,

$$\begin{aligned} p_{\text{gage}} &= \left( 16 \frac{\text{lb}}{\text{in}^2} - 14.7 \frac{\text{lb}}{\text{in}^2} \right) \left( 144 \frac{\text{in}^2}{\text{ft}^2} \right) + \left( 90 \frac{\text{lb}}{\text{ft}^3} \right) (4 \text{ ft}) \\ &\quad + \left( 62.4 \frac{\text{lb}}{\text{ft}^3} \right) (2 \text{ ft}) \\ &= 672 \frac{\text{lb}}{\text{ft}^2} = \left( 672 \frac{\text{lb}}{\text{ft}^2} \right) \left( \frac{1 \text{ ft}^2}{144 \text{ in}^2} \right) = \underline{\underline{4.67 \text{ psi}}} \end{aligned}$$