2.40

2.40 The differential mercury manometer of Fig. P2.40 is connected to pipe A containing gasoline ($SG = 0.65$), and to pipe B containing water. Determine the differential reading, h, corresponding to a pressure in A of 20 kPa and a vacuum of 150 mm Hg in B.

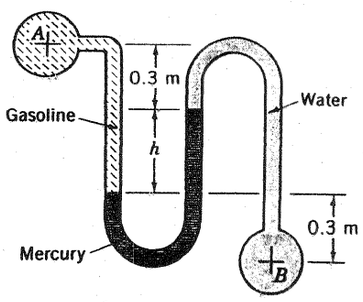

FIGURE P2.40

$$p_A + \gamma_{gas}(0.3m + h) - \gamma_{Hg} h + \gamma_{H_2O}(0.3m + h) = p_B$$

Thus,

$$h = \frac{p_A - p_B + \gamma_{gas}(0.3m) + \gamma_{H_2O}(0.3m)}{\gamma_{Hg} - \gamma_{gas} - \gamma_{H_2O}}$$

where $p_B = -\gamma_{Hg}(0.150m)$, so that

$$h = \frac{20\,kPa - \left[-\left(133\,\frac{kN}{m^3}\right)(0.150m)\right] + (0.65)\left(9.81\,\frac{kN}{m^3}\right)(0.3m) + \left(9.80\,\frac{kN}{m^3}\right)(0.3m)}{133\,\frac{kN}{m^3} - (0.65)\left(9.81\,\frac{kN}{m^3}\right) - 9.80\,\frac{kN}{m^3}}$$

$$= \underline{\underline{0.384\ m}}$$