Fluid Statics- problem 3-26 solution

Friday, 7 March, 2025 08:11 AM

3–26 The basic barometer can be used to measure the height of a building. If the barometric readings at the top and at the bottom of a building are 730 and 755 mmHg, respectively, determine the height of the building. Assume an average air density of 1.18 kg/m^3.

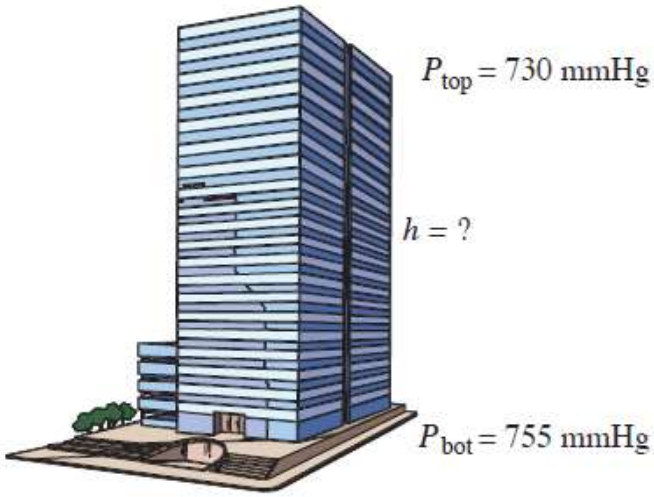


FIGURE P3–26

$$P_{top} = \rho_{Hg} \times g \times h_{Hg}$$

$$h_{Hg} = 730\,mm = 0.73\,m$$

$$\rho_{Hg} = 13.6 \times 1000 = 13600\ kg/m^3$$

$$G_{Hg}\ kg/m^3$$

$$g = 9.807\ m/s^2$$

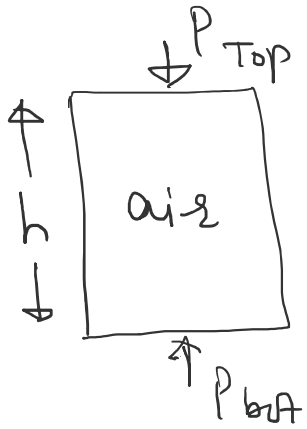
$$\Rightarrow P = 13600 \times 9.807 \times 0.73 = 97.36\ kPa$$

$\Rightarrow P_{top} = 13600 \times 9.807 \times 0.73 = 97.36\ kPa$

Similarly

$P_{bottom} = \rho g h_{bot} = 13600\ kg/m^3 \times 9.807\ m/s^2 \times 0.755\ m$

$= 100.7\ kPa$



$\Rightarrow P_{bot} = P_{top} + \rho_a g h$

$\Rightarrow P_{bot} - P_{top} = \rho_a g h$

$\Rightarrow 100.7 - 97.36 = 1.18 \times 9.807 \times 10^{-3} \times h$

$\Rightarrow h \simeq 289\ m$

h is height of air in building which means its also height of building

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