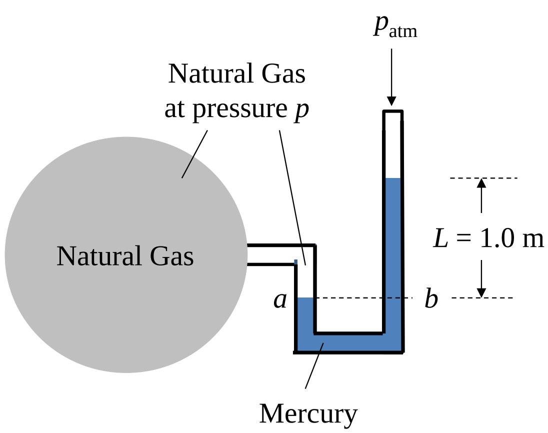
1.27 Figure P1.27 shows a storage tank holding natural gas. In an adjacent instrument room, a U-tube mercury manometer in communication with the storage tank reads L = 1.0 m. If the atmospheric pressure is 101 kPa, the density of the mercury is 13.59 g/cm^3, and g = 9.81 m/s^2, determine the pressure of the natural gas, in kPa.

KNOWN: A manometer is in communication with natural gas in a storage tank.

FIND: The pressure of the natural gas.

SCHEMATIC AND GIVEN DATA:

L = 1.0 m
p_{atm} = 101 kPa
$\rho_{mercury}$ = 13.59 g/cm^3



ENGINEERING MODEL:
1. Local gravitational acceleration is 9.81 m/s^2.

ANALYSIS:
Considering a manometer connected to the storage tank by a line filled with gas, we have $p_a = p_{gas}$ and $p_a = p_b$. p_b is evaluated using Eq. 1.11. Collecting results,

$$p_{gas} = p_{atm} + \rho g L$$

$$p_{gas} = 101\,\text{kPa} + \left(13.59\frac{\text{g}}{\text{cm}^3}\right)\left|\frac{1\,\text{kg}}{10^3\,\text{g}}\right|\left|\frac{10^2\,\text{cm}}{1\,\text{m}}\right|^3\left(9.81\frac{\text{m}}{\text{s}^2}\right)(1.0\,\text{m})\left|\frac{1\,\text{N}}{1\frac{\text{kg}\cdot\text{m}}{\text{s}^2}}\right|\left|\frac{1\,\text{kPa}}{10^3\,\frac{\text{N}}{\text{m}^2}}\right|$$

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

$$p_{gas} = \underline{\mathbf{234.3\ kPa}}$$