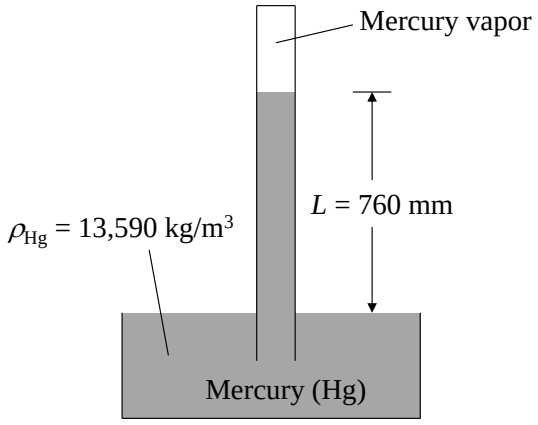
1.32 Show that a standard atmospheric pressure of 760 mmHg is equivalent to 101.3 kPa. The density of mercury is 13,590 kg/m^3 and g = 9.81 m/s^2.

KNOWN: Standard atmospheric pressure of 760 mmHg.

FIND: Show that 760 mmHg is equivalent to 101.3 kPa.

SCHEMATIC AND GIVEN DATA:



ENGINEERING MODEL:
1. Local gravitational acceleration is 9.81 m/s^2.
2. Pressure of mercury vapor is much less than that of the atmosphere and can be neglected.

ANALYSIS:
Equation 1.12 applies.

$$p_{atm} = p_{vapor} + \rho_{Hg} g L = \rho_{Hg} g L$$

Neglecting the pressure of mercury vapor and applying appropriate conversion factors yield

$$p_{atm} = \left(13{,}590 \frac{\text{kg}}{\text{m}^3}\right)\left(9.81 \frac{\text{m}}{\text{s}^2}\right)(760\ \text{mm}) \left| \frac{1\ \text{N}}{1 \frac{\text{kg} \cdot \text{m}}{\text{s}^2}} \right| \left| \frac{1\ \text{m}}{1000\ \text{mm}} \right| \left| \frac{1\ \text{kPa}}{1000 \frac{\text{N}}{\text{m}^2}} \right| = \underline{\textbf{101.3 kPa}}$$