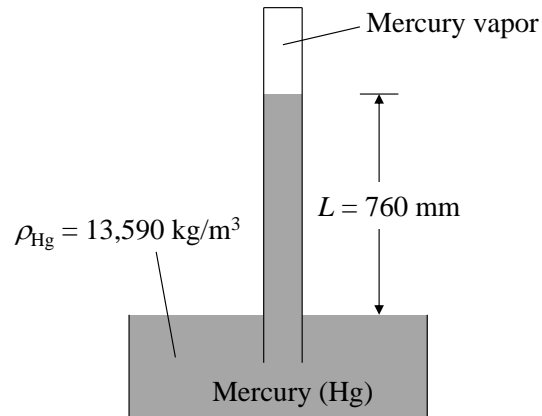


1.39 Show that a standard atmospheric pressure of 760 mmHg is equivalent to 101.3 kPa. The density of mercury is $13,590 \text{ kg/m}^3$ and $g = 9.81 \text{ m/s}^2$.

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.

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

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

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