70 (a).

Problem 15.27E (HRW)

To suck lemonade of density 1000 kg/m^{-3}*up a straw to a maximum height of* 4 cm, *what minimum gauge pressure must be produced in the lungs?*

Solution:

Pressure in the lung plus the pressure due to 4 cm column of lemonade of density 1000 kg/m^{-3} has to be equal to the atmospheric pressure in order that we may be able to suck lemonade using a straw to a maximum height of 4 cm. This condition gives the algebraic relation

$$P_{lung} + 4.0 \times 10^{-2} \times 10^{3} \times 9.80 = P_{atm}.$$

Solving this equation, we find

$$P_{lung} - P_{atm} = -3.9 \times 10^{-1} \times 10^{3} \text{ Pa},$$

$$= \frac{-3.9 \times 10^{-1} \times 10^{3} \text{ Pa}}{1.01 \times 10^{5} \text{ Pa/}P_{atm}}$$

$$= -3.9 \times 10^{-3} P_{atm}.$$