

63.

Problem 15.13E (HRW)

The human lungs can operate against a pressure differential of up to about $\frac{1}{20}$ of an atmosphere. If a diver uses a snorkel for breathing, we have to find how far below water level can he or she swim.

Solution:

Human lungs can operate against a pressure differential of up to about one-twentieth of atmospheric pressure.

$$\Delta p = 1 \text{ atm} = \frac{1}{20} \times 1.01 \times 10^5 \text{ Pa.}$$

Gauge pressure of water below a depth of h m is ρgh .

Equating the pressure at depth h to Δp , we get

$$1.0 \times 10^3 \times h \times 9.8 = \frac{1}{20} \times 1.01 \times 10^5$$

or

$$h = 0.515 \text{ m.}$$

That is one can swim up to a depth of 0.52 m by using a snorkel.