62.

## Problem 15.6E (HRW)

A fish maintains its depth in fresh water by adjusting the air content of the porous bone or air sacs to make its average density the same as that of the water. Suppose that with its air sacs collapsed fish has a density of 108 g/cm³. We have to find the fraction of the expanded volume that the fish must inflate its air sacs to reduce its density to that of water.
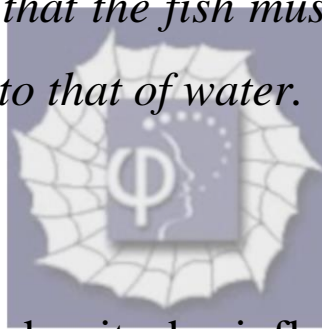
Solution:

Fish change their density by inflating their air sacs and for floating reduce their density to that of water. Let the volume of a fish with collapsed air sacs be V. Its density in this condition is 1.08 g cm^{-3}. Let the volume of the fish after it has inflated itself be V'. After inflating its volume fish adjusts its density such that it becomes equal to that of water, which is 1.00 g cm^{-3}. As the mass of the fish remains unchanged during inflation of volume, we have

$$V' \times 1.0 = V \times 1.08$$

or

$$\frac{V'\text{-}V}{V} = 0.8.$$

Fractional change in volume that a fish attains for reducing its density to that of water is 8%.