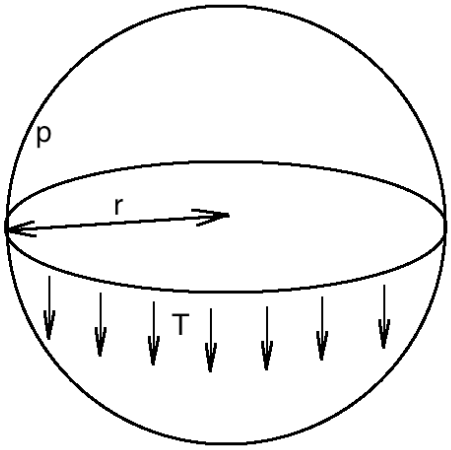
Answer on Question #42011 – Physics – Other

the pressure inside an air bubble of radius 2 cm formed 20cm below an open water surface is (given surface tension of water= 70*10^-3)

Solution:



$T = 70 \cdot \frac{10^{-3}N}{m} - surface\ tension\ of\ the\ water;$
$r = 0.02m - radius\ of\ the\ bubble;$

Analyzing a air bubble: instead of two surfaces, there is only the exterior surface to consider. Along this cross section, ignoring the very slight difference in inner and outer radius, we know the circumference will be $2\pi r$. The total force from the surface tension is, therefore

$$F_1 = T \cdot 2\pi r$$

Inside the bubble, however, we have a pressure p which is acting over the entire cross-section πr^2, resulting in a total force of

$$F_2 = p \cdot \pi r^2$$

Since the bubble is stable, the sum of these forces must be zero so we get:

$$F_1 = F_2$$
$$T \cdot 2\pi r = p \cdot \pi r^2$$
$$\mathrm{p} = \frac{2\mathrm{T}}{\mathrm{r}} = \frac{2 \cdot 70 \cdot 10^{-3}\,\frac{\mathrm{N}}{\mathrm{m}}}{0.02\mathrm{m}} = 7\mathrm{Pa}$$

Answer: $\mathrm{p} = 7\mathrm{Pa}$