Answer on Question #65211, Physics / Mechanics | Relativity

Question:

A swimmer sees an object that falls on the sea. He hears the sound of impact twice:
once by the ear that is below the water surface and the other time by the ear that is in
the air, 1 second later. At what distance from the observer did the impact took place?

Solution:

Let L be the distance from the swimmer to the impact,
v_{air} — speed of sound in the air,
v_{water} — speed of sound in sea water,
Δt — delay between the two events of detecting the sound.
We may write that $\Delta t = \frac{L}{v_{air}} - \frac{L}{v_{water}} = \frac{L(v_{water} - v_{air})}{v_{water} \cdot v_{air}}$, and then $L = \frac{v_{water} \cdot v_{air} \cdot \Delta t}{v_{water} - v_{air}}$.
$v_{air} = 331 \, m/s$
$v_{water} \cong 1510 \, m/s$
$\Delta t = 1 \, s$
$L = \dfrac{1510 \cdot 331 \cdot 1}{1510 - 331} \cong 424 \, m$

Answer:

$424 \, m$

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