Answer on Question #50141, Physics, Mechanics | Kinematics | Dynamics

It takes 3s for a sound wave to travel to a point 1km above the water surface from its source which is kept under the water at a depth of h m. Determine the value of h, if it is given that velocity of sound in air is 340 ms^{-1} and in water is 1420 ms^{-1}.

Solution:

The time of travel is

$$t = t_1 + t_2 = 3 \text{ s}$$

where t_1 and t_2 are times of travel in water and air, respectively.

$$t_1 = h/v_{water}$$

$$t_2 = \frac{d}{v_{air}} = \frac{1000 \text{ m}}{340 \text{ m/s}}$$

Thus,

$$\frac{h}{v_{water}} + \frac{d}{v_{air}} = t$$

Hence,

$$h = v_{water}\left(t - \frac{d}{v_{air}}\right) = 1420 * \left(3 - \frac{1000}{340}\right) = \frac{1420}{17} = 83.5 \text{ m}$$

Answer: $h = 83.5$ m