

Question #77654, Physics / Other

A block of wood weighs 60g in air. A lead sinker weighs 70g in water. The sinker is attached to the wood and both together weigh 65g in water. Find the relative density of the wood

Solution

$$(\rho_{lead} - \rho_{water})V_{lead} = 70 \text{ g}$$

$$V_{lead} = \frac{70}{(\rho_{lead} - \rho_{water})}$$

$$(\rho_{wood})V_{wood} = 60 \text{ g}$$

$$V_{wood} = \frac{60}{(\rho_{wood})}$$

$$(\rho_{lead})V_{lead} + (\rho_{wood})V_{wood} - \rho_{water}(V_{lead} + V_{wood}) = 65 \text{ g}$$

Thus,

$$(\rho_{lead})\frac{70}{(\rho_{lead} - \rho_{water})} + (\rho_{wood})\frac{60}{(\rho_{wood})} - \rho_{water}\left(\frac{70}{(\rho_{lead} - \rho_{water})} + \frac{60}{(\rho_{wood})}\right) = 65 \text{ g}$$

$$(\rho_{lead})\frac{70}{(\rho_{lead} - \rho_{water})} + (\rho_{wood})\frac{60}{(\rho_{wood})} - \rho_{water}\left(\frac{70}{(\rho_{lead} - \rho_{water})} + \frac{60}{(\rho_{wood})}\right) = 65 \text{ g}$$

$$70 - 60\left(\frac{\rho_{water}}{\rho_{wood}} - 1\right) = 65$$

$$60\left(\frac{\rho_{water}}{\rho_{wood}} - 1\right) = 5$$

$$\frac{\rho_{water}}{\rho_{wood}} - 1 = \frac{5}{60} = \frac{1}{12}$$

$$\frac{\rho_{water}}{\rho_{wood}} = 1 + \frac{1}{12} = \frac{13}{12}$$

The relative density of the wood is

$$\frac{\rho_{wood}}{\rho_{water}} = \frac{12}{13} \approx 0.923$$

Answer provided by <https://www.AssignmentExpert.com>