A block of wood floats in water with 3 by 4 part under water if it float in another liquid with 9 by 10 part under water then the relative density of this liquid is?

Solution:

When a body floats in liquid, the net force is zero

$$F_{\text{net}} = mg - g\rho_{\text{L}}V_{\text{disp}} = 0$$

Thus

$$m = \rho_{\text{L}}V_{\text{disp}}$$

where m is a body mass, ρ_{L} is a liquid density, V_{disp} is the volume of the displaced body of liquid. Because $m = \rho V$, the body density

$$\rho = \rho_{\text{L}}\frac{V_{\text{disp}}}{V}$$

Let us consider this equation for two cases:

$$\rho = \rho_{\text{water}}\frac{V_{\text{disp1}}}{V} = \rho_{\text{water}}\frac{3/4V}{V} = \frac{3}{4}\rho_{\text{water}}$$

$$\rho = \rho_{\text{liquid}}\frac{V_{\text{disp2}}}{V} = \rho_{\text{liquid}}\frac{9/10V}{V} = \frac{9}{10}\rho_{\text{liquid}}$$

Therefore

$$\frac{3}{4}\rho_{\text{water}} = \frac{9}{10}\rho_{\text{liquid}}$$

Finally

$$\rho_{\text{liquid}} = \frac{30}{36}\rho_{\text{water}} = \frac{5}{6}\rho_{\text{water}}$$

Answer: $\rho_{\text{liquid}}/\rho_{\text{water}} = 5/6$

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