**Answer on Question 74132, Physics / Mechanics | Relativity**

**Question**

Two solids A and B float in water . It is observed that A floats with half its volume immersed and B float with 2/3 of its volume immersed . Compare the densities of A and B.

**Solution.** According to the Archimedes' principle the buoyant force $F_b$ on an object equals the weight of the water it displaces, $w_{fl}$, that is,

$$F_b = w_{fl} = m_w g$$

where $m_w$ is the displaced mass of water. Let the volumes of the solids A and B be equal, $V_A = V_B = V$. Buoyant forces for these solids are

$$F_{bA} = m_{wA} g, \;\; F_{bB} = m_{wB} g.$$

Here $m_{wA}$ and $m_{wB}$ are the mass of water displaced by these solids

$$m_{wA} = \rho_w \cdot \frac{1}{2} V, \;\; m_{wB} = \rho_w \cdot \frac{2}{3} V$$

where $\rho_w$ is the density of water. Then we get for buoyant forces

$$F_{bA} = \frac{1}{2} \rho_w g V, \;\; F_{bB} = \frac{2}{3} \rho_w g V.$$

The masses of solids A and B are

$$m_A = \rho_A V, \;\; m_B = \rho_B V$$

where $\rho_A$ and $\rho_B$ are the densities of A and B respectively.

The weights of these bodies are

$$w_A = m_A g = \rho_A g V, \;\; w_B = m_B g = \rho_B g V$$

Since these bodies float in water, they are in equilibrium, and weight of the solids is equal to the buoyant force, that is,

$$F_{bA} = w_A, \;\; F_{bB} = w_B$$

or

$$\frac{1}{2} \rho_w g V = \rho_A g V,$$
$$\frac{2}{3} \rho_w g V = \rho_B g V$$

Dividing the first equality by the second, we obtain

$$\frac{\rho_A}{\rho_B} = \frac{1/2}{2/3} = \frac{3}{4}$$

**Answer:** the density ratio is

$$\frac{\rho_A}{\rho_B} = \frac{3}{4}$$