

Answer on Question #39465, Physics, Mechanics | Kinematics | Dynamics

Question:

2 cubes (side 1 meter) one of relative density 0.6, the other 1.15 are connected by weightless wire and placed in a water tank. In equilibrium, the height of part of lighter cube above water is?

Answer:

Newton's first law of motion:

$$m_1g + m_2g = F_{b1} + F_{b2},$$

where $F_{b1} + F_{b2}$ is total buoyant force

$$m = \rho V = \rho a^3,$$

buoyant force equals (assuming Archimedes' principle):

$$F_{1b} = \rho_w g V = 1 \cdot g a^2 (a - x),$$

where x is the height of part of lighter cube above water

$$F_{1b} = \rho_w g V = 1 \cdot g a^3,$$

therefore

$$\rho_1 a^3 g + \rho_2 a^3 g = g a^2 (a - x) + g a^3$$

$$x = (2 - \rho_1 - \rho_2)a = (2 - 0.6 - 1.15) \cdot 1 = 0.25 \text{ m}$$

Answer: 0.25 m