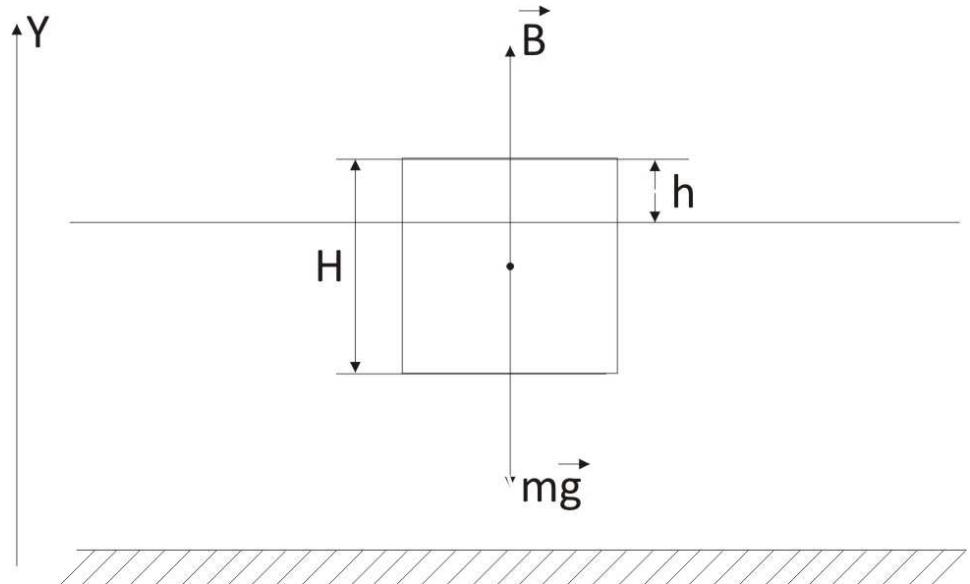


A 10 cm cube floats in water with height of 4 cm remaining above the surface. What is the density of materials from which the cube is made?

Solution.

$$\rho_w = 1000 \frac{kg}{m^3}, H = 10cm = 0.1m, h = 4cm = 0.04m;$$

$$\rho_c - ?$$



Newton's second law in vector form:

$$m\vec{a} = \vec{B} + m\vec{g}.$$

A cube is at rest, then:

$$\vec{a} = 0.$$

$$0 = \vec{B} + m\vec{g}.$$

Projection on Y :

$$0 = B - mg;$$

$$B = mg.$$

B – a buoyancy force.

m - a mass of a cube.

$$m = \rho_c V_c;$$

ρ_c – the density of a cube.

V_c – a volume of a cube.

$$V_c = H^3.$$

$$B = \rho_w V g;$$

ρ_w – a density of a water;

V – a part of volume of a cube below water surface.

$$V = S(H - h);$$

h - the height of the cube above the surface;

S - the area of the face of the cube.

$$S = H^2;$$

$$V = H^2(H - h);$$

$$\rho_w V g = mg;$$

$$\rho_w V = m;$$

$$\rho_w V = \rho_c V_c;$$

$$\rho_w H^2(H - h) = \rho_c H^3;$$

$$\rho_c = \frac{\rho_w(H - h)}{H}.$$

The density of the cube is:

$$\rho_c = \frac{1000 \cdot (0.1 - 0.04)}{0.1} = 600 \left(\frac{kg}{m^3} \right).$$

Answer: The density of the cube is $\rho_c = 600 \frac{kg}{m^3}$.