

Question#18741

A solid metallic having a volume of  $.3m^3$  is completely submerged in water. The weight of the cube when submerged in water is 52300 N. Determine the kind of material the cube is made of. (density of gold=  $19300 \text{ kg/m}^3$  , density of silver=  $18200 \text{ kg/m}^3$  , density of copper=  $17200 \text{ kg/m}^3$ )

Solution:

Let:

$$V = 0.3 \text{ m}^3$$

$$P_{in \text{ water}} = 52300$$

$$\rho_{Au} = 19300 \text{ kg/m}^3, \rho_{Ag} = 18200 \text{ kg/m}^3, \rho_{Cu} = 17200 \text{ kg/m}^3$$

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$$\rho - ?$$

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The weight of metallic in water is:

$P_{in \text{ water}} = mg - F_A$ , where:  $m$  – mass of metallic,  $g = 9.8$ ,  $F_A$  – buoyant force (Archimedes' force)

$$F_A = \rho_{water}gV$$

$$m = \frac{P_{in \text{ water}} + F_A}{g} = \frac{P_{in \text{ water}} + \rho_{water}gV}{g} = \frac{P_{in \text{ water}}}{g} + \rho_{water}V$$

Such as:  $m = \rho V, \rho = \frac{m}{V}$

$$\rho = \frac{\frac{P_{in \text{ water}}}{g} + \rho_{water}V}{V} = \frac{P_{in \text{ water}}}{gV} + \rho_{water}$$

$$\rho = \frac{52300}{9.8 \cdot 0.3} + 1000 = \mathbf{18789.12 \text{ kg/m}^3}$$

**Answer:** the density of metallic is middle from gold and silver, maybe it is an alloy.