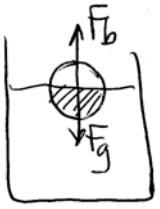
PHYS101.13
QUIZ#11- CHAPTER 14
DATE: 9/6/09

Name: Key Id#:

A solid sphere of density 0.7 g/cm^3 is floating in oil with half of its volume submerged. Calculate the density of oil in kg/m^3.



$$F_b = F_g$$

$$\rho_f g V_{sub} = \rho_o V_o g$$

$$V_{sub} = \frac{V_o}{2} \Rightarrow \rho_f \frac{V_o}{2} = \rho_o V_o$$

$$\rho_f = 2\rho_o = 2 \times 700 \text{ kg/m}^3$$

$$= \boxed{1400 \text{ kg/m}^3}$$

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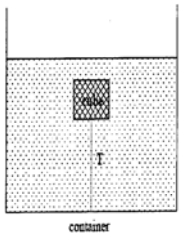
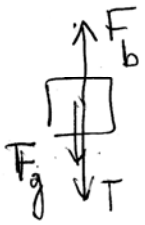
A cube of wood of side = 15.0 cm has a density of 700 kg/m^3. As shown in the figure, the cube is held in equilibrium under water by a string tied to the bottom of a container. Find the tension in the string.



$$F_b - F_g - T = 0$$

$$\Rightarrow T = F_b - F_g$$

$$= \rho_f g V_{ob} - \rho_o g V_{ob}$$



$$T = (\rho_f - \rho_o)\, g\, V_{ob}$$

$$= (1000 - 700) \times 9.8 \times (0.15)^3$$

$$\boxed{T = 9.1 \text{ N}}$$

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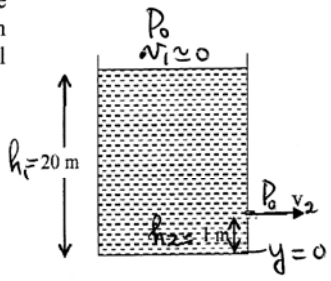
Consider a large [redacted] cylindrical tank with oil inside it. There is a small hole at a height of 1.0 m from the bottom of the tank. The top of the cylinder is open to the atmosphere. Find the speed at which oil leaves the hole, when the oil level is 20 m above the bottom of the tank. (The density of oil is 850 kg/m^3).



$$P_0 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = P_0 + \frac{1}{2}\rho v_2^2 + \rho g h_2$$

$v_1 \simeq 0$

$$\rho g h_1 = \frac{1}{2}\rho v_2^2 + \rho g h_2$$

$$v_2^2 = 2g(h_1 - h_2)$$

$$v_2 = \sqrt{2g(h_1 - h_2)}$$

$$= \sqrt{2 \times 9.8(20 - 1)} = \boxed{19.3 \text{ m/s}}$$