Read 9.5
10.1

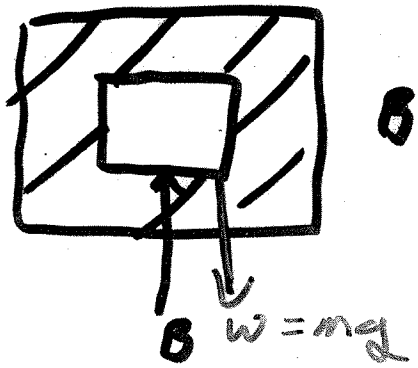
Group tomorrow

office hours 1:30 - 2:30

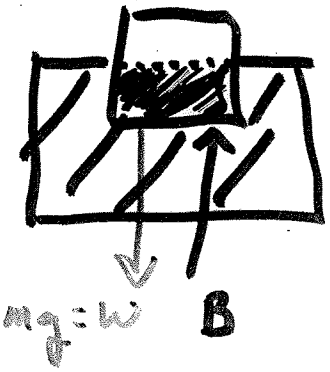
Review

Archimedes principle

Buoyant force = weight of fluid displaced

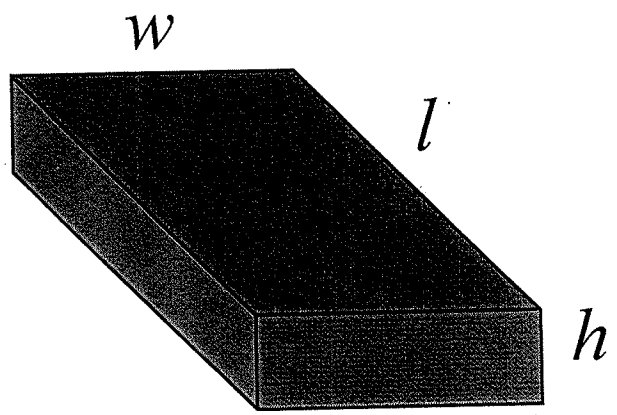


$B = \rho_f V_f g = \rho_f V_{object} g$



$B = \rho_f V_f g$

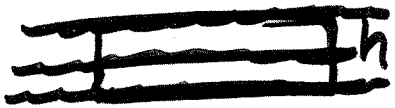
Problem: A small steel boat is shaped like a rectangular box with dimensions of 6.5 m long, by 2.0 m wide, by 0.6 m high and has a weight of 7000 N. How much cargo can you put in this boat before it sinks?

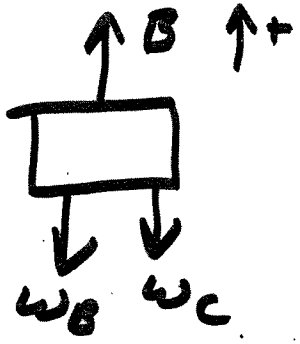


$w_B = 7000\,N$

$l = 6.5\,m$, $w = 2\,m$ $h = .6\,m$

want w_{cargo}





$F_{net} = 0$

$B - w_c - w_B = 0$

$w_c = B - w_B$

$= \rho_w V_w g - w_B$

$= \rho_w l w h g - w_B = (1000\,kg/m^3)(6.5\,m)(2\,m)(.6\,m)(9.8\,m/s^2) - 7000\,N$

$w_c = 69,400\,N$

(A)

Interactive Question

A 10 kg piece of aluminum sits at the bottom of a lake, right next to a 10 kg piece of lead. Which has the greater buoyant force on it? Aluminum is less dense than lead. Hint: Which piece of metal is larger?

A) The aluminum
B) The lead
C) Both have the same buoyant force
D) It is impossible to determine without knowing their volumes.

Interactive Question

50 cm^3 of wood is floating on water, and 50 cm^3 of iron is totally submerged. Which has the greater buoyant force on it?

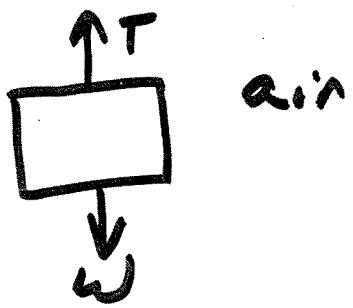
A) The wood.
B) The iron.
C) Both have the same buoyant force.
D) It is impossible to tell from the information given.

Interactive Question

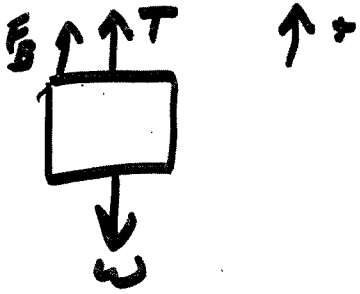
An object floats with half its volume beneath the surface of the water. The weight of the displaced water is 2000 N. What is the weight of the object?

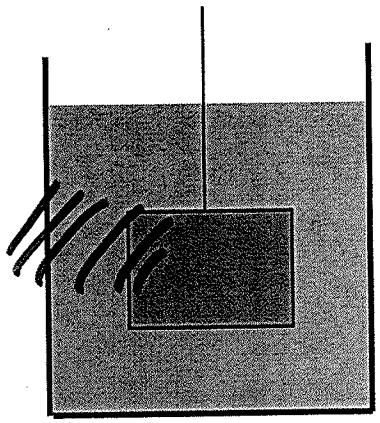
A) 1000 N
B) 2000 N
C) 4000 N
D) Impossible to determine without more information.

Problem: A block of aluminum with a density of 2700 kg/m^3 is hanging in a beaker of water by a string, but not touching the bottom. If the aluminum has a mass of 0.450 kg, what is the tension in the string?



air





$T + F_B - \omega = 0$

$T = \omega - F_B = mg - \rho_w V_w g = mg - \rho_w V_{al} g$

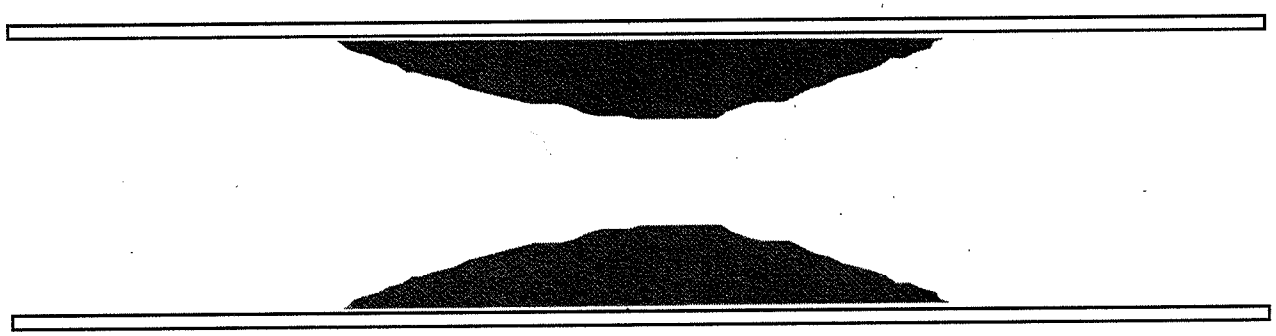
$\rho = \frac{m}{V} \quad V = \frac{m}{\rho} = \frac{.45\,kg}{2700\,kg/m^3} = .000166\,m^3$

$T = (45\,kg)(9.8\,m/s^2) - (1000\,kg/m^3)(9.8\,m/s^2)(.000166\,m^3)$

$= 441\,N - 1.63\,N = 2.8\,N$

Interactive Question

Blood flows through a coronary artery that is partially blocked by deposits along the artery wall. Through which part of the artery is the volume flow rate largest?

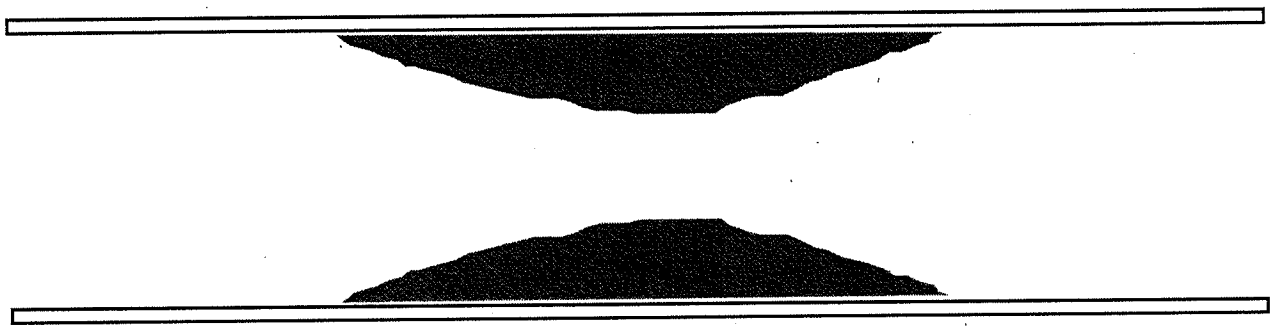


A) The narrow part
B) The wide part
C) The flow rate is the same in both parts

(A)

Interactive Question

Blood flows through a coronary artery that is partially blocked by deposits along the artery wall. Through which part of the artery is the flow speed largest?



A) The narrow part
B) The wide part
C) The speed is the same in both parts

(A)

Interactive Question

Water flows through pipe A into pipe B. Pipe B has three times the cross-sectional area that pipe A has. Compared to the speed of the water in pipe A, the speed in pipe B is:

A) 1/3 as fast

B) 1/2 as fast

C) the same

D) 3 times faster

E) 9 times faster

Interactive Question

Water enters a pipe of radius r with a certain velocity. The water encounters a location in the pipe where its velocity is increased to 4 times its initial velocity. What is the radius of the pipe? (Remember that $A = \pi r^2$)

A) $r/16$
B) $r/4$
C) $r/2$
D) $2r$
E) $4r$