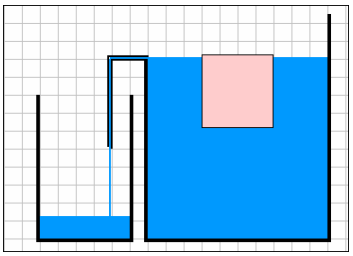
Worksheet for Exploration 14.1: Floating and Density



How can a boat made out of a material more dense than water float? The block has a mass of 0.185 kg **(position is given in centimeters)**. If this block is a *cube*, what is the density of the block? Note that since it is greater than water (1000 kg/m^3) the block sinks as shown in the animation. Restart.

Block Density=_____

We reshape the block so that it has the same depth into the screen, but is wider and taller with walls that are 0.21-cm thick.

a. When the animation runs, what is the volume of water displaced (the dimension of the water container into the screen that you cannot see is 10 cm)?

   i. First sketch a free body force diagram for forces acting on the reshaped box. (One of these is the buoyant force).

Displaced water:

Length=_____ Width=_____ Depth=_____

Volume displaced=_____

b. Using the density of water (1000 kg/m^3), find the mass of the water displaced. Show that it is equal to the mass of the reshaped block. Thus, the block floats.
   i. Think about how mass, density and volume all relate.

mass of water=_____

c. Another way to think about this is that in its new shape the block has an effective density (total mass/total volume) less than that of the water. Divide the mass (0.185 kg) by the new volume to find the new effective density of the block.

Effective Block Density=_____

d. How does the effective density compare to the density of water?

The weight (mass*9.8 m/s^2) of the water displaced (even if the displaced water leaves the container) is equal to the buoyant force on the block. In the case of a floating object, the buoyant force is equal to the weight of the floating object.