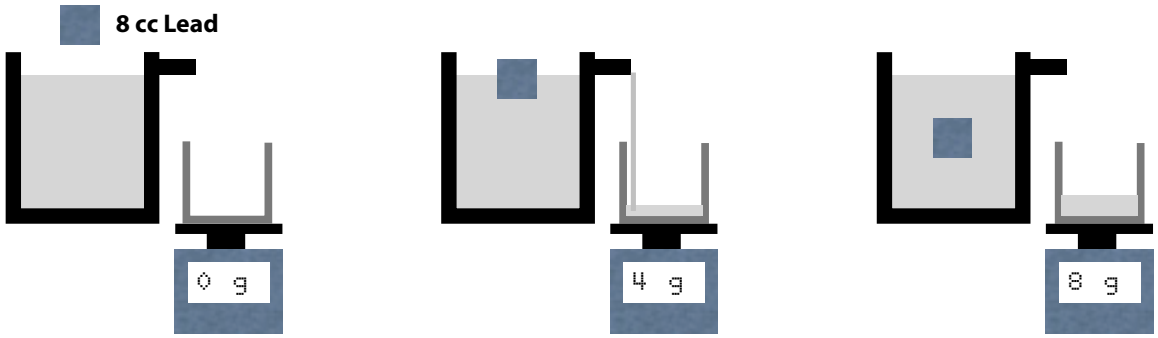
PhyzJob: Buoyancy Overflow

Felix

Densities: **Water: 1.0 g/cc** **Lead: 11 g/cc** **Aluminum: 2.7 g/cc** **Styrofoam 0.9 g/cc**

1. A vessel is filled with water to its brim. An 8 cc (cubic centimeter: cm^3) cube of lead is placed in the vessel. It sinks to the bottom, causing 8 cc of water to overflow.



Since the density of water is 1 g/cc, the 8 cc of water that overflow has a mass of 8 grams.

a. If an 8 cc sphere of aluminum had been used instead of the 8 cc cube of lead, how much water would have overflowed? Explain

8 cc since it would sink (become fully submerged)

b. If an 8 cc cylinder of water had been used, would the result have been any different? Explain.

8 cc since it would become completely submerged

c. If an 8 cc tetrahedron of Styrofoam had been used, would the result have been any different? Explain.

Less water would be displaced since the immersed Styrofoam would not become fully submerged.

2. While the lead block sank to the bottom, the pressure on it _____increased_____

while the buoyant force on it _____remained the same_____.

3. Rank the volume of water displaced by each object: lead, aluminum, water, and Styrofoam.

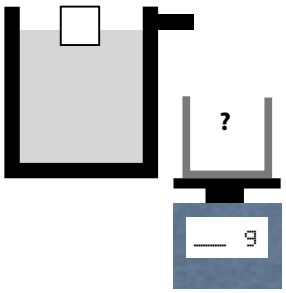
Displaced Volume: Lead = Aluminum = Water > Styrofoam

4. Rank the buoyant force acting on each object: Lead, Aluminum, and Styrofoam.

Buoyant Force: Lead = Aluminum = Water > Styrofoam

4. Lead = Aluminum = Water > Styrofoam

5. An 8 cc plastic cube is immersed in the water and causes 2 cc of water to overflow. (Since the density of water is 1 g/cc, 2 cc = 2 g.)
a. What is the density of the plastic (in g/cc)?



ρ = m/V = 2 g / 8 cc = 0.25 g/cc

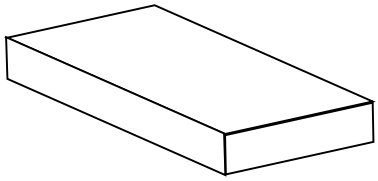
b. How much water would overflow if an identical cube were set on top of the original cube?

4 cc

c. How many cubes (total) could be stacked on top of the original cube before that cube is completely submerged?

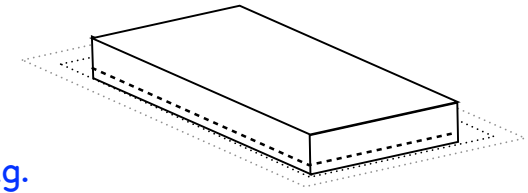
3 on top of the one in the water (each displaces an additional 2 cc)

6. A raft is 5 meters long, 2 meters wide, and 0.1 meter tall.
a. What is the volume of the raft?



V = L x W x H = 5 m · 2 m · 0.1 m = 1.0 m^3

When set in the water it sinks 2 centimeters deep into that water.
b. What volume of water was displaced?



V = L x W x H = 5 m · 2 m · 0.02 m = 0.2 m^3

c. What mass of water was displaced?

ρ = m/V => m = ρ V = 1000 kg · 0.2 m^3 = 200 kg.

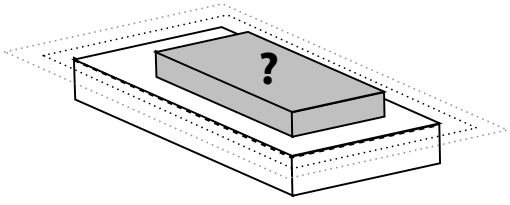
d. What is the mass of the raft?

m = 200 kg.

e. What is the density of the raft?

ρ = m/V = 200 kg / 1 m^3

f. How much water would be displaced if the entire raft were forcibly submerged? Answer in terms of volume and the corresponding mass.



1 m^3 = 1000 kg

g. How much mass could be added to the deck of the raft before it was completely submerged?

800 kg more than the 200 kg mass of the raft.

2. 0.25 g\cc e. 200 kg\m^3 g. 800 kg more