Homework

- Done Online
- First one is due today at 11

Labs

- In S415 ESC
- Can be done anytime during week
- Turn into boxes outside classroom.
- No make-up--equipment is taken down Sat.
Buoyant Force:

The force caused by the difference in pressure between the top and the bottom of an object when the object is in a fluid (liquid or gas).
What is the net force on a 1 kg cube with sides which are 20 cm long submerged 1 meter under water (not touching bottom)? Remember that the acceleration due to gravity is 9.8 m/s$^2$ and the density of water is 1000 kg/m$^3$.

A. 78.4 N upward
B. 68.6 N downward
C. 68.6 N upward
D. 78.4 N downward
E. None of the above
\[ F = \rho g L^3 - mg \]

Bouyant Force

\[ \bar{F}_T - \frac{\rho T A}{F_t} + f_B + f_g = F \]

\[ -(P_0 + \rho g h) L^2 + (P_0 + \rho g (h + L)) L^2 \]
The buoyant force on an object totally submerged in a fluid depends on

A. The mass of the object

B. The volume of the object, or

C. Both.

✓
What if it’s not a cube?
Eureka!

Archimedes principle: The buoyant force is *always* the weight of the fluid that the object is displacing at the moment.
Three cubes of the same size are completely submerged under water: lead, steel and wood. The bouyant force is greatest on the ________ cube

1. Lead
2. Steel
3. Wood
4. None... it is the same
Consider a rowboat floating on a lake. The weight of the rowboat, including the people sitting in it, is 500 pounds. The buoyant force on the rowboat is

a) Greater than 500 pounds,

b) Less than 500 pounds, or

c) Equal to 500 pounds.

✅ c) Equal to 500 pounds.
Three Cases
1) Penny—More dense than the liquid
2) Ping Pong Ball—Less dense than the liquid
3) Submarine, fish—Neutral buoyancy

Submarines and fish can adjust their density!
An iron cannon is placed in a boat. The boat sinks a little to displace more water. The amount of new water displaced is

A. A volume of water equal to the volume of the cannon.

B. A volume of water greater than the volume of the cannon.

C. A volume of water less than the volume of the cannon.
WHAT ARE YOUR OPTIONS? (I HEARD SOMETHING ON THE RADIO)
A cube of styrofoam, one meter on a side and weighing 10 kg, is floating in water, sinking a depth $h$ into the water. Knowing that water has a density of 1000 kg/m$^3$, what is $h$?

A. 2 cm < $h$ ≤ 4 cm
B. 4 cm < $h$ ≤ 6 cm
C. 6 cm < $h$ ≤ 8 cm
D. 8 cm < $h$ ≤ 10 cm
E. None of the above
\[ F = 0 = F_b - mg \]

\[ = m_w g - mg \]

\[ = \rho_w A h g - mg = 0 \]