"Floating a Boat" Lab Answers

PROCEDURE:

1. Mass = 265 grams (*Note that the mass of your raft may have been a little different*)

$$W = mg = (0.265\ kg)(9.81\ m/s^2) = \mathbf{2.59\ N}$$

2. Probably at about 2 cm

3. 8 cm x 16 cm = 128 cm^2 (*Note that you may have slightly different area*)

$$128\ cm^2 \times \frac{1\ m}{100\ cm} \times \frac{1\ m}{100\ cm} = \mathbf{0.0128\ m^2}$$

4. $Dgh = \frac{F}{A}$

$$h = \frac{F}{DgA} = \frac{2.59\ N}{(1000\ kg/m3)(9.81\ m/s^2)(0.0128\ m^2)} = \mathbf{0.0206\ m}$$

5. h = **2.06 cm**

6. Assuming the water line was at exactly 2 cm, the percent error is…

$$\frac{2.06 - 2.0}{2.06} \times 100\% = \mathbf{2.9\%\ error}$$

QUESTIONS:

1) Wood is less dense than water, so it floats on the water.

2) Steel has a much higher density than water, so Archimedes principle applies. The steel cargo ship must displace its weight plus the cargo weight in order to float; thus, much of the ship is under water displacing the water.

3) There are two ways you could have answered this…

> Somewhat Correct: The buoyant force is always the same; the stone displaces the same amount of water wherever it is in the lake. Note: this assumes water is not compressible.
>
> Correct: The buoyancy force is greatest near the bottom of the lake because the density of the water changes with depth creating more pressure, and thus, more buoyancy force than near the surface.

4) The pine raft would float **lower** in the rubbing alcohol as compared to water. The rubbing alcohol is less dense than water, so more alcohol will need to be displaced to equal the weight of the raft.

5) The boat would sit **higher**. The lead block suspended under the boat displaces some of the water, so the boat does not need to displace as much water and sits higher.