Name _____ Date _____

CONCEPTUAL Physics PRACTICE PAGE

Chapter 13 Liquids

Archimedes' Principle I

1. Consider a balloon filled with 1 liter of water (1000 cm^3) in equilibrium in a container of water, as shown in Figure 1.

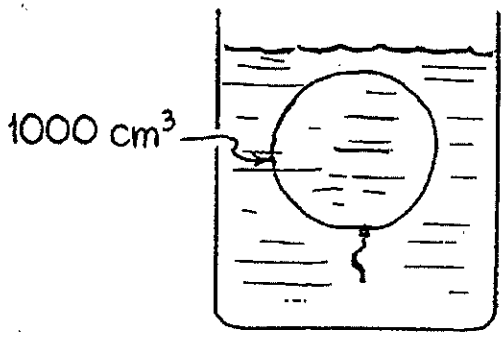


Figure 1

a. What is the mass of the 1 liter of water?

_____

b. What is the weight of the 1 liter of water?

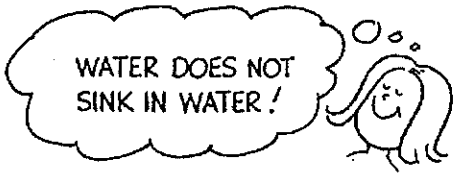
_____

c. What is the weight of water displaced by the balloon?

_____

d. What is the buoyant force on the balloon?

_____



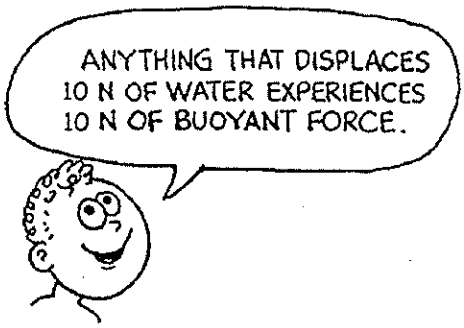
e. Sketch a pair of vectors in Figure 1: one for the weight of the balloon and the other for the buoyant force that acts on it. How do the size and directions of your vectors compare?

_____

2. As a thought experiment, pretend we could remove the water from the balloon but still have it remain the same size of 1 liter. Then inside the balloon is a vacuum.

a. What is the mass of the liter of nothing?

_____

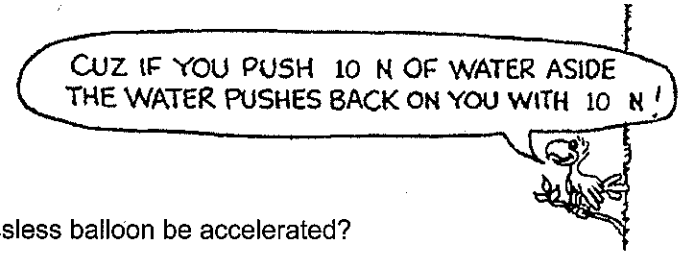


b. What is the weight of the liter of nothing?

_____

c. What is the weight of water displaced by the nearly massless 1-liter balloon?

_____



d. What is the buoyant force on the nearly massless balloon?

_____

e. In which direction would the nearly massless balloon be accelerated?

_____

Chapter 13 Liquids

Archimedes' Principle I*—*continued

3. Assume the balloon is replaced by a 0.5-kilogram piece of wood that has exactly the same volume (1000 cm^3), as shown in Figure 2. The wood is held in the same submerged position beneath the surface of the water.

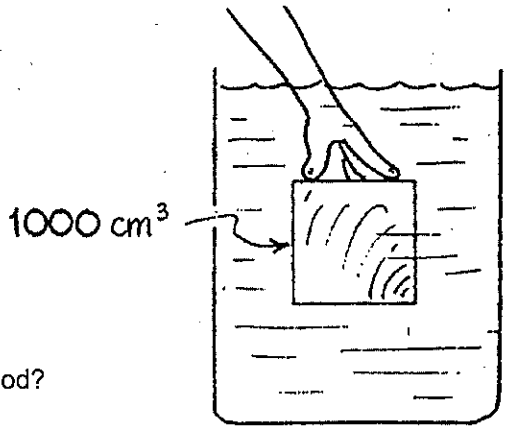


Figure 2

a. What volume of water is displaced by the wood?

_____

b. What is the mass of the water displaced by the wood?

_____

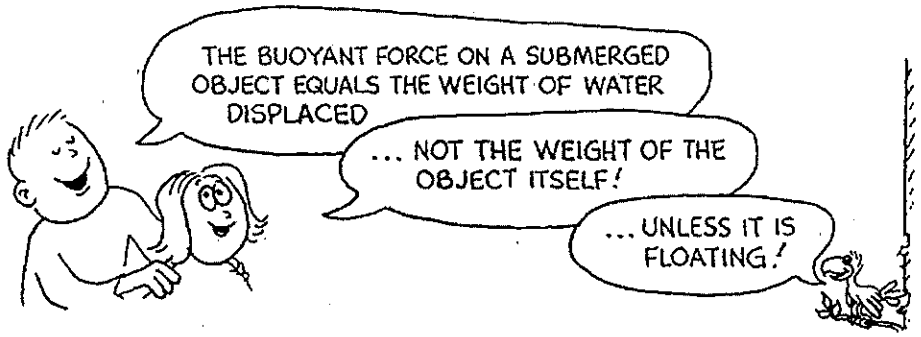
c. What is the weight of the water displaced by the wood? _____

d. How much buoyant force does the surrounding water exert on the wood? _____

e. When the hand is removed, what is the net force on the wood?

_____

f. In which direction does the wood accelerate when released? _____



4. Repeat parts *a* through *f* in the previous question for a 5-kg rock that has the same volume (1000 cm^3), as shown in Figure 3. Assume the rock is suspended by a string in the container of water.

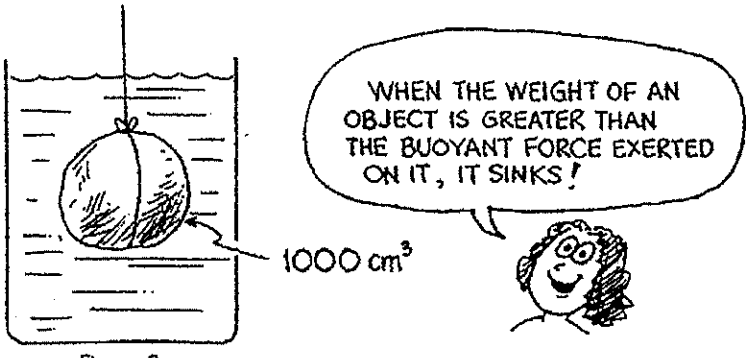


Figure 3

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

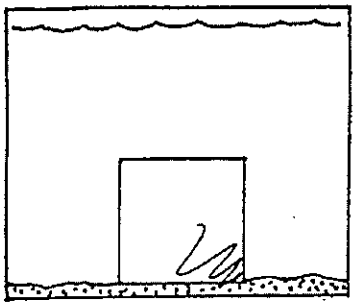
Hewitt Drew it!

Name _____ Date _____

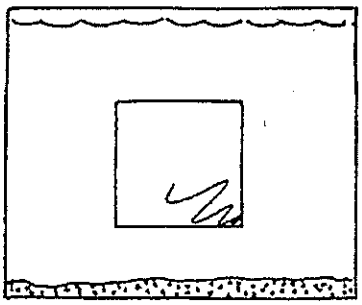
CONCEPTUAL Physics PRACTICE PAGE

Chapter 13 Liquids
Archimedes' Principle II

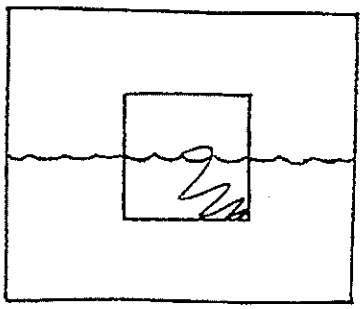
1. The water lines for the first three cases are shown. Sketch in the appropriate water lines for cases *d* and *e*, and make up your own for case *f*.



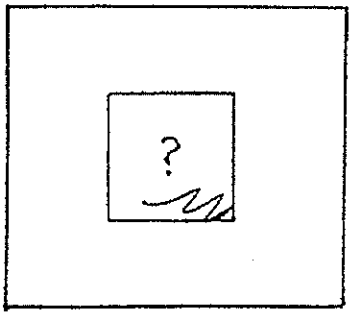
a. DENSER THAN WATER



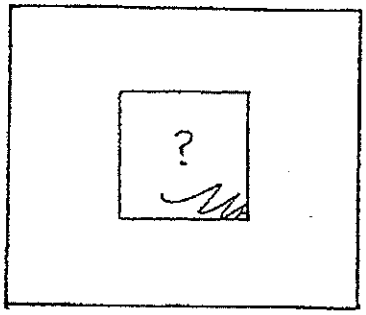
b. SAME DENSITY AS WATER



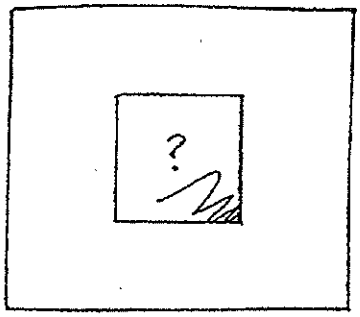
c. 1/2 AS DENSE AS WATER



d. 1/4 AS DENSE AS WATER



e. 3/4 AS DENSE AS WATER



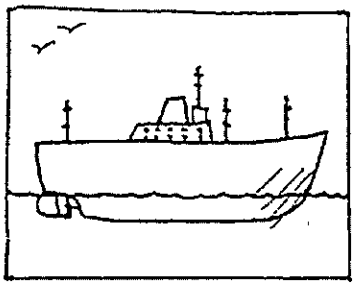
f. ___ AS DENSE AS WATER

2. If the weight of a ship is 100 million N, then the water it displaces weighs _____.

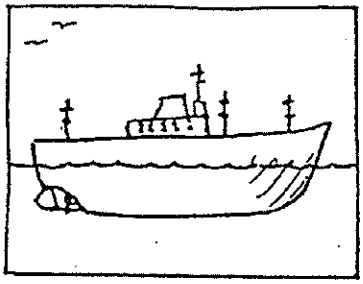
   If cargo weighing 1000 N is put on board, then the ship will sink down until an extra

   _____ of water is displaced.

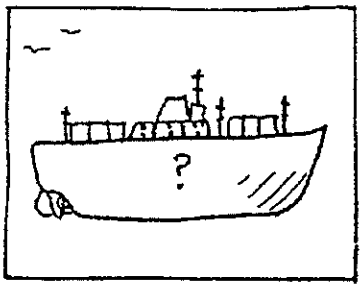
3. The first two sketches below show the water line for an empty and a loaded ship, respectively. Draw in the appropriate water line for the third sketch.



a. SHIP EMPTY



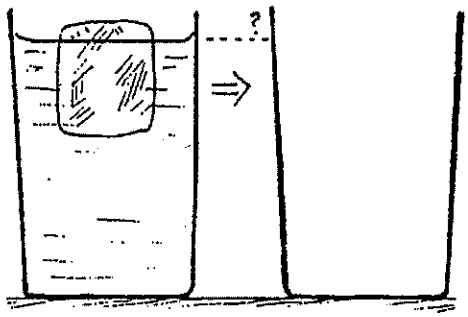
b. SHIP LOADED WITH 50 TONS OF IRON



c. SHIP LOADED WITH 50 TONS OF STYROFOAM

Chapter 13 Liquids

Archimedes' Principles II*—*continued



4. Here is a glass of ice water with an ice cube floating in it. Draw the water line after the ice cube melts. (Will the water line rise, fall, or remain the same?)

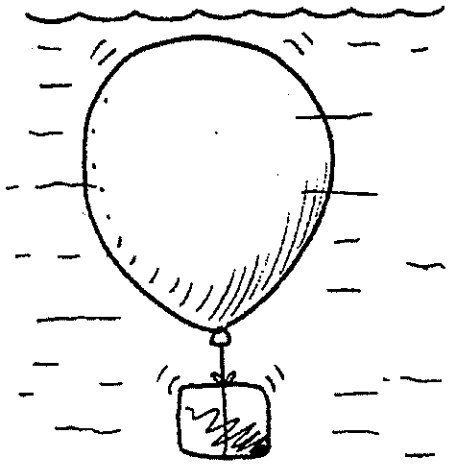
_____

_____

_____

_____

_____



5. The air-filled balloon is weighted so it sinks in water. Near the surface, the balloon has a certain volume. Draw the balloon at the bottom (inside the dashed square) and show whether it is bigger, smaller, or the same size.

   a. Since the weighted balloon sinks, how does its overall density compare to the density of water?

   _____

   b. As the weighted balloon sinks, does its density increase, decease, or remain the same?

   _____

   _____

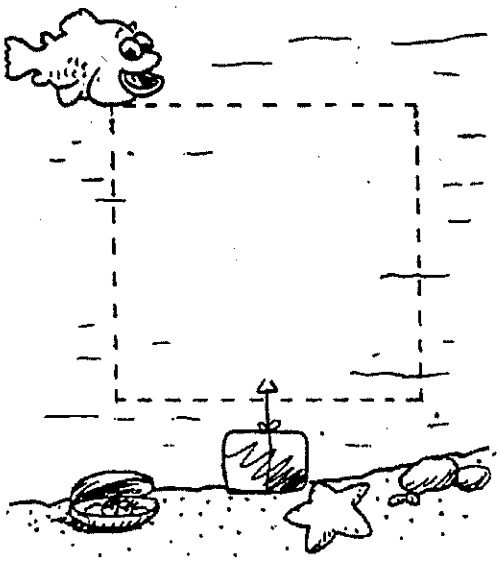
   c. Since the weighted balloon sinks, how does the buoyant force on it compare to its weight?

   _____

   d. As the weighted balloon sinks deeper, does the buoyant force on it increase, decrease, or remain the same?

   _____

   _____



6. What would your answers be to the above questions (5a to d) for a rock instead of an air-filled balloon?

   a. _____

   b. _____

   c. _____

   d. _____

Hewitt Drew It!