Name: _____

Think about it

Vocabulary
density
bladder
ballast

Did you ever wonder how water wings help a little kid float? Water wings are those inflatable "doughnuts" filled with air and worn on each arm. They take up a lot of space (volume) but are not very heavy. These wings can increase the volume of the person without adding much to the person's mass. When the volume is increased without much increase in mass, the person and the wings together have a better chance of floating. The relationship between mass and volume that affects sinking and floating is called *density.* An object that has a large volume compared to its mass has a low density. An object that has a large mass compared to its volume has a higher density.

If an object is less dense than water, it floats. If it is more dense than water, it sinks. With the water wings on and filled with air, the person and wings together are less dense than the water, and therefore float. If the person takes off the water wings, the person's volume decreases, but they still have about the same mass. This means that the person becomes more dense and had better know how to swim!

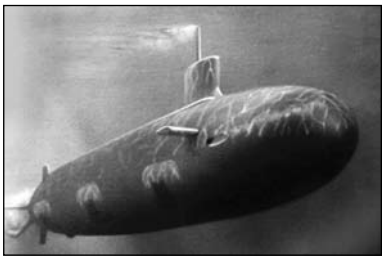
A life jacket works in a similar way. A life jacket is filled with a very light foam material. If you've ever worn one, you know the life jacket increases your volume but doesn't increase your mass by much. This causes the person and the life jacket together to be less dense than water, and therefore float.

Fish also need a way to help them float or sink. Many fish have a special balloon-like bladder in their bodies to help them adjust their depth in the water. This built-in swim bladder keeps the fish at the right depth so it doesn't have to waste energy keeping itself in place. Gas in the fish's blood can move into the bladder to increase the bladder's volume or move out of the bladder to decrease the volume. When the fish swims down into deeper water, gas moves out of the

Think about it (*continued*)

swim bladder. This decreases the volume of the bladder and the entire fish. This decrease in volume *increases* the density of the fish and helps it stay down in deeper water. When the fish rises to the surface, gas moves into the swim bladder. This increases the volume of the bladder and the entire fish. This increase in volume *decreases* the density of the fish and helps it stay closer to the surface. Some fish such as sharks don't have swim bladders at all. To help keep itself at the correct depth, sharks have large oily livers, which are less dense than water and specially shaped fins, which they use for adjusting their depth in the water.

People usually float better when they take a deep breath and hold it. When they do, they fill their lungs with air and their chests expand. This increases their volume which decreases their density and helps them float. When they exhale, their volume decreases, they become more dense, and they tend to sink.



Submarines can also control their sinking and floating. But instead of taking in and releasing gas, submarines take in and release sea water. Submarines are built with special tanks called *ballast* tanks. Submarines can sink, rise, and float by adjusting the amount of water and air in these tanks. The sub is built so when the tanks are full of air, the sub's volume and mass make it float. When the ballast tanks are filled with sea water instead of air, the sub has the same volume as before, but greater mass. This increases the sub's density and makes it sink. To rise again, the sub reduces its mass by pushing the sea water out. Now the sub has the same volume but less mass. This decreases the sub's density and the sub moves up toward the surface. To stay at a particular depth below the surface, enough water is brought into the tanks so that the density of the sub is equal to the density of the water surrounding it.

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Think about it (*continued*)

1. Which of the following is the best summary of this passage?
   a. Water wings and life jackets can help you float.
   b. Life jackets increase your volume quite a bit without increasing your mass very much.
   c. Fish, life jackets, and submarines all can float.
   d. Density is a relationship between mass and volume, which explains why things sink or float.

2. When kids wear water wings, their…
   a. mass increases quite a bit and volume increases quite a bit.
   b. mass decreases slightly and volume increases quite a bit.
   c. mass increases slightly and volume increases quite a bit.
   d. mass and volume both stay the same.

3. Gas moves into or out of a fish's swim bladder to…
   a. help the fish swim faster.
   b. help the fish stay at the right depth in the water.
   c. help the fish get more worms from fishing hooks.
   d. help the fish increase its mass.

4. In the first paragraph, the word *volume* refers to…
   a. how heavy something is.
   b. how much space something takes up.
   c. how dense you are in water.
   d. how well you can float.

5. When you inhale and hold your breath, you float more easily because…
   a. your mass decreases.
   b. your volume increases.
   c. your volume and mass both decrease.
   d. your volume stays the same.

6. Submarines take in or release sea water from their ballast tanks to…
   a. enable them to become more or less dense than the surrounding water.
   b. bring water in for the people inside the submarine to drink.
   c. clean the sea water of pollution.
   d. move faster in the ocean.

Name: _____

Think about it (*continued*)

7. Most wood floats in water but samples of a type of wood called ebony can sink. Based on the reading, what would you say about the density of this sinking wood compared to the density of water?

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8. Almost all rocks sink but a type of rock called pumice floats. Based on the reading, what would you say about the density of this floating rock compared to the density of water?

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9. If a fish with a swim bladder needs to go deeper in the water, explain how the swim bladder helps the fish stay in deeper water.

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10. If a submarine is far under water and needs to rise toward the surface, explain how ballast tanks are used to help the submarine go up.

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