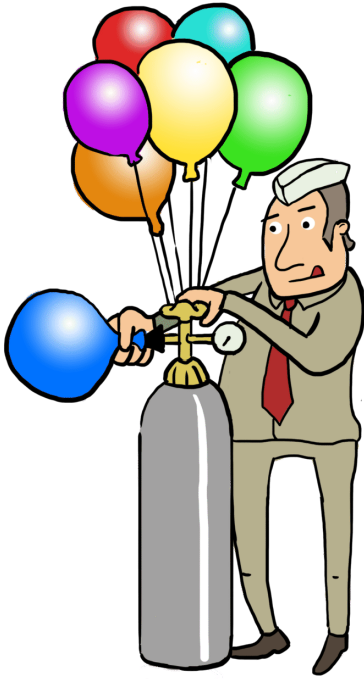


Water Reading 2



[Figure1]

The man in this cartoon is filling balloons with helium **gas**. What will happen if he lets go of the filled balloons? They will rise up into the air until they reach the ceiling. Do you know why? It's because helium has less **density** than air.

Defining Density

Density is an important physical property of matter. It reflects how closely packed the particles of matter are. When particles are packed together more tightly, matter has greater density. Differences in density of matter explain many phenomena, not just why helium balloons rise. For example, differences in density of cool and warm ocean **water** explain why currents such as the Gulf Stream flow through the oceans.

To better understand density, think about a bowling ball and volleyball, pictured in the **Figure below**. Imagine lifting each ball. The two balls are about the same size, but the bowling ball feels much heavier than the volleyball. That's because the bowling ball is made of **solid** plastic, which contains a lot of tightly packed particles of matter. The volleyball, in contrast, is full of air, which contains fewer, more widely spaced particles of matter. In other words, the matter inside the bowling ball is denser than the matter inside the volleyball.



A bowling ball is denser than a volleyball. Although both balls are similar in size, the bowling ball feels much heavier than the volleyball.[Figure2]

Q: If you ever went bowling, you may have noticed that some bowling balls feel heavier than others even though they are the same size. How can this be?

A: Bowling balls that feel lighter are made of matter that is less dense.

Calculating Density

The density of matter is actually the amount of matter in a given space. The amount of matter is measured by its mass, and the space matter takes up is measured by its volume. Therefore, the density of matter can be calculated with this formula:

Density=mass/volume

Assume, for example, that a book has a mass of 500 g and a volume of 1000 cm³. Then the density of the book is:

Density=500 g/1000 cm³=0.5 g/cm³

Q: What is the density of a **liquid** that has a volume of 30 mL and a mass of 300 g?

A: The density of the **liquid** is:

Density=300 g/30 mL=10 g/mL

Summary

- Density is an important physical property of matter. It reflects how closely packed the particles of matter are.
 - The density of matter can be calculated by dividing its mass by its volume.
-

Review

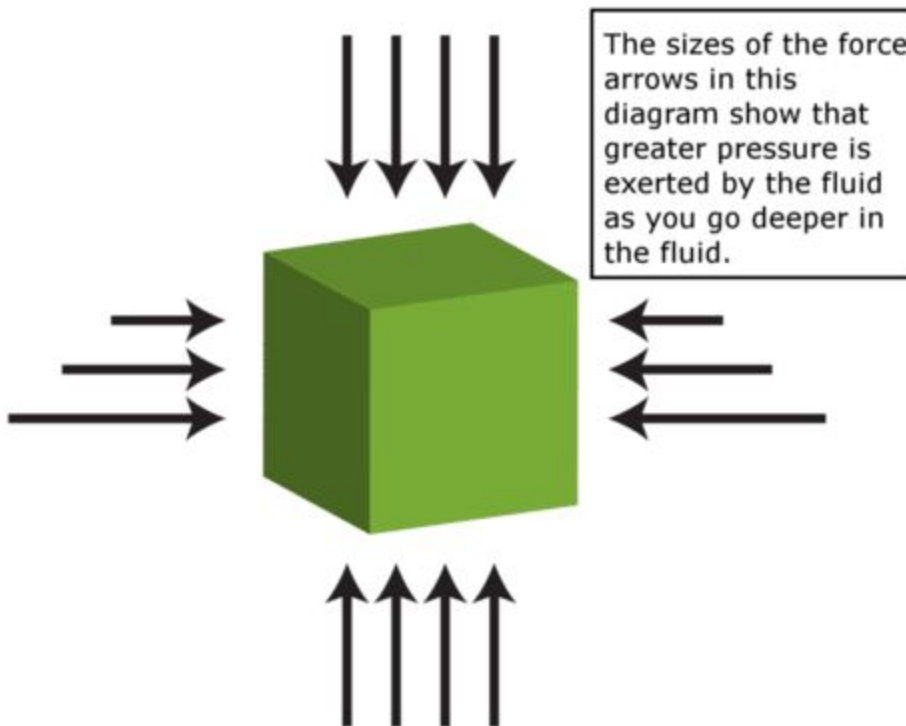
1. What is density?
2. Find the density of an object that has a mass of 5 kg and a volume of 50 cm³.
3. Create a sketch that shows the particles of matter in two substances that differ in density. Label the sketch to show which substance has greater density.

What could be more refreshing than floating in cool [water](#) on a hot summer day? Water and other fluids have a special force that allows people and things to float in them. The force is called **buoyant force**.

What Is Buoyant Force?

Buoyant force is an upward force that fluids exert on any object that is placed in them. The ability of fluids to exert this force is called **buoyancy**. What explains buoyant force? A fluid exerts pressure in all directions, but the pressure is greater at greater depth. Therefore, the fluid below an object, where the fluid is deeper, exerts greater pressure on the object than the fluid above it. You can see in the [Figure below](#) how this works. Buoyant force explains why the girl pictured above can float in [water](#).

Fluid Pressure



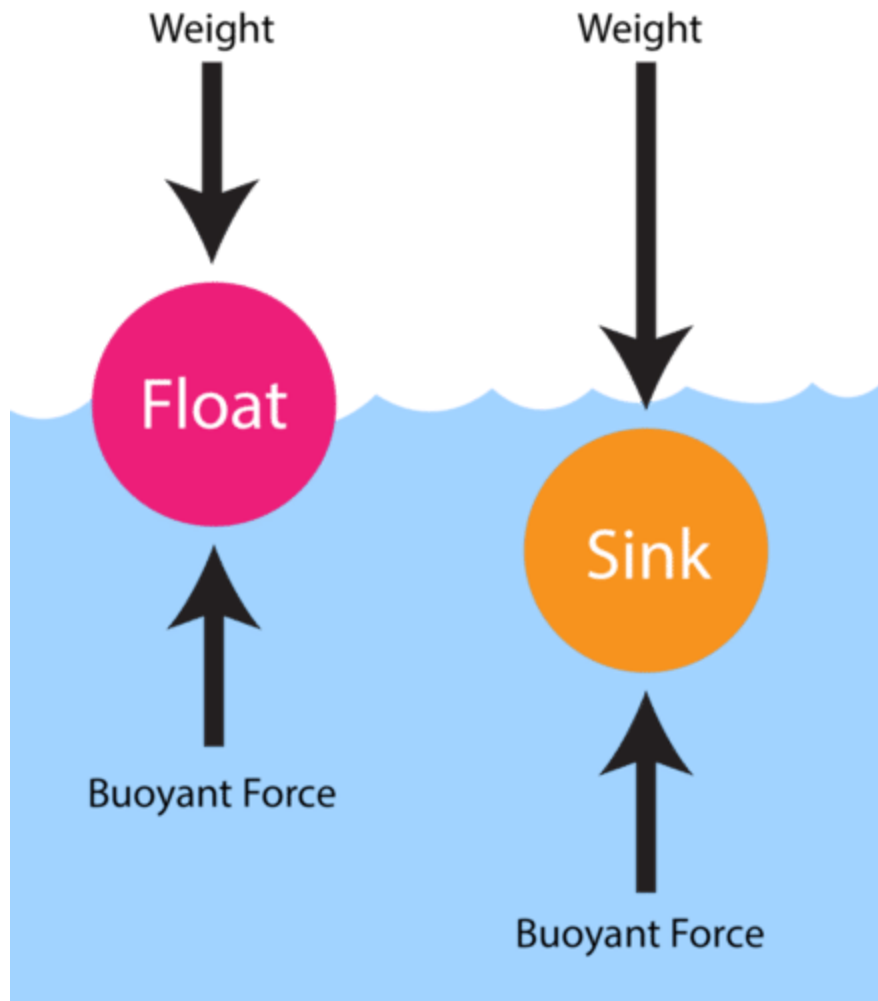
[Figure2]

Q: You've probably noticed that some things don't float in [water](#). For example, if you drop a stone in water, it will sink to the bottom rather than floating. If buoyant force applies to all objects in fluids, why do some objects sink instead of float?

A: The answer has to do with their [weight](#).

Weight and Buoyant Force

Weight is a measure of the force of gravity pulling down on an object, whereas buoyant force pushes up on an object. Which force is greater determines whether an object sinks or floats. Look at the [Figure below](#). On the left, the object's [weight](#) is the same as the buoyant force acting on it, so the object floats. On the right, the object's weight is greater than the buoyant force acting on it, so the object sinks.



[Figure3]

Because of buoyant force, objects seem lighter in water. You may have noticed this when you went swimming and could easily pick up a friend or sibling under the water. Some of the person's weight was countered by the buoyant force of the water.

Density and Buoyant Force

Density, or the amount of mass in a given volume, is also related to the ability of an object to float. That's because density affects weight. A given volume of a denser substance is heavier than the same volume of a less dense substance. For example, ice is less dense than liquid water. This explains why the giant ice berg in the **Figure below** is floating in the ocean.



[Figure4]

Q: Can you think of more examples of substances that float in a fluid because they are low in density?

A: Oil is less dense than water, so oil from a spill floats on ocean water. Helium is less dense than air, so balloons filled with helium float in air.

Have you ever gone fishing? Oftentimes, a sinker is attached to a fishing line in order to sink the hook deep enough in the water to bait a fish. Use the simulation below to adjust the material of the sinker so that it submerges in the water. Then, play around with the different materials to see if they will sink or float. Challenge: Can you get the rubber ducky to sink?

Summary

- Buoyant force is an upward force that fluids exert on any object that is placed in them. Buoyant force occurs because the fluid below an object exerts greater pressure on the object than the fluid above it.
- If an object's weight is less than the buoyant force acting on it, then the object floats. If an object's weight is greater than the buoyant force acting on it, then the object sinks.
- A given volume of a denser substance is heavier than the same volume of a less dense substance. Therefore, density of an object also affects whether it sinks or floats.

Review

1. What is buoyant force?
2. Why does buoyant force occur?
3. Why is a heavier object more likely than a lighter object to sink instead of float in water?
4. Assume you have an ice cube and also a small rock that is the same size and shape as the ice cube. Predict what would happen if you placed the ice cube and rock in a glass of water. Explain your prediction.

What is the Water Cycle?

The water cycle is a way that water moves all around the Earth. It never stops and doesn't really have a beginning or an end. It's like a big circle. We'll describe it by starting with water that's on land. For example, water that resides in the ocean or in a lake. Some water on the surface of the ocean will evaporate due to heat from the sun. When it evaporates it turns into vapor water and goes up into the atmosphere. This vapor water gets together with a lot of other vapor water and turns into [clouds](#). Clouds move about the earth with the weather and once they are so full of water they drop the water to Earth in some form of precipitation. It could be rain, snow, sleet, or hail. When the water hits the earth it may fall right back into the ocean or feed a flower or be snow on the top of a mountain. Eventually this water will evaporate and start the whole cycle again.

How water goes from land to vapor in the atmosphere

There are three main ways that water on land turns into vapor:

Evaporation - This is the main process by which water goes from the ground to vapor in the atmosphere. Around 90 percent of the water vapor in the atmosphere got there through evaporation. Evaporation takes place only on the water's surface. It takes energy in the form of heat. Hot water will evaporate more easily than cold water. The sun provides a lot of the energy for evaporation in the water cycle, primarily causing evaporation from the surface of the ocean.

Sublimation - This is when water moves directly to vapor from ice or snow without ever melting into water. Good conditions for sublimation to occur is when ice or snow is in very cold conditions, but it is windy and the sun is shining.

Transpiration - Transpiration is when plants release water on to their leaves that then evaporates into vapor. Plants will release a lot of water as they grow. Around 10 percent of the water vapor in the atmosphere is estimated to come from transpiration.

Water in the atmosphere

We see water in the atmosphere in the form of clouds. There is a small amount of water even in clear skies, but clouds are where water has started to condense. Condensation is the process of water vapor becoming liquid water. Condensation is a major step in the water cycle. The atmosphere helps to move water around the world. It takes water that evaporated from the ocean and moves it over land where clouds and storms form to water plants with rain.

Precipitation

Precipitation is when water falls from the atmosphere back to land. Once enough water gathers in a cloud droplets of water will form and fall to the earth. Depending on the temperature and weather this could be rain, snow, sleet, or even hail.

Water storage

A lot of the Earth's water does not take part in the water cycle very often., Much of it is stored. The Earth stores water in a number of places. The ocean is the largest storage of water. Around 96 percent of the Earth's water is stored in the ocean. We can't drink the salty ocean water, so fortunately for us, freshwater is also stored in lakes, glaciers, snow caps, rivers, and below the ground in groundwater storage.

1. Where does the energy for the water cycle come from?
 - a. The spin of the Earth
 - b. The Moon
 - c. Fossil fuels
 - d. The Sun
 - e. Electricity
2. Which of the following is NOT a way that water moves from the land to the atmosphere?
 - a. Evaporation
 - b. Precipitation
 - c. Sublimation
 - d. Transpiration
3. What is the main process by which water moves from land to the atmosphere?

- a. Evaporation
- b. Precipitation
- c. Sublimation
- d. Transpiration
- e. Condensation

4. What is it called when plants release water that turns into vapor?

- a. Evaporation
- b. Precipitation
- c. Sublimation
- d. Transpiration
- e. Condensation

5. What is the process called when water from ice or snow turns directly into vapor without melting?

- a. Evaporation
- b. Precipitation
- c. Sublimation
- d. Transpiration
- e. Condensation

6. In what form can we see water in the atmosphere?

- a. Lakes
- b. Rivers
- c. Oceans
- d. Wind
- e. Clouds

7. What is the process called when water vapor becomes liquid water?

- a. Evaporation
- b. Precipitation
- c. Sublimation
- d. Transpiration
- e. Condensation

8. What is it called when water falls from the atmosphere to the Earth?

- a. Evaporation
- b. Precipitation
- c. Sublimation
- d. Transpiration
- e. Condensation

9. Where is most of the water on Earth stored?

- a. Lakes
- b. Rivers
- c. Oceans
- d. Ice caps
- e. Glaciers

10. Which of the following is a form a precipitation?

- a. Rain
- b. Snow
- c. Sleet
- d. Hail
- e. All of the above