STEM Sims™

Matter and Changes

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Do you need an idea for a scientific study?
Try out one of our ideas or make one of your own.

Most substances can exist in different states of matter. Water can be a solid, liquid, and gas all in the same place at the same time. Take the following brief quiz to see how much you already know about the different states of matter. See the bottom of page 4 to check your answers.

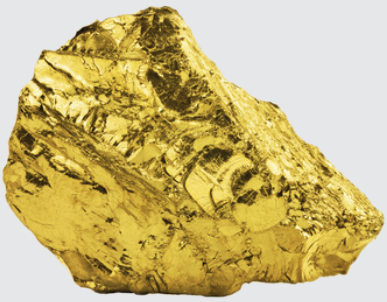
1. At what temperature does oxygen become a solid?
   a. -219 °C
   b. -88 °C
   c. -4 °C
   d. 0 °C

2. What is the most common state of matter in the entire universe?
   a. solid
   b. liquid
   c. gas
   d. plasma

3. A neutron star is a special kind of matter. If a person had a one cubic centimeter sample of a neutron star, what would be the approximate mass of the sample?
   a. 10,000 kilograms
   b. 1,000,000 kilograms
   c. 100,000,000 kilograms
   d. 100,000,000,000 kilograms

4. The glass at the bottom of a very old window is thicker at the bottom than at the top because glass is a liquid at room temperature and the glass flows downward over time.
   a. true
   b. false

5. What is the most expensive naturally found matter on Earth?
   a. painite
   b. gold
   c. diamond
   d. ruby

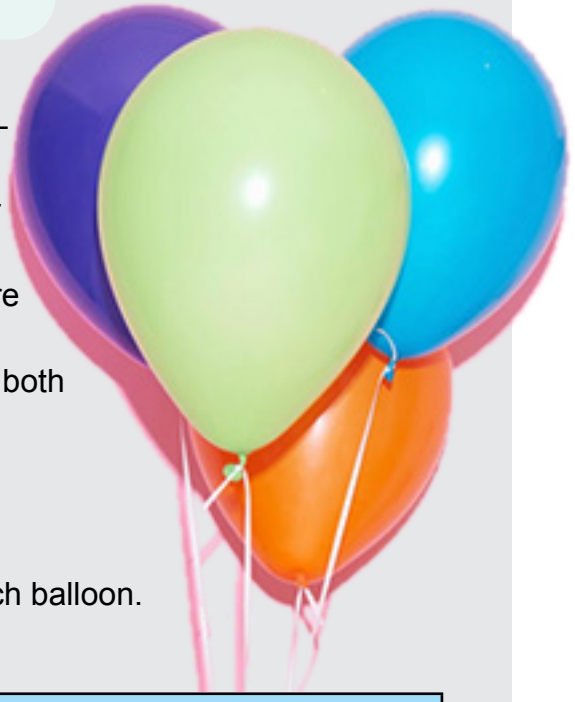


It's A Gas!

Most people love balloons and enjoy receiving them for special occasions. But can a balloon help you understand something that sounds complicated? Grab a balloon and get ready to investigate kinetic molecular theory. Don't blow this one, get started now.

Materials

2 - balloons
freezer or refrigerator
flexible tape measure



Directions

1. Make sure that you get permission before conducting this experiment.
2. Carefully blow up one balloon and tie off the end so no air escapes from the balloon.
3. Repeat step #2 for the other balloon. Make sure both balloons are inflated the same amount.
4. Use the flexible tape measure to measure the circumference of both balloons. Record this information in Table 1.
5. Place one inflated balloon in the freezer section of a refrigerator.
6. Place the other inflated balloon on a countertop.
7. Wait one hour and then remove the balloon from the freezer.
8. Quickly measure and record in Table 1 the circumferences of each balloon.

Table 1. Balloon Circumferences

Balloon Location	Initial Circumference (cm)	Final Circumference (cm)
Freezer		
Countertop		

Questions

1. What was causing the walls of the balloons to be moved outward when you blew up the balloons?

2. Which balloon changed its circumference the greatest?

3. Explain why the balloon you stated in the previous question changed its circumference.

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Up, Up, and Away

The first noted balloon flight took place in 1783 in Paris, France. The balloon was filled with hydrogen gas and flew into the clouds and descended over 20 kilometers away from where it was launched. The balloon took five days to fill with hydrogen gas. The hydrogen gas was produced using a chemical reaction of iron metal and sulfuric acid.

While hydrogen gas makes a great “lighter than air” balloon ship, the extreme flammability of hydrogen increases the likelihood of a dangerous accident. The most infamous accident was filmed in 1937 when the Hindenburg airship filled with hydrogen gas exploded as it was docking in New Jersey. The German balloon ship carried commercial passengers between Europe and the United States prior to the accident that destroyed the air ship.

Newer balloon ships use helium instead of hydrogen gas to aid in flight. Helium, just like hydrogen gas, is less dense than air. Since the atmosphere can be thought of as a sea of air, anything less dense than air will rise in the atmosphere. This is like a ball filled with air rising to the top of a swimming pool when the ball is submerged beneath the surface of the water. The greater the difference in densities between the water and the air inside the ball, the faster the ball will rise.

Many students and amateur ballooners create their home-made balloons. These balloons can fly as high as 30,000 meters into the upper part of the atmosphere. Students place many different instruments inside these balloons to measure data from the atmosphere. These devices include weather stations, cameras, and transponders for retrieving their balloons.

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STEMsims.com

Answers: Page 2 Answers: 1) a, 2) d, 3) d, 4) b, 5) a. **Page 3 Answers:** It's A Gas! 1) The air particles colliding with the walls of the balloon. 2) The freezer balloon. 3) The lower temperature caused the particles of air inside the balloon to have less kinetic energy, so the particles collided with the walls of the balloon with less force.