

It's a Matter of Space

Question

What will happen if two kinds of matter try to take up the same space at the same time?

Setting the Stage

- Have two students come to the front of the room and play musical chairs with one chair. Ask the class what happened when they both tried to take up the same space at the same time.
- Have a team come up to form a liquid molecule shape (standing slightly apart, holding hands). Have another team come up and huddle like a solid molecule shape. Ask them to enter the “liquid” molecule team. The liquid molecules will have to spread apart to let them in.
- Remind students that one of the two things which are true for all kinds of matter is that matter takes up space. They just saw that when two students try to take up the same space at the same time, one of them has to leave.
- Today they will do an experiment in which they investigate what happens when two kinds of matter try to take up the same space at the same time. In this experiment, they will need to carefully measure, using both a measuring cup and a ruler.
- Review measuring procedures, pointing out that when using a measuring cup they must first be certain that they are using the correct measuring cup, then, that the cup is filled to the top. If they spill what is in the cup they will need to remeasure.
- Demonstrate setting the #1 cm end of a ruler on the table next to a cup and reading the measurement next to a line on the cup.
- Discuss and demonstrate that to determine how much space matter took up, they will need to first measure the water in a cup before any matter is added, then measure the water after the matter is added. They will then need to subtract the first measurement from the second in order to see how much space was taken up.

Materials Needed for Each Group

- three clear plastic cups
- 3/4 cup (187.5 mL) of water
- 3/4 cup (187.5 mL) of juice
- 3/4 cup (187.5 mL) of beans
- a straw
- one set of measuring cups
- a ruler
- one experiment sheet
- data-capture sheet

Procedure

1. Discuss the question. Thinking about what you have observed around you and learned in class, make a team hypothesis. Write it on your experiment sheet.
2. Follow the procedure steps on your experiment sheet. Be certain to check off each step as you do it. Complete your data-capture sheet as you work.

It's a Matter of Space *(cont.)*

Procedure *(cont.)*

3. Write the results of your experiment, telling what you actually saw happening. Talk about the materials you used in the experiment.
4. Discuss the conclusion. Remember that you are trying to answer the experiment question. Be sure that you have a because statement in the conclusion, and talk about the molecules.

Extensions

- Have students do a Writing to Inform exercise. Ask them to explain to a student in another class what they did in this experiment, using sequence words, and tell what they discovered.
- Put a hole in the bottom of a large empty juice can. Place the can upside down in a bucket of water, having students place their hands near the hole. As water enters the can, they will feel air rushing out of the can. As the water enters the space inside the can, it pushes the air which was there out, since they both cannot take up the same space at the same time.
- Try two short experiments to show that ice takes up more space than water: 1) Fill a bottle to the top with water and make a loose fitting cap out of aluminum foil. Put the bottle in the freezer until the contents are frozen. The ice will expand, pushing the top off. The molecules in ice have a different configuration than the molecules in water. 2) Float an ice cube in a glass of water that is almost full. Have students watch what happens to the water line as the ice melts.

Closure

- Discuss the experiment hypotheses, results, and conclusions. Examine the team charts to make certain that all the teams got the same measurements for the first step of each part of the experiment. Everyone should have the same cm measurement for 1/2 cup (125 mL) of water, every time. The experiment results will be affected if the measurements weren't properly taken.
- Discuss the fact that the solids and liquids were carefully measured, but there was no way to carefully measure gas, so that the experiment cannot fully compare a gas with the liquid and solid.
- Have students make a science journal entry: "Two kinds of matter cannot stay in the same space at the same time."

The Big Why

Students conduct an experiment in which they prove that two kinds of matter cannot take up the same space at the same time.

It's a Matter of Space *(cont.)*

Science Experiment Form

Team Name _____ Date _____

Question (What do I want to find out?)

What will happen if two kinds of matter try to take up the same space at the same time?

Hypothesis (What do I think or guess will happen?)

Procedures (What are the steps to find out?)

1. Adding a solid to a liquid
 - a. Use your measuring cups to put 1/4 cup of water into a clear plastic cup.
 - b. Use your marker to draw a line on the cup which shows how high the water is in the cup now. Do not draw a line which goes up and down. Draw a line straight across the cup. Record the measurement on the data-capture sheet.
 - c. Use your measuring cups to put 1/4 cup of beans in the cup.
 - d. Put a new mark on the cup to show how high the water is in the cup now.
 - e. Measure the mark and record it on your data-capture sheet.
 - f. Subtract the first mark from the second mark to see how much space the solid took up and record it on your data-capture sheet.
2. Adding a gas to a liquid
 - a. Put 1/4 cup (62.5 mL) water in another plastic cup and draw a line to show how high the water is.
 - b. Use your ruler to measure the line and record the measurement on your data-capture sheet.
 - c. Put your straw in the water and blow some gas into it while another team member puts a mark on the cup to show how high the water in the cup went when you blew gas into it.
 - d. Measure the mark and record it on your data-capture sheet.
 - e. Subtract the first mark from the gas mark to see how much space the gas took up and record it on your data-capture sheet.

It's a Matter of Space *(cont.)*

Science Experiment Form *(cont.)*

3. Adding a liquid to a liquid
 - a. Put 1/4 cup (62.5 mL) water in another plastic cup and draw a line to show how high the water is.
 - b. Measure the line. Record the measurement on your data-capture sheet.
 - c. Use your measuring cups to put 1/4 cup (62.5 mL) of juice in the cup of water.
 - d. Put a mark on the cup to show how high the water in the cup went when you put another liquid into it.
 - e. Measure the mark and record it on your data-capture sheet.
 - f. Subtract the first mark from the second mark to see how much space the other liquid took up and record it on your data-capture sheet.

Results (What did I see actually happen?)

1. Adding a solid to a liquid _____

2. Adding a gas to a liquid _____

3. Adding a liquid to a liquid _____

Conclusion (What is the answer to the question?)

It's a Matter of Space (cont.)

What will happen if two kinds of matter try to take up the same space at the same time?

Team Name _____

Date _____

Beginning Water Measurement	Water Measurement After Matter Is Added	Amount of Space the Matter Took Up
Part 1: The water was ____ cm high before any matter was added.	The water was ____ cm high after the beans were added.	The beans took up ____ cm of space in the water.
Part 2: The water was ____ cm high before any matter was added.	The water was ____ cm high after the gas was added.	The gas took up ____ cm of space in the water.
Part 3: The water was ____ cm high before any matter was added.	The water was ____ cm high after the juice was added.	The juice took up ____ cm of space in the water.