ACTIVITY 9

Properties of Gases

BROWARD COUNTY ELEMENTARY SCIENCE BENCHMARK PLAN

Grade 1—Quarter 1
Activity 9

SC.A.1.1.2
The student recognizes that the same material can exist in different states.

SC.A.2.1.1
The student recognizes that many things are made of smaller pieces, different amounts, and various shapes.

SC.H.1.1.1
The student knows that in order to learn, it is important to observe the same things often and compare them.

SC.H.1.1.3
The student knows that in doing science, it is often helpful to work with a team and to share findings with others.

SC.H.1.1.5
The student uses the senses, tools, and instruments to obtain information from his or her surroundings.

ACTIVITY ASSESSMENT OPPORTUNITIES

The following suggestions are intended to help identify major concepts covered in the activity that may need extra reinforcement. The goal is to provide opportunities to assess student progress without creating the need for a separate, formal assessment session (or activity) for each of the 40 hands-on activities at this grade level.

1. Show students a piece of a facial tissue wadded up and taped to the inside-bottom of a clear plastic cup or draw a picture of this arrangement. Ask, *If I turned this cup upside down in a large bowl of water and pushed down on the cup so it goes under water, will the tissue get wet? Why, or why not?* (No, the tissue will stay dry because air takes up space, and the air in the cup will keep water away from the tissue.)

2. Use the Activity Sheet(s) to assess student understanding of the major concepts in the activity.

In addition to the above assessment suggestions, the questions in bold and tasks that students perform throughout the activity provide opportunities to identify areas that may require additional review before proceeding further with the activity.

ACTIVITY 9

Properties of Gases

OBJECTIVES

Students are introduced to gases. They observe some properties of air and then infer properties of gases in general.

The students

- describe properties of air
- observe a demonstration that shows the physical presence of air
- infer properties of gases in general

SCHEDULE

About 40 minutes

VOCABULARY

gas

MATERIALS

For each student

1	Activity Sheet 9
1 pair	safety goggles*

For each team of two

1	bag, paper

For the class

1	bottle, plastic, large
1	chart, Describing Properties (from Activity 8)
1 piece	clay (from Activity 7)
1 btl	food coloring, red
1	funnel, plastic
1	marker, felt-tip*
1 sheet	paper, tissue
	paper towels*
1	pencil, sharpened*
1	pitcher*
1	spoon, plastic
	water, tap*
	Delta Science Reader, *Properties*

*provided by the teacher

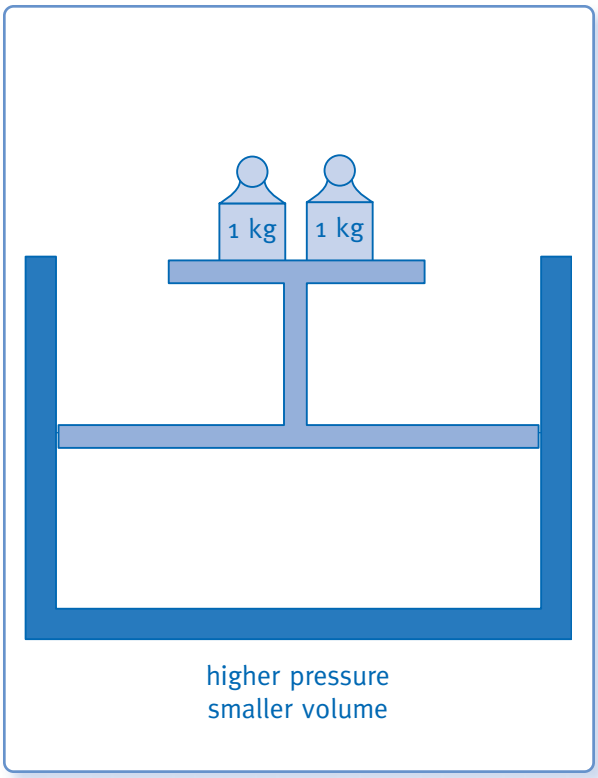
PREPARATION

1. Make a copy of Activity Sheet 9 for each student.
2. Fill a pitcher with water, add a few drops of red food coloring, and stir with a plastic spoon.
3. You will need the following materials for a class demonstration at the start of the activity: a large plastic bottle, a piece of clay, a funnel, some paper towels, a sheet of tissue paper, a sharpened pencil, and a pitcher of colored water.
4. Each team of two will need a paper bag.

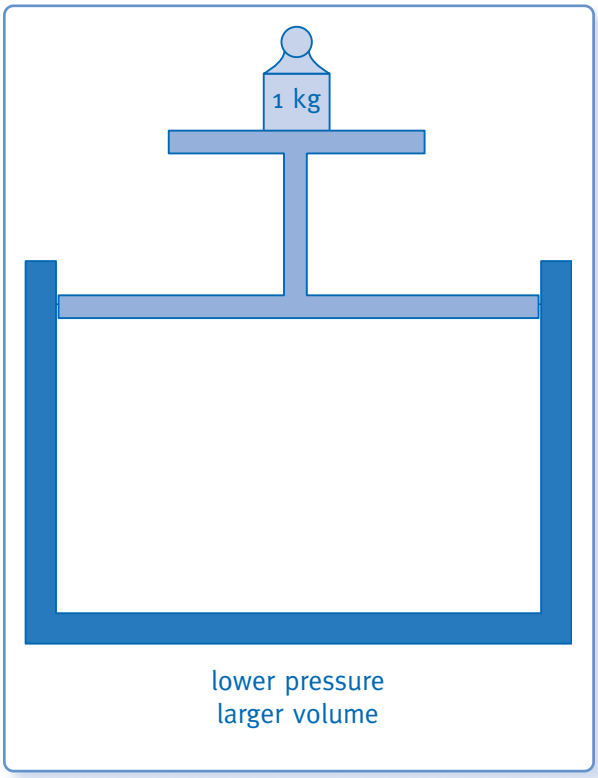
BACKGROUND INFORMATION

Gases are the third state in which matter can exist. Gases tend to be colorless and transparent, although some, like ammonia, have a strong smell. Like solids and liquids, gases are made of molecules, but the molecules of a gas are very far apart and move at high speeds in all directions.

As a result, gases have no definite volume or shape. They expand to fill any space available.



▲ ***Figure 9-1.*** *When the pressure on a gas increases, its volume decreases.*



▲ ***Figure 9-2.*** *When the pressure on a gas decreases, its volume increases.*

You can change the amount of space a gas occupies by heating or cooling it or by putting pressure on it. If you heat a gas, its molecules will move farther apart and it will expand; if you cool a gas, its molecules will move closer together and it will contract. If you put pressure on a gas, its molecules will move closer together and its volume will decrease (see Figure 9-1). If you decrease the pressure on a gas, its molecules will move farther apart and its volume will increase (see Figure 9-2).

▼ **Activity Sheet 9**

Properties of Gases

Circle all the things that contain a gas.

Guiding the Activity

Additional Information

1 Tell students that they are going to investigate the properties of the air that is all around them. Stimulate class discussion by asking, **Does air have color? Can we see air?**

Students should say that air does not have color and cannot be seen.

Write *colorless* and *cannot be seen* on the board. Ask, **How do we know that air exists if we cannot see it?**

Students might say that they can feel it when the wind blows against them or when they hold their hand in front of their face and blow on it. They might say that they can "see" it when the wind makes the branches of a tree sway.

2 Tell students that you are going to do a demonstration to show that although air cannot be seen, it is all around us. Put the funnel in the mouth of the plastic bottle. Point to the pitcher of colored water. Ask, **What do you think will happen when I pour that water into this funnel?**

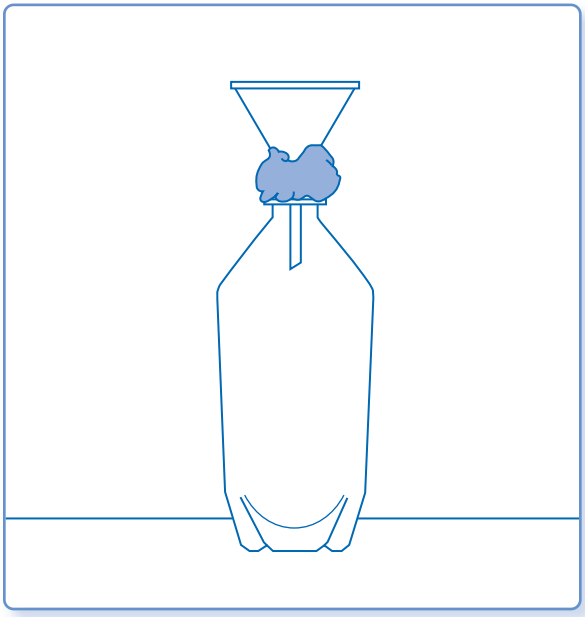
Students might guess that the water will flow through the funnel into the bottle.

Pour some water into the funnel. Ask, **What happened?**

Students should say that the water flowed through the funnel into the bottle.

Remove the funnel from the bottle and pour the water in the bottle back into the pitcher. Then dry the mouth of the bottle and the outside of the funnel with a paper towel.

3 Replace the funnel in the mouth of the bottle and put clay around the funnel to seal it to the mouth of the bottle (see Figure 9-3). Make sure there are no air holes.



▲ ***Figure 9-3.*** *Put clay around the mouth of the bottle.*

Guiding the Activity

	Guiding the Activity	Additional Information
	Point to the plastic bottle/funnel/clay assembly. Ask, **Is there anything in the plastic bottle?**	*Some students might say that the bottle is empty. Others might say that there is air in the bottle. Accept both answers.*
	Hold up the pitcher of colored water. Ask, **What do you think will happen when I pour this water into the funnel?**	*Students will probably say the water will flow through the funnel and into the plastic bottle. Accept all reasonable answers.*
4	Quickly pour the water into the funnel. Continue adding water until it stops flowing through the funnel. Ask, **What happened when I poured water through the funnel that is sealed to the bottle with clay?**	*Students should observe that the water started to flow through the funnel and then stopped.*
	Ask, **Why doesn't all the water flow through the funnel? The bottle looks empty. Why isn't there room for all of the water in the bottle?**	*Students might not know why the water does not flow from the funnel into the bottle. However, some students might correctly conclude that the bottle is filled with air so that there is no room for the water to flow into the bottle.*
5	Ask, **What could we do to make the water flow through the funnel and into the bottle?**	*Answers will vary.*
	Lead students to realize that the bottle is filled with air. Ask, **Why did I put clay around the rim of the bottle? What is the clay doing?**	*Some students might realize that the clay is keeping air in the bottle from escaping.*
	Tell students that you are going to poke a hole in the clay using a sharpened pencil to see what will happen. Hold a sheet of tissue paper over the hole so that students can see it move when the air escapes.	
	Poke a hole in the clay. Ask, **What happened when I poked a hole in the clay?**	*Students should observe that the rest of the water flowed into the bottle.*
	Ask, **What happened to the air in the bottle?**	*Students should respond that the air was pushed out of the bottle through the hole in the clay as the liquid entered the bottle. Students should have been able to "see" the air escaping because it made the tissue paper, held over the hole, flutter.*

Guiding the Activity

Additional Information

To summarize, ask, **Why did the water suddenly flow into the bottle after I poked a hole in the clay?**

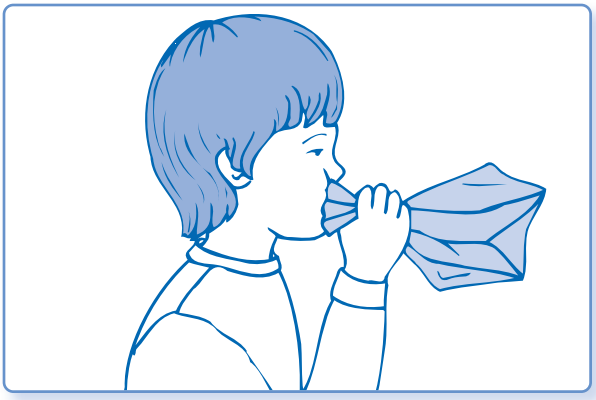
Students should conclude that all of the water initially could not flow into the bottle because the bottle was filled with air. When you poked a hole in the clay, the air was pushed out of the bottle as the water flowed into it.

6 Give each team a paper bag and tell them to open it. Ask, **What is in your paper bag?**

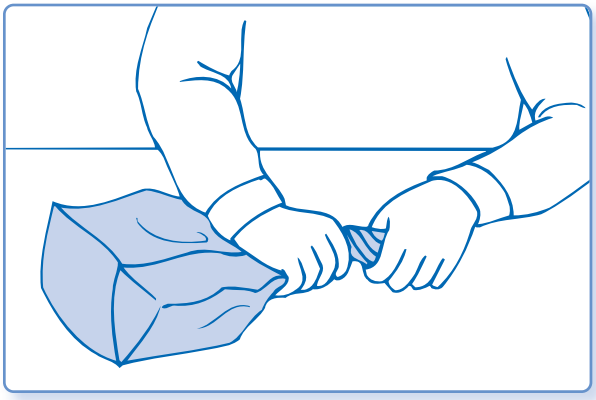
Some students might say that the bag is empty; others might remember that there is some air in the bag.

Tell each team to blow into the paper bag and show students how to twist the end of the bag and hold it closed (see Figures 9-4 and 9-5). Stimulate class discussion by asking, **What happens to the bag when you blow into it? What are you putting into the bag when you blow it up?**

Students should say that the bag gets bigger as it fills with the air they are blowing into it.



▲ ***Figure 9-4.*** *Blowing air into a paper bag.*



▲ ***Figure 9-5.*** *Twisting the paper bag closed.*

Encourage students to name some properties of air that you can add to the list on the board. Guide students by naming the properties they used to describe the blocks and the water and by asking questions, such as, **Blocks have their own shape, and their shape does not change very easily. Does the air in the bag have its own shape?**

Students should say that the shape of the air can be changed by squeezing the bag, so air, like water, takes the shape of its container.

Guiding the Activity

Guiding the Activity	Additional Information
Write *changes shape* on the board. Ask, **We were able to pour the water from one cup to another cup easily. We could pour it on the tray easily too. Can you move air easily? Does air flow?** Write *moves easily* on the board.	*Students should say that they can move air easily; it flows. Students can show that air flows by opening their bags and pouring the air out onto the table as they press down on the top of the bag.*
7 Read back the properties of air to the students. Write the word *gas* on the board and tell students that air is a gas. Encourage students to think of other gases. Explain to students that helium and carbon dioxide, like air, are gases and, therefore, have similar properties. Review the properties of air listed on the board. Ask students to identify those that are common to all gases. Add these common properties to the Describing Properties chart under the heading *Properties of Gases*. Explain that air and other gases are made of tiny pieces. In gases, the pieces float around freely. Add this property to the chart.	*Examples of gases that students might be familiar with include helium in balloons and carbon dioxide in soda.* *Lead students to conclude that all* **gases** *move easily and take the shape of their container. Most gases have no color and so cannot be seen.*
8 Distribute a copy of **Activity Sheet 9** to each student. Have students complete their activity sheets. Ask, **Which of the drawings show things that contain a gas?**	*Help students read the instructions.* *Students should say that the hot air balloon (air), the tire (air), the balloon (air), the empty jar (air), the can of soda (carbon dioxide), and the scuba diver's air tank (air) all contain gases.*
9 As appropriate, read or review pages 12–13 and 15 of the Delta Science Reader *Properties*.	

Reinforcement

Have students write down or draw as many things as they can think of that are filled with or contain gases, such as car tires, bicycle tires, balloons, and soda.

Science Journals

Have students place their completed activity sheets in their science journals.

Cleanup

Return the plastic bottle, food coloring, funnel, plastic spoon, and the chart to the kit. Store the clay in the resealable plastic bag. Have students discard the paper bags.

Connections

Science Challenge

Another difference between liquids and gases is that gases can be compressed but liquids cannot. Let students discover this through the following activity. Give each team an empty plastic soda bottle. Tell students to screw the cap on tightly and then squeeze the bottle as hard as they can. (They should be able to compress the bottle a noticeable amount.) Then have each team fill its bottle to the brim with water, replace the cap, and squeeze again. (Students will be able to compress the bottle only slightly, if at all.)

Science Extension

- Do this activity as a demonstration. Half fill a small cup with warm water, add two spoonfuls of sugar, and stir until the sugar is dissolved. Pour the sugar water into a tall, clear jar. Mix one spoonful of yeast with a little water and add this to the jar. Stretch the open end of a balloon over the top of the jar and secure it firmly in place with a rubber band. Tell students to watch the mixture and the balloon to see what happens. (The mixture will bubble and foam, and the balloon will inflate.) Explain that yeast is made of living things that feed on the sugar and grow. When this happens, the yeast makes a gas called *carbon dioxide*, the same kind of gas found in soda. Let students check the balloon and mixture throughout the day.

- Use the following activity to show students that although air feels very light on our skin, it actually can press on things very strongly. Lay a small, deflated pool float on the floor, put a board on top of it, and attach a bicycle pump to the float's valve. Ask a volunteer to sit on the board while you pump up the float. When the pressure of the air in the float begins to exceed the weight of the board and the student, he or she will begin to feel the board lift. Let students take turns using the materials.

Science, Technology, and Society

Show students photographs or a videotape of people parachuting, and ask students to explain how a parachute works. (The air caught inside the parachute keeps it from dropping suddenly to the ground.) Also guide them to note how the parachutes are constructed. Provide scissors, string or thread, tape, some small objects to use as loads, and a variety of plastic bags and tightly woven fabrics so students can make their own model parachutes. Let students test different parachute sizes and shapes (both square and round) to see which designs work best in carrying a load slowly and safely to the ground.