Lesson 2-What is Air?

Air Matters

Background Information

Air is matter in a gaseous phase. It is composed of many atoms that are constantly in motion. We can't see or taste air but we can feel it as it blows over our hands and faces.

When air is heated it becomes lighter and rises. The warm air rises and cold air moves in to take its place. This causes currents of air to move around inside buildings and outdoors as well. Birds float upward on rising currents of hot air and gliders stay up in the air the same way. Rising hot air is also used to lift huge hot-air balloons.

Air makes up the Earth's atmosphere and is composed of several different gases. (78% nitrogen, 21% oxygen, and 1% carbon dioxide and other gases)

Objectives

After completing this lesson, the students will understand the following scientific principles:

1. Air is a gas.
2. When air is heated it rises.
3. Air is composed of different gases.
4. Air makes up the Earth's atmosphere.
5. Air can be used to accomplish work.

Materials Needed

1. 20 fl. oz. plastic soda bottle
2. One balloon with a neck large enough to fit over the plastic bottle
3. One pan

4. One hot plate
5. Several paper towels
6. One empty, clear 64 oz. apple juice container with a neck opening just large enough to support a hardboiled egg
7. Matches
8. Two peeled, hard-boiled eggs
9. Packing wrap with air bubbles
10. Plastic grocery sacks

Optional:

11. A Scientific Procedure Sheet for each student

Preparation

1. Before beginning the lesson, fill the pan with water and place on the hot plate. Begin heating.

Procedure

1. Begin this lesson by trying to walk through the door without opening it. Pretend to bang your nose and ask why you couldn't get through the door.

2. Discuss the fact that any material (matter) that takes up space is made of small building blocks called atoms. The atoms form molecules. The door is composed of many tightly-packed atoms and molecules that are too small to be seen. This is why you could not walk through the door.

3. Next, announce that you are going to stand on air. Do this by stepping off a chair. Of course, you land on the floor. Ask the question, *how do molecules arranged in a solid door compare to molecules arranged in the air?* Help the students understand that solids have closely packed molecules and gases have molecules that are very far apart. Air is a gas.

4. Have the students simulate molecules in the door or any solid by standing close together and holding hands. When you try to walk through the students, they should be able to stop you. Then have the students drop their hands and move apart to simulate air or gas molecules. You should now be able to easily weave your way through the students. Ask the students to infer how molecules would be arranged in a liquid and then move to represent their predictions.

5. Ask the students what would happen if a bunch of molecules had to stand on a hot plate? The students will probably say that molecules would jump around.

6. Show the students the plastic bottle with the balloon stretched over its opening. Establish the fact that there are air molecules in the bottle.

7. Place the bottle in the hot water bath in the pan and ask for predictions about what will happen to the balloon as the air molecules get heated. The students will observe the balloon rising as the air molecules gain heat energy, collide with each other and spread apart increasing the empty space between them and thereby decreasing their density. The only place the molecules can go is up into the balloon.

8. Ask: *What happens when the sun causes the air to warm?* (The air will rise. Hot air rises.) *Will other air move in to take its place?* (Yes, cooler air.) Wind is this type of moving air.

9. See if the students can relate what they just learned to fire safety rules. (You should crawl out of smoke filled rooms. Smoke, which is hot air filled with the particles of combustion, rises, leaving a cooler, safer section of air near the floor.)

10. To demonstrate that air is made of different gases, one of which is oxygen and fires require oxygen, and to reinforce the fact that air pressure presses down, tell the students that they are about to see an amazing magic trick.

11. Ball up a paper towel and place it inside the apple juice bottle. Light a match and toss it inside the bottle. Let the fire catch. Place the peeled, hard-boiled egg on the opening. The hot air inside the bottle rises and escapes making the egg wobble a little. The egg will appear to be sucked into the bottle in one piece.

12. Elicit that the reason the egg fell into the bottle is that there was less air and pressure inside the bottle than before the fire. The greater pressure pushed the egg into the bottle.

13. Try the trick again. You should have a difficult time getting a fire started in the bottle. This will prove that an important part of air (oxygen) was used up by the previous fire.

14. To demonstrate that air can help us do work, make a pile of heavy books and challenge the students to lift the books using just their breath. Give the students a chance to try.

15. Lay a large plastic bag on the table and pile the books on top. Leave the open end of the bag sticking out. Blow into the bag keeping the opening as small as possible. Take your time and you should see the books rise off the table. They are supported by the compressed air in the bag. Ask if anyone can think of forms of transportation that use air in the same way. (Tires on cars or bicycles, etc.)

16. Show the students plastic bubble wrap and ask the students how we use the air in the bubble wrap. Can they think of other things that use air in a similar way? Make sure they understand that air can help us do work.

Extensions

1. The students can complete a Scientific Procedure Sheet for any of the activities. The steps of the scientific process can be discussed.
2. The students can start an "Air Journal" where they draw pictures and write about the different concepts introduced throughout this unit.
3. You could hold an "Air Fashion Show" where the different properties of air are shown and illustrated in creative ways designed by student pairs.
4. The students can create their own demonstrations showing that air can help us do work.

Sources of Information

Glover, D., (1987). *Flying and Floating*. New York: Kingfisher Books.

Walpole, B., (1988). *175 Science Experiments*. New York: Random House.

Weiner, E., (1992). *Dirt-Cheap Science*. New York: Scholastic.

Scientific Procedure Sheet

Experiment Title:

Purpose of Experiment:

Materials Needed:

Procedure:

Results and Observations:

Conclusions:

What would you do differently next time?