

# ACTIVITY 3.1

## IS THE AIR IN A CUP A REAL SUBSTANCE?

### TEACHING SUGGESTIONS:

#### **Plastic bag activity:**

1. When students collect air in the plastic bags, suggest that they trap air by scooping it through the air, not by blowing into it. Breathing into the bag may leave water vapor, which could be a source of confusion for this activity. Instruct students that once they have trapped air in the bag, to twist the top of the bag tightly so that no air can leak out during the activity.

#### **Cup and hose activity:**

2. You will need clear cups or plastic tumblers for this activity. To prevent the transfer of bacteria from one student to another during this activity, you should have both ends of the rubber tubing cleaned with alcohol before letting students begin. Also, allow only one student in a group to suck the air from the cup. You may also attach a straw to the end of the tube and discard it after each student uses it. Note how tape is used to keep the end of the hose near the top of the cup.

### STUDENT RESPONSES:

1. The student should say that it is taking up space in the bag and they can feel it when they squeeze the bag.
2. Yes.
3. Students should note that the air can be squeezed into a smaller space. Advise the students not to squeeze too hard, or they'll break the bags.

4. Students should recognize that the water level in the cup goes up when the air is sucked out.
5. The water level goes back down when air is blown into the cup.
6. Students should see that this is a result of air taking up space. When air was taken out of the cup, water had space to go into the cup. When air was pushed into the cup the water was pushed out because air takes up space.
7. The molecules of air in the cup pushed against the molecules of water, keeping the water out of the cup.

# QUESTION SET AND DEMONSTRATION 3.2

## CLEAN AIR AND SMELLS

### TEACHING SUGGESTIONS:

1. During this question set, you will need to release a small amount of perfume.

### STUDENT RESPONSES:

1. Nitrogen (N<sub>2</sub>), Oxygen (O<sub>2</sub>), carbon dioxide (CO<sub>2</sub>), and water vapor (H<sub>2</sub>O). (Air also contains argon, helium, hydrogen, and other gases.)
2. No. Students should realize that there is no such thing as an "air molecule," but rather that air is made up of different kinds of molecules which are mixed together.
3. Molecules that can be detected by your nose.
4. Some of the molecules of perfume left the container and then mixed in and spread throughout the air until the smell reached your nose. (In addition to molecules of air moving randomly throughout the room, air currents may also help the smell move toward your nose.)
5. Students may use their imaginations to some extent in this drawing, but they should include some ammonia molecules mixed in with the other molecules of air, and should display air by making the molecules far apart from each other.

A molecule of ammonia--(NH<sub>3</sub>)--is pictured on page 24 of the science book. Students should be able to figure out how ammonia molecules mix with the other molecules in air even before they see that picture.

## ACTIVITY 3.3

### BREATHING OUT AND BREATHING IN

#### TEACHING SUGGESTIONS:

It is not particularly important that the glass or plastic the students breathe on be cold--just cool enough so when the students breathe on them they will get a fog.

Follow directions in the Science Book Teacher's Guide (Lesson 3.3) for making and testing BTB solution.

#### STUDENT RESPONSES:

1. Students should see a fog on the piece of glass or plastic.
2. Tiny droplets of water. Students can run their fingers through the fog to see that it is water.
3. The fog came from your breath.
4. The air we breathe out contains a large amount of water vapor.
5. The solution should turn yellow. Students may ask whether the yellow BTB solution can change back to blue BTB. It usually will if left overnight. Try it. The carbon dioxide escapes from the water and BTB solution.
6. The students should respond that there is carbon dioxide in the air we breathe out.
7. The air we breathe out contains more CO<sub>2</sub> and more water vapor than the air we breathe in.

The observation that breath breathed out changes the color of the BTB solutions shows more CO<sub>2</sub> than in normal air, as you saw in the activity. Water vapor from breath condensing on a cool glass shows more H<sub>2</sub>O than in normal air. These observations suggest these two components (CO<sub>2</sub> and H<sub>2</sub>O) have variable composition in air. The relative amounts of N<sub>2</sub> and O<sub>2</sub> is quite constant throughout the world (78% N<sub>2</sub>, 21% O<sub>2</sub>, and about 1% other gases). The relative amounts of other gases are approximately: CO<sub>2</sub>, 0.03%; H<sub>2</sub>O, 0.3%.

Breathing at high altitudes is discussed in Lesson Cluster 5.3.

You might want to use Question Set 3.3: Cluster Review during the next class period. It can be used, if you wish, as an evaluatory tool.

## QUESTION SET 3.3

### CLUSTER REVIEW

1. Students should list nitrogen, oxygen, carbon dioxide, and water. The formulas are:  $N_2$ ,  $O_2$ ,  $CO_2$ , and  $H_2O$ . Their pictures should correspond to these formulas.  
  
(There are pictures of these formulas on page 23 of the Science Book.)
2. A speck of dust is trillions of times bigger than a carbon dioxide molecule.
3. When you smell something, the molecules of that substance are intermingling with the air molecules.
4. The smell molecules are constantly moving and so are the molecules of air. This constant movement causes the smell molecules to reach your nose. If the air in the room is not still, the smell molecules are also carried with the air flow.
5. More carbon dioxide, more water vapor, and less oxygen.