Air Is All Around Us

Air & Waste Management Association

Objectives

Students will do the following:

1. Name the components of air and tell which two are most abundant
2. Use a graph or exhibit to show the relative amounts of the components of air
3. Define the term "ambient air" as it pertains to our atmosphere
4. Describe air as a medium for sound, as something that affects light but isn't a medium for it, and as something that assists the spread of odors

Topics:
Ambient air and its components

Time:
2-3 class periods

Subjects:
Science, math, art

Materials:
78 large blue balloons
21 large red balloons
1 large white balloon. (You may use three other colors, if that is more convenient.)
Goggles
Protractors
Paper
Pencils
Crayons or colored pencils
Playdough® (homemade or commercial)
Flashlight
Air freshener in a spray bottle or a bottle of perfume
White paper plates (1 per student)
Crayons or markers (various colors)
Red, blue, and white construction paper
1 or 2 sheets of poster board (some color other than red, blue, or white)
Scissors
Glue
OPTIONAL: See extension suggestions

Background Information

Our planet, earth, is surrounded by a mixture of gases that we refer to as air. This blanket (or layer) of air is composed primarily of nitrogen (78%), oxygen (21%), and very small amounts of other gases (1%), including argon, carbon dioxide, water vapor, helium, neon, krypton, hydrogen, xenon, and ozone. Air often also carries water droplets, ice crystals, and dust, but they are not considered part of the composition of the air. So when we talk about 78% nitrogen, 21% oxygen, etc., we are referring to the composition of dry air.

Air is critical to sustaining life on earth as we know it. In environmental science, you'll often hear the term "ambient air." Ambient air is the air that surrounds us. In our atmosphere, ambient air is in the layer called the troposphere. [The troposphere is the layer of atmosphere closest to the earth, and it extends about 5 to 10 miles (8 to 16 km) up.] This layer of air protects the earth from excessive heat and dangerous radiation from the sun during the day, keeps some of the sun's heat near the earth's surface (which provides the earth with helpful warmth) at night, and provides oxygen for animals and carbon dioxide for plants.

When we say that air is composed of gases (nitrogen, oxygen, and others) we mean that it is composed of molecules of those gases; so air is, more specifically, a layer of trillions and trillions of gas molecules. The air that surrounds us serves as a vast avenue through which much information or data comes to our senses. In the case of light rays, molecules in the air can scatter certain wavelengths of light, thereby affecting the colors we perceive. Air is not essential for light transmission, however. Light can travel through a vacuum.

Air is much more critical for our sense of smell. Odors and fragrances are actually molecules of substances. These "smelly" molecules spread out by ricocheting off of other molecules. Without the air molecules to help bounce the smelly molecules around and keep them aloft, the spread of odors would be much diminished.

Air is essential to our sense of hearing—sound is impossible in a vacuum. A sound wave is nothing more than a relay of compressed molecules that transmit pressure from a vibrating source to our eardrums. A vibrating object alternately pushes, then does not push—pushes, then does not push against air molecules next to it. These air molecules in turn push against the air molecules next to them. When these waves of compression reach the air molecules next to our eardrums, and our eardrums then get pushed, the workings of our inner ears and our brains translate the compressions into sound.

Procedure

I. Setting the Stage

A. This activity leads up to Objectives 1 and 2. It will encourage students to think about the characteristics of air.

Third-, fourth-, and fifth-graders

B. Present students with this riddle:

"You can't taste me or see me. I am all around you. What am I?" (Air)

Third-graders

C. Ask the students what they know about air. List their ideas on a chart.

Fourth- and fifth-graders

D. Divide the students into small groups (2 or 3 students per group).

E. Ask them to make a list of facts about air. Have a spokesperson from each group tell you what their group listed. List these on a chart. (Alternative: Have students put their ideas on index cards and then arrange the cards in clusters on a concept map.)

II. Activity. What's In The Air

A. This activity relates to Objectives 1 and 2. Students will understand that air is a mixture of gases.

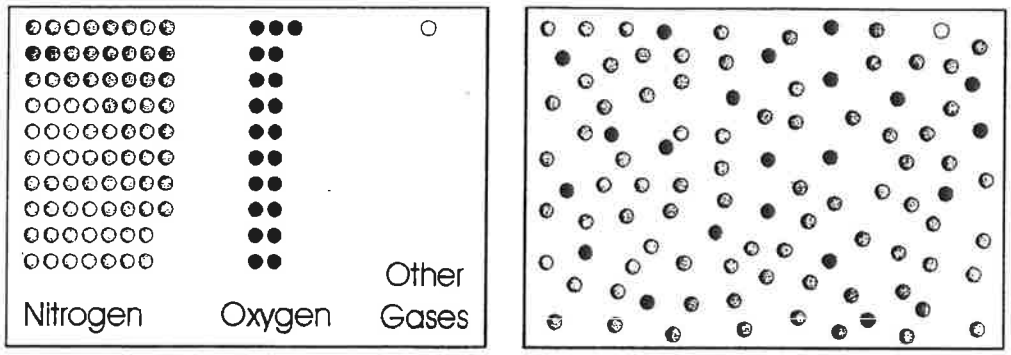
Third-graders

You will need the following materials:

- ☐ White paper plates (1 per student)
- ☐ Crayons or markers (various colors)
- ☐ Red, blue, and white construction paper
- ☐ 1 or 2 sheets of poster board (some color other than red, blue, or white)
- ☐ Scissors
- ☐ Glue

B. Give each student a white paper plate and a set of crayons or markers (three colors). Ask students to draw and color wedges that represent the relative amounts of nitrogen, oxygen, and other gases.

C. Have students cut out squares or circles of blue, red, and white construction paper. They should cut 78 blue pieces, 21 red pieces, and 1 white piece. Have students glue all of the pieces on a large sheet of poster board. The pieces may be glued in groups by color (to show relative percentages) or may be glued randomly, which would more accurately represent how the molecules are found in the atmosphere. Or, you might have students cut double the above number of pieces and create and compare both charts.



Fourth-graders

D. Place the "What's In The Air" overhead transparency on the projector (or, if you don't have an overhead projector, make photocopies and give one to each student).

E. Ask the students the following questions:

1. What are the substances that make up air? (Answer: Oxygen, nitrogen, and small amounts of other substances)

2. What type of substances (i.e., in what state of matter) are oxygen, carbon dioxide, argon, etc.? (Answer: Gases)

3. Which is there more of in our air, oxygen, nitrogen or carbon dioxide? (Answer: Nitrogen)

4. Why don't people talk about needing nitrogen when they say they need air? (Answer: Our bodies need a lot of oxygen, but not much nitrogen. This is discussed in some detail in Lesson Three. Assure students that they will learn more about this in that lesson.)

Fourth-graders (optional for third-graders)

You will need the following materials:

- ☐ 78 large blue balloons (or colored paper plates)
- ☐ 21 large red balloons (or colored paper plates)
- ☐ 1 large white balloon (or colored paper plate) Note: You may use three other colors, if that is more convenient.

F. Have the students help you blow up the large balloons to a uniform size and tie them shut. The single white balloon should be about 1/3 the size of the large balloons. **CAUTION: STUDENTS NEED**

TO WEAR GOGGLES WHEN HANDLING BALLOONS. (If you are using paper plates, have students label the plates with an N, O, or Other, as appropriate.)

G. Tie a 36-in. (91-cm) piece of string or ribbon to each balloon (or plate).

H. Hang the group of balloons (or plates) from the ceiling or wall.

I. Explain to the students that the different-colored balloons (or plates) represent the components of air: blue represents nitrogen molecules, red represents oxygen molecules, and white represents molecules of all the other gases.

Fifth-graders

You will need the following materials:

- ☐ Protractors
- ☐ Paper
- ☐ Pencils
- ☐ Crayons or colored pencils
- ☐ Playdough® (homemade or commercial)

J. Place the "Components of Dry Air" overhead transparency on the projector. Note that it is a list and not a chart.

K. Ask the students to use a protractor and crayons or colored pencils to draw and color a pie chart showing the major components of air. The "wedges" should show relative amounts. A full circle contains 360 degrees. Thus, a 78% portion would be represented by a 281-degree wedge; a 21% portion would be represented by a 75-degree wedge; a 0.94% portion by a 3-degree wedge; and the two 0.03% portions by a 0.5-degree wedge each. (Note: The 3-degree and 0.5-degree wedges are very difficult to create. You might want to let the students "lump together" the smaller portions into one little wedge labeled "other gases." (Note: If this is too difficult for students, use the activity for fourth-graders, the "What's In The Air?" transparency, instead.) Then ask some of the questions listed above.

L. The pie chart included with this lesson is correctly constructed. Use it to help students check their charts.

M. Divide the class into six small groups. Have each group of students make a model of the components of air using three colors of "playdough." Molecules of the gases can be represented by small balls of the playdough. Place the balls in a transparent container to represent "captured" air.

III. Activity. Ambient Air

A. This activity relates to Objective 3. Students will learn a term that is widely used in discussions of air quality.

You will need the following materials:

- ☐ Flashlight
- ☐ Air freshener in a spray bottle or a bottle of perfume

Third-, fourth-, and fifth-graders

B. Ask students if they have ever heard the term "ambient air." If so, compile a definition on the board. If not, give students the correct definition and discuss it. (Ambient air is the air that surrounds us.)

IV. Activity. Air As A Medium

C. This activity relates to Objective 4. It introduces the concept of air as a medium.

Third- and fourth-graders

D. Demonstrate the uses of air as a medium. Ask students the following questions. Have students discover the answers as they help you try the "experiments."

1. Do you think that sound can move through air? [Yes. Experiment: Have a student stand at one end of the room (with everyone else at the other end) and say something. (If the room is large enough, you can have all but one student stay in their seats and have the one student stand at some distance from them.) Ask the other students if they could hear what was said. Ask students how the sound got to them. (See background materials.)]

2. Do you think that light can travel through air? [Yes. Experiment: Darken the classroom as much as possible. Have a student stand at one end of the room (with everyone else at the other end) and turn on a flashlight. Ask the other students if they could see the light. Point out to them that the light traveled through the air.]

3. Can light be there when there is no air? (Yes. Note: If you have access to a transparent jar with the air removed, i.e., a jar with a vacuum, show students that they can see through it.)

4. Do you think that smells (odors) can travel through air? (Yes. Experiment: Have a student stand on one end of the room and all the others on the end of the room. Have the student spray some air freshener or open a bottle of perfume. Ask the students to raise their hands as soon as they can smell the air freshener. They will see that the students closer to it will smell it first, but that eventually the odor will travel, through the air, to the other side of the room.)

5. Do you think you could smell something if there were no air? (No, the odor's normal path to your senses would be missing.)

Fifth-graders

E. Divide the class into three or six small groups. Have each group figure out a way to demonstrate to the rest of the class one of the following:

1. Sound travels through air.

2. Light travels through air.

3. Odors travel through air.

V. Follow-up

Third-, fourth-, and fifth-graders

A. Ask the students the following questions and have them help explain the answers.

1. Can there be sound when there is no air? (No.)

2. Can there be light when there is no air? (Yes.)

3. Could you smell something if there were no air? (No, the odor's normal path to your senses would be missing.)

VI. Extension

A. Discuss, or compare and contrast, the air quality in different regions of the country.

B. Set up a center for students to measure the distances that sound, odor, and light travel through air. The center could contain a ticking clock, cinnamon bun, cotton ball soaked in perfume or vanilla extract, flashlight, and measuring tape. Provide record sheets on which to record the object, the distance, and the student's analysis of why the sound, odor, or light traveled the distance it did.

C. Create a form on which students can record sounds, odors, and sources of light in their homes or throughout the school.

D. Ask students to write a report on sound and how we hear.

E. Have students create a riddle about the components of air.

F. Give each student 5 sheets of paper with a 10 x 10 grid on it. Ask students to create different pattern using 78 squares of one color, 21 squares of another color, and 1 square of a third color. Ask students if they think that the molecules of air are in any particular pattern or if the molecules are randomly scattered.

Resources

Ardley, Neil. *101 Great Science Experiments.* London: Dorling Kindersley, 1993.

Barr, George. *Science Research Experiments for Young People.* New York: Dover, 1989.

Gega, Peter C. *Science in Elementary Education.* New York: McMillan, 1986.

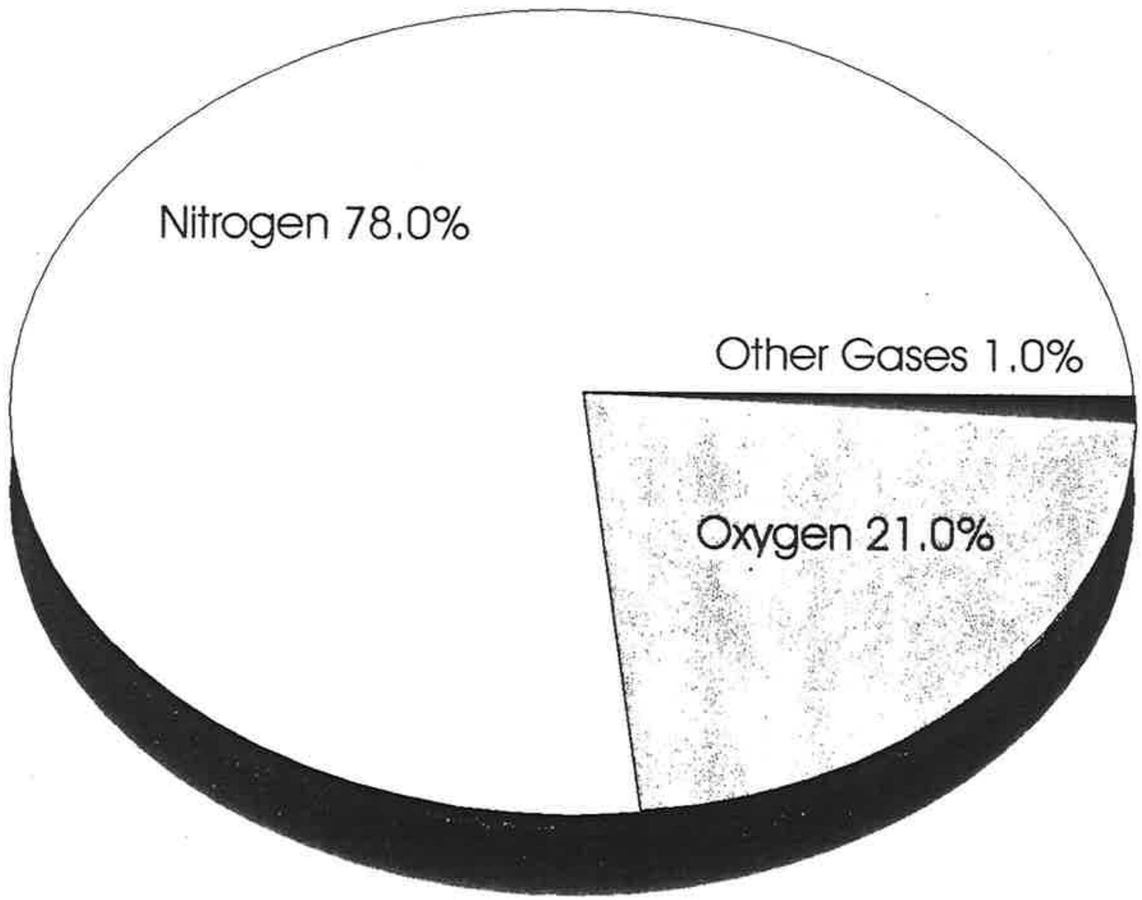
Hann, Judith. *How Science Works.* London: Dorling Kindersley, 1991.

Trefil, James. *1001 Things Everyone Should Know about Science.* New York: Doubleday, 1992.

United States Environmental Protection Agency Office of Air Quality Planning and Standards. *Environmental Science Summer Institute Workbook.* Research Triangle Park, NC. 1995.

World Book Encyclopedia, 1994 edition, s.v. "Air."

What's In The Air?



The Components of Dry Air

Nitrogen	78%
Oxygen	21%
Argon	0.94%
Carbon dioxide	0.03%
Other gases	0.03%

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