



Every Breath You Take

Grade 7, Science

Length of Lesson:

1 hour 20 minutes to 1 hour 50 minutes (depending on whether part of the lesson is assigned as homework)

National and/or Local Standards:

[NAAEE Guidelines for Excellence in Environmental Education](#)

Strand 1 F Models

Strand 2.4 A Human/Environment Interactions

Georgia Performance Standards:

S7CS5 Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.

b. Understand that different models (such as physical replicas, pictures, and analogies) can be used to represent the same thing.

S7L2 Students will describe the structure and function of cells, tissues, organs, and organ systems.

e. Explain the purpose of the major organ systems in the human body (i.e., digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection from disease).

Focus: Air Quality and Electricity

In this lesson, seventh graders will explore the respiratory system and the effects of air pollution on the human body. Students will learn the parts and function of the respiratory system from interactive Web sites and build working models of the lungs and diaphragm. After researching adverse health effects of air pollution, students will modify their lung models to demonstrate pollution-related health effects. Finally, the class will use the knowledge they have gained about times when air pollution risks are greatest and which groups of people are most vulnerable in order to brainstorm strategies for protecting themselves and others from the adverse effects of exposure to air pollution.



Description:

To demonstrate understanding of lesson concepts, each student will correctly label a diagram of the respiratory system (Step Two), construct and demonstrate a working model of lungs and diaphragm (Step Three), complete a Research Worksheet (Step Four), and modify the respiratory system model to illustrate the health impacts of air pollution on people who are at risk (Step Five). A Scoring Rubric for lesson activities is provided in the Assessment section. (This rubric can be distributed to students at Step 2 so they will know what is expected and used as a score sheet at the end of the lesson). A link to the Answer Key for the labeling diagram as well as an Answer Key for the Research on the Health Effects is also in the Assessment section. Students' research notes are not intended to be assessed or scored.

Materials:

For each student:

- One copy: Respiratory System Labeling Diagram
- One copy: Research Worksheet on Health Effects of Air Pollution
- One copy: Scoring Rubric
- One copy: Lung Model Directions

For the teacher:

- Interactive whiteboard of Internet-connected computer, LCD projector or TV hook-up and scan converter
OR
Overhead projector and transparencies of Web resources included in Trackstar track, frames 2-4
OR
Internet-connected computers for students to view the Trackstar lesson introduction individually

For the class:

- Internet-connected computers for student research, if assigned as class work (one- two students per computer)

For lung model, per pair of students:

- One copy of the directions for making the lung model:
<http://www.scribd.com/doc/3394749/lung-model-with-two-lungs-and-diaphragm-lab>
- One 1-liter bottle (preferably with bottom of bottle cut off in



advance)

- Three balloons
- 2" cube of modeling clay
- 6" of surgical, aquarium, or irrigation tubing, to fit the connector listed below
- Scissors that will cut plastic bottles
- One three-way (y or t) connector from irrigation section of garden or hardware store, or from any online irrigation equipment supplier, such as the Drip Store (<http://www.dripirrigation.com/index.php?cPath=37&sort=2a&page=3>)

For lung model modifications, per pair of students:

- Small clips, fasteners, glue, gelatin or corn starch and water, cotton, etc. (which students may be asked to bring in from home)

Procedure:

Step One: Teacher Preparation

Decide how the class will view Web resources for the Introduction (at Step Two). For instance, the teacher may display the Web resources using an interactive whiteboard or Internet-connected computer with scan converter, LCD projector and screen or TV monitor. If this technology is unavailable, transparencies could be made from print-copies of the Web pages and shown on an overhead projector, but the value of animations and interactive diagrams would be lost. As an alternative, students may use Internet-connected computers to go to Trackstar (<http://trackstar.4teachers.org/>), and then select track #355488 to view all of the Web resources.

At least one week prior to this lesson, ask students to bring in clear, empty one-liter bottles. Cut the bottom end off the bottles in advance or provide scissors and allow extra time for students to do this at the beginning of the model-making lab (Step Three). Obtain the rest of the supplies listed in the Materials section.

Make copies of the following materials for each student: Respiratory System Labeling Diagram

(<http://www.enchantedlearning.com/subjects/anatomy/lungs/label/>) for use in Step Two; directions for the Do-It-Yourself Lung Model)



<http://www.scribd.com/doc/3394749/lung-model-with-two-lungs-and-diaphragm-lab>) for use at Step Three; and Student Worksheet for Research on the Health Effects of Air Pollution in the Assessment section below for use at Step Four. (Note that lung model directions can also be seen on the TrackStar (<http://trackstar.4teachers.org>) Web page, if it is possible for students to view instructions online while building the models). Divide the class into lab partner pairs.

Step Two: Introduction: How the Respiratory System Works

Duration - 20 minutes

(Optional~ Distribute copies of the Scoring Rubric in advance so students will know what is expected in this lesson). Distribute copies of the Respiratory System Labeling Diagram:

(<http://www.enchantedlearning.com/subjects/anatomy/lungs/label/>)

and tell students that they are to label the diagram as Web sites with pertinent information are viewed. Direct the class to add the following terms to the word bank at the bottom of the worksheet, and advise students that they will be responsible for drawing in and labeling these parts as well: alveoli, esophagus, pleura, and ribs.

Introduce the basic structure and function of the human respiratory system by showing the class (or allowing students to view on individual Internet-connected computers) the Web resources provided in frames 2 – 4 of the Trackstar track for this lesson: #355488.

Step 3: Model Making: Lungs and Diaphragm, Duration - 20 minutes

Divide students into pairs. Provide each pair of lab partners with a copy of these directions (<http://www.scribd.com/doc/3394749/lung-model-with-two-lungs-and-diaphragm-lab>) and the materials necessary to build a working model of the lungs and diaphragm. After the models are assembled, students can pull down on the diaphragm (the balloon stretched and tied across the bottom of the bottle) to cause the lungs to inflate. Direct students to demonstrate their working models for the teacher before proceeding with research and model modifications.

Step Four: Student Research: Air Pollution Health Effects and Risk Factors, Duration - 0 to 30 minutes (depending on if assigned as homework or class work)



Initiate a discussion about who is at risk of adverse effects from air pollution. Challenge students to think of reasons why some groups of people may be at greater risk than others. [Responses may include the elderly (because their respiratory systems may already be compromised by age or illness); children (because they exercise outdoor more frequently, breathe 50% more air per body weight than adults, and have narrower air passages); people with heart or lung conditions (because their pre-existing health problems make them more vulnerable); active adults (who exercise outdoors and may therefore have greater exposure to air pollution, especially if they run on streets late in the day); people with asthma (because the condition can be triggered or exacerbated by air pollution); and anyone else (when pollution levels are high enough)].

Tell students that they are to research the effects of air pollution on the respiratory system. As they read through the Web resources linked below, students should be taking notes and answering questions on the 'Student Research on Health Effects of Air Pollution' worksheet. Also, they should be thinking of how they could modify their lung models to simulate one or more of the symptoms caused by breathing polluted air.

To complete the research, provide each student with access to Internet-connected computers during class time (or assign the research to be done as homework, if every student has access to an Internet-connected computer at home) and refer students to the TrackStar Web page created specifically for this lesson. (The TrackStar Web address: <http://trackstar.4teachers.org/> and this lesson's track number (#355488) are printed on the Student Research Worksheet).

Step Five: Modify Lung Model to Demonstrate Health Effects of Air Pollution, Duration - 15 minutes

Based on research conducted in the previous step, students are to modify their lung/diaphragm models to demonstrate or simulate the adverse health effects which air pollution could cause. Encourage creativity by providing a wide assortment of fasteners, glues, tapes, quilt batting, gelatin, water, corn starch, and other materials which could be used for this activity, and encouraging students to bring additional supplies from home. Some of the effects which may be demonstrated are reduced lung function; restricted air intake;



incomplete exhaling; rapid, shallow breathing; inflammation; mucus accumulation and edema or swelling. See Answer Key for Research on Health Effects of Pollution (in Assessment section) for more information on symptoms the models may portray.

Step 6: Debriefing, Duration: 25 minutes

Have students demonstrate their modified lung models and explain both the health effect they have portrayed and a pollution-sensitive group which may be vulnerable to it. If a student with asthma has been identified in advance and would like to share information about his or her condition, provide an opportunity for that to happen. The Answer Key for the Student Research Worksheet (attached) may be used as talking points for teacher.

Engage students in a review of the lesson's big ideas:

1. Recall parts of respiratory system, using a copy of the chart linked at Step Two.
2. Emphasize that the respiratory system is not a "dead end" but is connected to the circulatory system. Discuss the function of the respiratory system (to provide energy the body needs, by delivering oxygen to the lungs, which subsequently travels through the blood to the cells; and to remove waste by-products of respiration and cell functions, such as carbon dioxide).
3. Review the possible adverse effects of air pollution on the respiratory system (irritated and inflamed airways, damaged lung lining, decreased air flow, shortness of breath or rapid, shallow breathing, coughing, wheezing, chest tightness, aggravated asthma, and decreased stamina are associated with ozone; aggravation of heart and lung diseases, heart arrhythmias, and respiratory infections are associated with particulate pollution; and tightening of muscles around the airways, swelling of airway linings, clogging of airways with thick mucous, and difficulty moving air in and out of the air sacs are symptoms of asthma, which can be triggered or exacerbated by air pollution)
4. Identify groups of people who are at particular risk for the effects of air pollution (The very young and very old, people with asthma and other pre-existing heart and lung diseases, those who are heavily exposed, such as outdoor workers, and people who are highly active).



Step 7: Brainstorming Solutions, Duration: 15 minutes

Tell about school policies (if any) for protecting students on smog days. Challenge the class to brainstorm ways in which people can protect their respiratory systems from adverse effects of air pollution. {Possible responses may include: recognizing the risk factors and symptoms, monitoring the Air Quality Index (smog alerts), limiting exposure during times when air pollution is high, exercising in the morning before ozone levels build, avoiding roadsides when exercising during smog season, and various strategies for reducing air pollution such as reducing the volume of traffic through carools and work-at-home programs, cleaning up or preventing emissions, using alternative transportation or alternative fuels, etc.

Assessment:

- Student Worksheet for Research on Health Effects of Air Pollution:
Distribute a copy of this worksheet to each student, to guide their research and provide an organizer for note-taking. The worksheet provides the TrackStar Web address and a track number which students can use to quickly connect to Web resources needed for step 4 of this lesson
- Answer Key for Research on Health Effects of Air Pollution Worksheet
- Scoring Rubric for "Every Breath You Take"
The Scoring Rubric can be used to evaluate all the activities in this lesson.

Follow-Up:

After you have taught this lesson plan, please tell the Clean Air Schools program about your efforts in a brief, 60-second online survey at CleanAirCampaign.org. The information you provide is invaluable in helping this non-profit education program direct its resources to improving these lesson plans and creating new materials for your students. Thanks!



Research Notes on Health Effects of Air Pollution

Name: _____

Enter TrackStar Web site at <http://trackstar.4teachers.org/> and type 355488 in Find Track box. View in frames.

Frame 5: Directions for Lung Model

Read these direction for making a working model of the lungs, if the teacher so directs.

Frame 6: The Clean Air Campaign's Health Advisory on Smog

Read this Web resource to learn how smog can affect people's health. List some of the effects on the chart below:

Health Effects of Smog	Health Effects of Ground Level Ozone	Health Effects of Particle Pollution
Symptoms of asthma, which can be aggravated by any type of air pollution		

What four factors make people more susceptible to health problems from polluted air?

During what time of day and time of year is smog most likely to form? _____

Frame 7: "Ozone and Your Health" from EPA's AirNow Web site

Click on "How can ozone affect your health?" and read. Add new information to the chart, above.

Frame 8: Interactive Asthma Tutorial from Children's Medical Center, Univ. of Virginia

Click "Symptoms" link on the right side of Web page to find out what happens during an asthma attack. Describe an asthma attack below. Add asthma symptoms to the chart above.

Frame 9: "How Ozone Pollution Works" from the How Stuff Works Web site

Click on "Avoiding and Reducing Ozone." Add notes to the health effects chart, above. List at least two ways to avoid or reduce exposure to ozone.

Select a health effect to demonstrate by modifying your lung model. Describe your plan.

Symptom: _____

Modifications: _____

The Clean Air Schools program is helping educate future leaders about air quality and transportation. Learn more at CleanAirCampaign.org.



Answer Key: Research Notes on Health Effects of Air Pollution

Enter TrackStar Web site at <http://trackstar.4teachers.org/> and type 355488 in Find Track box. View in frames.

Frame 5: Directions for Making Lung Model

Read the directions and view animation, if the teacher so directs.

Frame 6: The Clean Air Campaign Health Advisory on Smog

Read this Web resource to learn how smog can affect people's health. List some of the effects on the chart below:

<p>Health Effects of Smog <i>coughing</i> <i>chest tightness, congestion</i> <i>wheezing</i> <i>inability to breathe deeply</i> <i>fatigue.</i> <i>changes in heart rhythm</i> <i>change in blood pressure</i> <i>deaths</i> <i>decreased lung growth (in children with chronic exposure)</i></p>	<p>Health Effects of Ground Level Ozone <i>irritated and inflamed airways</i> <i>decreased air flow</i> <i>shortness of breath</i> <i>coughing</i> <i>wheezing</i> <i>chest tightness</i> <i>decreased stamina</i></p>	<p>Health Effects of Particle Pollution <i>aggravate heart diseases</i> <i>aggravate lung diseases</i> <i>contribute to heart arrhythmias</i> <i>cause respiratory infections</i></p>
<p>Symptoms of Asthma, which can be aggravated by any type of air pollution</p> <p><i>Muscles around the airways tighten</i> <i>Lining inside the airways swells</i> <i>Airways get clogged with lots of thick mucous</i> <i>Harder to move air in and out of the air sacs</i> <i>Difficulty exhaling -> difficulty breathing</i></p>		

What four factors make people more susceptible to health problems from polluted air?

- **Age Extremes:** *The very young and the very old*
- **Poor Health:** *People with asthma and with other pre-existing heart and lung diseases*
- **High Exposure:** *People who are heavily exposed, such as outdoor workers*
- **High Activity Level:** *Physically active people can double or triple the amount of air they breathe, increasing their exposure*

During what time of day and time of year is smog most likely to form? *From 3 p.m. - 7 p.m. on summer days*

Frame 7: "Ozone and Your Health" from EPA's AirNow Web site.

Click on "How can ozone affect your health?" and read. Add any new information to the chart.

Frame 8: Interactive Asthma Tutorial from Children's Medical Center, Univ. of Virginia

Click "Why?" link on the left side of Web page to find out what happens during an asthma attack. Describe an asthma attack below. Add asthma symptoms to the chart above.

See middle box of chart, above.

Frame 9: "How Ozone Pollution Works" from the How Stuff Works Web site

Click on "Avoiding and Reducing Ozone." Add notes to the health effects chart, above. List at least two ways to avoid or reduce exposure to ozone. *(accept any two of the following OR any two reasonable responses)*





Avoiding ozone: do strenuous work outdoors only in morning or late evening, during summer; stay in when AQI > 100
Reducing ozone: avoid filling gas, driving cars, running mowers during heat of day; conserve energy; use safe paints

Select a symptom to demonstrate by modifying your lung model. Describe your plan.

Symptom: *Any symptom listed above is acceptable.* Modifications: *Methods and materials should be listed.*

Scoring Rubric for Every Breath You Take

Name: _____

Level of Proficiency > Lesson Activities V	4 Caped Crusader 	3 Earth Saver 	2 Pollution Buster 	1 Only Human 	Your Score
Labeling of Respiratory System Diagram 3 points for each correctly labeled part (up to 30 pts) plus Bonus 3 points each for alveoli, esophagus, pleura, ribs (up to 12 pts)	29 - 30 pts earned score = 4 33 - 36 pts earned score = 4.5 39 - 42 pts earned score = 5	24 - 28 pts. score = 3	18 - 23 pts score = 2	3 - 17 pts. Score = 1	<u> </u> /4
Construction of Lung-Diaphragm Model Model is attempted plus Model is completed according to directions plus Model is functional (lungs inflate /deflate when diaphragm moved)	All criteria met	2 of 3 criteria met	1 of 3 criteria met	No criterion met	<u> </u> /4
Modification of Model to Simulate Effects of Air Pollution Model modified to demonstrate a health effect of air pollution plus Student identifies and describes specific symptom or health effect (see Step 4 or Research Answer Key) plus Student identifies a special risk group which may be susceptible to this effect (see Step 5 or Res Ans Key)	All criteria met	2 of 3 criteria met	1 of 3 criteria met	No criterion met	<u> </u> /4
Total Student Score	<i>Suggested conversion of proficiency level points to letter grades:</i> A = 11 - 12 (13 = A+) B = 9 - 10 C = 7 - 8 D = 6				<u> </u> /12