



## **ANALYSIS OF THE HUMAN LUNGS: HOW DO THEY REALLY WORK?**

### **INTRODUCTION:**

Students will be introduced to the structure and workings of the human lungs through the use of models, class generated data, and engaging a series of questions. Students will investigate how the respiratory system works, the uses and limiting attributes of models, and the form and function of the human lung. In addition, a brief explanation as to how the respiratory system and the circulatory system are related is introduced.

### **LESSON OVERVIEW**

**Grade Level & Subject:** Grades 5 – 8: Science

**Length:** One class period

#### **Objectives:**

After completing this lesson, students will be able to:

- State and describe the respiratory structures in humans
- Analyze and interpret class data on breathing
- Make a model to demonstrate how the lungs work during respiration

#### **National Standards Addressed:**

This lesson addresses the following National Education Standards:<sup>1</sup>

- Content Standard: **[NS.5-8.3 LIFE SCIENCE](#)**  
As a result of their activities in grades 5-8, all students should develop understanding of
  - Structure and function in living systems
  - Regulation and behavior

#### **Materials Needed:**

- Stopwatch
- Balloons
- 2- liter plastic bottles with bottom 1/3 cut off
- Ziploc Bags (Freezer Bags)
- Rubber bands
- **Reproducible #1 – Model Lung Activity**
- **Reproducible #2 – Human Lung Diagram**

---

<sup>1</sup> <http://www.education-world.com/standards/>

**Assessment:**

Students will be assessed through the following activities:

- Participation in class discussion
- Completion of **Reproducible #1 – Model Lung Activity**
- Answers to Wrap up questions

**LESSON BACKGROUND****Relevant Vocabulary:**

- **Alveoli:** A small air-containing compartment of the lungs from which respiratory gases are exchanged.<sup>4</sup>
- **Bronchi:** Small tubes that help move air into and out of the lungs.<sup>3</sup>
- **Circulatory system:** The system of blood, blood vessels, and heart concerned with the circulation of the blood and lymph.<sup>7</sup>
- **Diaphragm:** Muscle and connective tissue; specifically : a part of the body separating the chest and abdominal cavities in mammals.<sup>5</sup>
- **Larynx:** Voice box<sup>8</sup>
- **Lung:** One of two elastic, spongy organs that constitute the basic respiratory organ of humans.<sup>6</sup>
- **Respiratory System:** A system of organs that aid in respiration and consist of the nose, nasal passages, pharynx, larynx, trachea, bronchi, and lungs.<sup>1</sup>
- **Trachea:** The main tube by which air passes to and from the lungs in vertebrates.<sup>2</sup>

1 “Respiratory System Entry.” Merriam- Webster Online Dictionary. Retrieved 2 March 2011 from <http://www.merriam-webster.com/dictionary/respiratorysystem>.

2 “Trachea Entry.” Merriam- Webster Online Dictionary. Retrieved 2 March 2011 from <http://www.merriam-webster.com/dictionary/trachea>.

3 “Bronchi Entry.” Merriam- Webster Online Dictionary. Retrieved 2 March 2011 from <http://www.merriam-webster.com/dictionary/bronchi>.

4 “Alveoli Entry.” Merriam- Webster Online Dictionary. Retrieved 2 March 2011 from <http://www.merriam-webster.com/dictionary/alveoli>.

5 “Diaphragm Entry.” Merriam- Webster Online Dictionary. Retrieved 2 March 2011 from <http://www.merriam-webster.com/dictionary/diaphragm>.

6 “Lung Entry.” Merriam- Webster Online Dictionary. Retrieved 2 March 2011 from <http://www.merriam-webster.com/dictionary/lung>.

7 “Circulatory System Entry.” Merriam- Webster Online Dictionary. Retrieved 2 March 2011 from <http://www.merriam-webster.com/dictionary/circulatorysystem>.

8 “Larynx Entry.” Merriam- Webster Online Dictionary. Retrieved 2 March 2011 from <http://www.merriam-webster.com/dictionary/larynx>.

## Background Information:

The **respiratory system** uses many parts for breathing in oxygen and releasing carbon dioxide. These include the nose, the **trachea**, and the **lungs**. First, air enters through the nose and mouth and passes through the **larynx** and the trachea. Once it enters the trachea, it branches out into tubes called **bronchi**. These bronchi eventually separate into tiny **alveoli**, which are surrounded by capillaries (tiny blood vessels). The actual act of breathing involves two main actions: inhaling, which pulls air into the lungs, and exhaling, which pushes air out of the lungs. Your chest can allow air in and out as a result of a muscle called the **diaphragm**. The diaphragm makes up the floor of the chest cavity. When you breathe in, your diaphragm contracts and moves down, creating more space in your chest for your lungs to fill with air. When you exhale, your diaphragm relaxes, decreasing the space in your chest and forces air out of your lungs.

A body system that works closely with the respiratory system is the **circulatory system**. This system aids in providing oxygen to all parts of the body and works with the respiratory system to carry oxygen to your cells and dissolved carbon dioxide back to your lungs. The circulatory system is the method of transportation for all the blood that is pumped into and out of your heart.

## Resources:

- **Lungs** *National Geographic*  
<http://science.nationalgeographic.com/science/health-and-human-body/human-body/lungs-article.html>.
- **How Your Lungs Work** *National Heart Lung and Blood Institute*  
[http://www.nhlbi.nih.gov/health/dci/Diseases/hlw/hlw\\_all.html](http://www.nhlbi.nih.gov/health/dci/Diseases/hlw/hlw_all.html)
- **Your Lungs** *American Lung Association*  
<http://www.lungusa.org/your-lungs/>
- **Fast Facts About Your Body** *Did you Know?*  
<http://didyouknow.org/fastfacts/body/>

## LESSON STEPS

### Warm-up: *Count your Breaths!*

1. Begin this lesson by asking students “How many times do you think you take a breath in one minute?” -*Student answers will vary, accept all answers*
2. Ask them to count how many times they take a breath in one minute while you keep track of time with a stopwatch. Repeat this three times and ask them to calculate the average. Post this average on the board.
3. Have students stand and jump up and down in place ten times. Then, ask them to count how many times they breathe in one minute again. Repeat this three times and ask them to calculate the average. Post on the board.
4. Display class data in a chart on the board. Ask students to compare the two sets of data.
5. Share these facts with them:
  - a. Did you know that you breathe an average of 23,000 times a day?
  - b. On average, people can hold their breath for about one minute. The world record is 21 minutes 29 seconds
  - c. Every minute, you breathe about 13 pints of air. That is equal to approximately *four* 2-liter bottles of soda!

### Activity One: *Model your breathing*

1. Give each student a copy of **Reproducible #1- Model Lung Activity**. Divide students into small groups (3 or 4 will work best). Ask them to follow the directions on their reproducible to create a model with their group. Make sure each group has access to balloons, 2-liter plastic bottles, rubber bands, and Ziploc bags.
2. Give students **Reproducible #2- Human Lung Diagram** after they have assembled their model. Students should use **Reproducible #2** to compare and contrast their model lung with the parts in a real human lung and answer the questions on **Reproducible #1**.

### Wrap Up: *Class Data Revisited*

1. Revisit concept by asking students to refer to chart on the board dealing with breaths per minute at rest vs. breaths per minute after activity. Tell them to answer the following questions: “What other factors might affect number of breaths per minute?” and “What things in the environment might make the air more difficult to breathe?”
2. Brainstorm as a class and make a list on the board.

## CONCLUSION:

Students examined and described the respiratory structures in humans, analyzed class data on breaths per minute, and built models to familiarize themselves with the workings of the human lung. Students evaluated the strengths and weaknesses of their model as compared to a real human lung. Students considered other factors that may affect the number of times that they breathe per minute

as well as what environmental issues could cause difficulties in breathing. Students are introduced to the fact that the respiratory system can affect the circulatory system and asked to begin thinking about environmental factors that may affect their respiratory systems.

## **LESSON PLAN CREDITS**

**Sharvari Chwastyk – Author**

Middle School Science Teacher, Cabin John Middle School

**Maggie Ollove – Editor**

Education Associate, Earth Day Network

Name \_\_\_\_\_ Date \_\_\_\_\_

## **Model Lung Activity**

**Testable Question:** How can you model and explain breathing?

**Prediction:** \_\_\_\_\_

### **Materials:**

- Balloons
- 2- liter plastic bottles with bottom 1/3 cut off
- Ziploc Bags (Freezer Bags)
- Rubber bands

### **Procedure:**

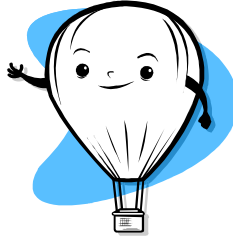
1. Obtain the pre-cut plastic bottle from your teacher. Have a group member bring all other materials to your work table.
2. Stretch the opening of the balloon over the top of the bottle. Push the balloon through the top of the bottle.
3. Open the Ziploc bag and put it around the opening at the bottom of the plastic bottle. Secure the Ziploc bag around the bottle with the rubber bands. Do not stretch out the Ziploc bag and make it too tight at the bottom of the bottle.
5. Gently push and pull on the Ziploc bag to move the plastic in and out. What do you observe? Describe what happens to the balloon as the plastic moves in and out. Explain your observations.

### **Observations:**

### **Summary Questions:**

1. Draw a labeled diagram of your model. Include any parts that are on your human lung diagram.

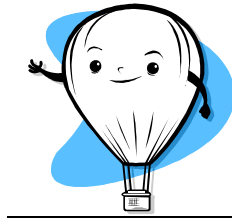
2. After looking at Reproducible #2- Human Lung Diagram, what parts does your model have in common with a real human lung?
3. After looking at Reproducible #2- Human Lung Diagram, what parts are missing from your model that are present in a real human lung?
4. Name the organs, in order, through which air passes.
5. What do the balloons represent?
6. What does the plastic container represent?
7. What causes the balloon to fill up?
8. What gas flows into your lungs when you inhale? Exhale?
9. What is the function of the respiratory system?
10. If something in the environment affects your respiratory system, how might that affect your circulatory system as well? Explain your response.



Name \_\_\_\_\_ Date \_\_\_\_\_

### **Model Lung Activity Summary Questions- Answer Key**

1. **Draw a labeled diagram of your model.** *Answer: student diagrams will vary.*
2. **After looking at Reproducible #2- Human Lung Diagram, what parts does your model have in common with a real human lung?** *Answer: Students' model lung should have a chest cavity, diaphragm, and trachea.*
3. **After looking at Reproducible #2- Human Lung Diagram, what parts are missing from your model that are present in a real human lung?** *Answer: Students' model lung does not have bronchi or alveoli.*
4. **Name the organs, in order, through which air passes.** *Answer: Trachea, Bronchi, Alveoli, Diaphragm.*
5. **What do the balloons represent?** *Answer: The balloon represents the lung.*
6. **What does the bottle represent?** *Answer: The bottle represents the chest cavity.*
7. **What does the Ziploc bag represent?** *Answer: The plastic represents the diaphragm.*
8. **What causes the balloon to fill up?** *Answer: The balloon fills up with air because when you push down on the Ziploc bag (diaphragm), it creates more space in your chest for your lungs (balloon) to fill with air.*
9. **What gas flows into your lungs when you inhale? Exhale?** *Answer: When you inhale, oxygen flows into your lungs. When you exhale, carbon dioxide flows out of your lungs.*
10. **What is the function of the respiratory system?** *Answer: The primary function of the respiratory system is to exchange gases so that blood in the body receives oxygen.*
11. **If something in the environment affects your respiratory system, how might that affect your circulatory system as well? Explain your response.** *Answer: If something affects your respiratory system, it could hurt your ability to breathe properly and reduce the circulatory system's capacity to deliver oxygen to cells in your body efficiently. This could manifest itself in the form of a health condition.*



Name \_\_\_\_\_ Date \_\_\_\_\_

## Human Lung Diagram<sup>2</sup>

**Background Information:** The **respiratory system** helps our bodies with breathing in oxygen and releasing carbon dioxide. Without it, we wouldn't be able to survive! We use the nose, **trachea**, and **lungs** to bring air into our bodies. First, air enters through the nose and mouth and passes through the **larynx** and the trachea. Once it enters the trachea, it branches out into tubes called **bronchi**. These bronchi eventually separate into tiny **alveoli**, which are surrounded by capillaries (tiny blood vessels). The actual act of breathing involves two main actions: inhaling and exhaling. Inhaling means air is being pushed into your lungs, and exhaling means air is being pushed out of your lungs. The reason your chest is able to allow air in and out is because of a muscle called the **diaphragm**. The diaphragm makes up the floor of the chest cavity. When you inhale, your diaphragm contracts and moves down, creating more space in your chest for your lungs to fill with air. When you exhale, your diaphragm relaxes, decreasing the space in your chest and forcing air out of your lungs.

A body system that works closely with the respiratory system is the **circulatory system**. This system aids in providing oxygen to all parts of the body and works with the respiratory system to carry oxygen to your cells and dissolved carbon dioxide back to your lungs. The circulatory system is the method of transportation for all the blood that is pumped into and out of your heart.

---

<sup>2</sup> "The Respiratory System." Photograph. *The National Heart Lung and Blood Institute*. Retrieved 3 March from [http://www.nhlbi.nih.gov/health/dci/Diseases/hlw/hlw\\_respsys.html](http://www.nhlbi.nih.gov/health/dci/Diseases/hlw/hlw_respsys.html).

