Lesson 3.9: The Respiratory System

Task	Page(s)	Learning Target
1	2	I can identify structures and explain functions of the respiratory system.
2	3	I can plan a model for the respiratory system using household materials.
3	4-5	I can read an article about a scientific study and describe experimental parts.
4	6-7	I can follow a multi-step procedure in order to model how breathing occurs.

Task 1 Learning Target: I can identify structures and explain functions of the respiratory system.

1. Function- _____
A. How does respiration compare to breathing?

1. Structures

A. nose/mouth:

B. trachea:

C. bronchi:

D. alveoli:
Watch the following video: https://sites.google.com/a/ps207tigers.org/207sci/alveoli
**Draw a diagram that illustrates the two gasses that are exchanged by the capillaries and alveoli.

E. Cilia:

F. Epiglottis:
**Watch the following video: https://www.youtube.com/watch?v=pNcV6yAfq-g
**How does the epiglottis show the nervous, digestive, respiratory, and muscular systems working together?

G.***Draw a picture of the respiratory system

2. Connection to the Circulatory System: https://biomanbio.com/HTML5GamesandLabs/Physiogames/respiratory_journeyhtml5page.html
How does the respiratory system interact with the circulatory system?

4. Connection to the Muscular and Nervous Systems: https://www.youtube.com/watch?v=0PyDEna7qs0
How does the diaphragm muscle and nervous system interact to allow you to breathe?

5. Diseases and Disorders

Watch the following video: https://www.youtube.com/watch?v=2nBPqSiLg5E

A. Asthma:

B. Lung Cancer:

C. Emphysema:

D. Bronchitis:

E. Respiratory Infections:

F. Draw a diagram that illustrates one of the described diseases.

Resource Link: http://www.tenalpscommunicate.com/clients/siemens/humanbodyOnline/##

Task 2 Learning Target: I can plan a model for the respiratory system using household materials.

Material	How does it represent structure?	How does it represent function?

Task 3 Learning Target: I can read an article about a scientific study and describe experimental parts.

Breathing very dirty air may boost obesity risk

Rats that inhaled air full of pollution became heavier and less healthy

BY ASHLEY YEAGER 7:00AM, APRIL 4, 2016

1. Air pollution is bad for our lungs. It may not be great for our waistlines either, a new study in rats finds. China's capital city of Beijing has some of the worst air pollution in the world. On really bad days, its air can host more than 10 times as many tiny pollutant particles as the World Health Organization says is safe for human health. In a new study, rats breathed in this air. And those rodents gained more weight, and were unhealthier overall, than were rats breathing much cleaner air. The results suggest that exposure to air pollution can raise the risk of becoming extremely overweight. And, adds Loren Wold, "It is highly likely that this is happening in humans."

2. Wold works at Ohio State University in Columbus. There, he studies how air pollution affects the heart. He was not involved in the new study. But he says it agrees with many other studies that have suggested air pollution can affect metabolism, which is how the body breaks down food and uses it for fuel. Polluted air contains particles of ash, dust and other chemicals. Sometimes these particles are so numerous that they create a thick, dense smog can cuts visibility.

3. Earlier experiments among 18-year olds in Southern California had linked heavier traffic with higher *body mass index* (a measure of overweight and obesity). Areas with heavy traffic also tend to have more of those pollutant particles. Another study found that when pregnant mice were exposed to exhaust from diesel engines, their pups grew up to be heavier. The pups also developed more *inflammation* in their brains. In the new study, researchers tested how Beijing's polluted air affects the health of pregnant rats.

4. Jim Zhang is an environmental scientist at Duke University in Durham, N.C. He and his co-workers put rats in two indoor chambers in Beijing. They piped polluted air from the city directly into one chamber. Air piped into the other chamber went through a filter. That filter removed almost all of the big pollution particles from the air and about two-thirds of the smaller ones. This made the air more like what people breathe in typical U.S. cities and suburbs, Zhang says.

5. All rats ate the same type and amount of food. But after 19 days, the pregnant rats breathing the heavily polluted air weighed more than the rats breathing the filtered air. They also had higher amounts of cholesterol — a waxy, fatlike substance — in their blood than did the rats breathing filtered air.

6. Those breathing the dirtier air had higher levels of inflammation. This is a sign of the body responding to tissue damage. These rats also had higher *insulin resistance*. This means their bodies weren't responding as well to insulin, a hormone that helps with using sugar for energy. Insulin resistance can lead to diabetes, a dangerous health condition. Taken together, the scientists say, these symptoms indicate the rats were developing *metabolic syndrome*. It's a condition that puts the animals at risk of heart disease and diabetes.

7. During the experiment, the pregnant rats gave birth. Their pups stayed in the chambers with their mothers. And young rats that breathed in the polluted air were heavier than pups born to moms living in the cleaner air. Like their moms, the pups breathing very polluted air had more inflammation and insulin resistance. The longer these pups breathed the dirty air, Zhang says, the more unhealthy they became. This suggests that breathing polluted air for a long time can lead to sickness, Zhang says.

8. It's not yet clear exactly how air pollution affects rat metabolism. But it seems, Zhang says, to impair how the animals process fat and sugar. Pollution also increases signs of inflammation in the lungs, blood and fat. Zhang says this is probably what led to weight gain in the animals.

9. Wold says it might be possible to create medicines that reverse the negative health effects of air pollution. But these medicines will take time to develop. Until then, Zhang and Wold say that paying attention to air pollution levels can help people manage their health risks. On days when pollution levels are high, they recommend that people stay indoors, if possible — or at least avoid tough outdoor exercise.

Questions:

1. Why is Loren Wold referenced in the article?
2. How do earlier experiments among 18-year olds support current research?
3. In a new study, researchers tested how Beijing's polluted air affects the health of pregnant rats. Based on the experiment led by Jim Zhang, what is the independent variable?
4. Based on the experiment led by Jim Zhang, what is the dependent variable?
5. Based on the article, how does Jim Zhang control variables in his experiment?
6. Why might the author include details that explain how variables were controlled in Jim Zhang's experiment?
7. What evidence supports the claim that rats breathing heavily polluted air developed metabolic syndrome?
8. What were the results of Jim Zhang's experiment?
9. What statement supports the claim that breathing polluted air for a long time can lead to sickness?
10. How does the author compare current treatment to future treatment?

Enrichment:

11. What primary question(s) do the researcher(s) focus on?
12. What led the scientist(s) to conduct the investigation? What about the topic interested or motivated them?
13. How did historical and/or current scientific knowledge influence the study?
14. How did technology improve the researchers' ability to collect, analyze, organize and manipulate the data?
15. Does the article reveal any ways that mathematics helped the scientists in their investigation? If not, what kind of math do you think was used in designing, analyzing, and communicating about the investigation?
16. Are the conclusions based on evidence? Are the explanations logical? Explain.
17. Do the researchers suggest areas for further study? If not, can you think of any?
18. In what ways are you skeptical of the research design approach and/or conclusions?

Task 4 Learning Target: I can follow a multi-step procedure in order to model how breathing occurs.
Essential Question: What enables your body to inhale and exhale air?

Pre-Lab Questions- Read with purpose and identify the answers to the following questions:

1. How does air get into and out of the lungs?
2. Why is it useful to make a model to study how breathing occurs?

Background:

Reviewing Content

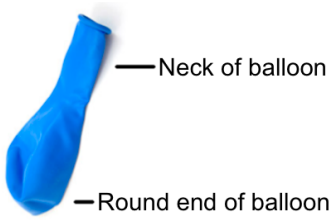
Breathing, like other body movements, is controlled by muscles. Muscles between the ribs help expand the ribs to provide room for the lungs to inflate. The diaphragm is at the base of the lungs. This large, dome-shaped muscle also makes the chest cavity larger by providing space for the lungs to lengthen as the diaphragm contracts or flattens. When you exhale, or breathe out, the rib muscles and diaphragm relax. This reduces the size of the chest cavity, and air flows out.

Reviewing Inquiry Focus

You will make a model to explore how breathing occurs. You will create a physical representation of how the chest cavity works, including the trachea, lungs, and diaphragm. Models are used to understand a process that is not easily observed otherwise. In this case, the model will allow you to observe how moving the diaphragm on the model changes the air pressure inside the model. You will see how these changes in pressure affect the "lungs" of the model. You will then draw conclusions based on your observations of how the model acts under different conditions and how your body might act under comparable conditions.

Procedure:

1. Cut off and discard the bottom of a small plastic bottle. Trim the cut edge so that there are no rough spots.
2. Stretch one balloon.
3. Insert the round end of the balloon through the mouth of the bottle.
4. With a partner holding the bottle, stretch the neck of the balloon and pull it over the mouth of the bottle.
5. Stretch the other balloon.
6. Cut off and discard the balloon's neck.
7. Have a partner hold the bottle while you stretch the remaining part of the balloon over the bottom opening of the bottle.
8. Use one hand to hold the bottle firmly. With the fingers of your other hand, pinch the bottom balloon and push upward on the balloon that covers the base of the bottle.
9. Pull the balloon down.
10. Repeat this procedure a few times.
11. Observe what happens to the balloon that is inside the bottle. Record your observations.



Create a Report:

1. Draw a 2-stage diagram that shows the **bottle** "inhaling" and "exhaling." (You should show two separate visuals.) Diagrams should be neat and labeled with the following words:

○ Trachea	○ Lungs	○ Chest	○ Chest cavity	○ Diaphragm

2. Explain how the **three** parts of the model represent structure and function.
   Example: *The trachea was represented in the model as* _____.
   This represented the trachea in structure because _____.
   This represented the trachea in function because _____.
3. How does the pressure in the chest cavity affect airflow in the lungs when inhaling **and** exhaling?
   Example: *When a person inhales, the diaphragm moves* ***upward or downward****.*
   This ***increases or decreases*** *space in the chest cavity and therefore,* ***increases or decreases*** *pressure.*
   When there is ***more or less*** *pressure in the chest cavity, air will move* ***into or out of*** *the lungs.*
4. Describe/explain at least one model strength **and** limitation.
5. Describe at least 2 variables in this model that could affect how well the model works.

	3	2	1
1.Diagram	A 2-stage diagram that shows the **bottle** "inhaling" and "exhaling" is neat and correctly labeled with all the following: -Trachea -Lungs -Chest -Chest Cavity -Diaphragm	A 2-stage diagram that shows "inhaling" and "exhaling" is neat and correctly labeled with most of the following: -Trachea -Lungs -Chest -Chest Cavity -Diaphragm	A diagram that shows the "inhaling" and/or "exhaling" is neat and correctly labeled with few of the following: -Trachea -Lungs -Chest -Chest Cavity -Diaphragm
2.Model Representations	All three model parts are correctly described in structure **and** function: -Trachea -Lungs -Chest -Chest Cavity -Diaphragm	Two model parts are correctly described in structure **and** function: -Trachea -Lungs -Chest -Chest Cavity -Diaphragm	One model part is correctly described in structure **and** function: -Trachea -Lungs -Chest -Chest Cavity -Diaphragm
3.Pressure in the Chest Cavity	The effect of pressure in the chest cavity on air flow is thoroughly and accurately described for inhaling and exhaling.	The effect of pressure in the chest cavity on air flow is thoroughly and accurately described for inhaling or exhaling.	The effect of pressure in the chest cavity on air flow is partially or inaccurately described for inhaling and exhaling.
4.Strengths and Limitation	One model strength and one model limitation are thoroughly and accurately described.	One model strength and one model limitation are accurately described with limited detail.	One model strength or one model limitation is described with limited detail.
5.Variables	Two variables that could affect the working of the model are thoroughly and accurately described.	Two variables that could affect the working of the model are described with limited detail.	One variable that could affect the working of the model is described with limited detail.

Job Well Done:	**Areas for Improvement:**
Your diagram is thorough with clear and correct labels.	Your diagram labels need revision. 1 or more items are mislabeled. -Trachea -Lungs -Chest -Chest Cavity -Diaphragm
The model representations are correctly described in structure **and** function.	Review the structure and/or function of the -Trachea -Lungs -Chest -Chest Cavity -Diaphragm
The effect of pressure in the chest cavity on air flow is thoroughly and accurately described for inhaling **and** exhaling.	*When a person inhales, the diaphragm moves **upward or downward**. This **increases or decreases** space in the chest cavity and therefore**, increases or decreases** pressure. When there is **more or less** pressure in the chest cavity, air will move **into or out of** the lungs.* *****You should use this example to then describe what happens when a person exhales.*
Model strengths and limitations are thoroughly and accurately described.	How did the model accurately represent the respiratory system? What was not accurate about the model?
You thoroughly described 2 variables that would affect how well the model would work.	What two variables might make the model not work properly? Why would this cause the model not to work properly?
Additional Questions:	
Was the _____ a good representation for the _____? Why? How would you better model the _____.	