

# TPJ Technology

## Project Name—Respiratory System

**Context:** To show that the general functions of the respiratory system is to deliver oxygen to the tissues, the importance of cellular respiration, the processes of inhalation/exhalation, and to determine the volume of air exhaled and to eliminate carbon dioxide formed in the body.

**Design Brief:** Students will:

- Demonstrate that there is oxygen in the air we breathe.
- Build a model of the respiratory system.
- Measure the amount of air that can be forced out of the lungs.
- Demonstrate that carbon dioxide is exhaled from the body.

**Possible Solutions:** Have instructor demonstrate/explain the process. Have another student explain the process. Read a manual and text. Pay someone to do the work...

**Design Constraints:**

1. You will work in groups, assigned by Mr. Ferguson.
2. Each *individual* will prepare a report on the groups findings (see report outline). There is no "Group Report".

**Detail Design:** The following are the steps for the task:

### Part A

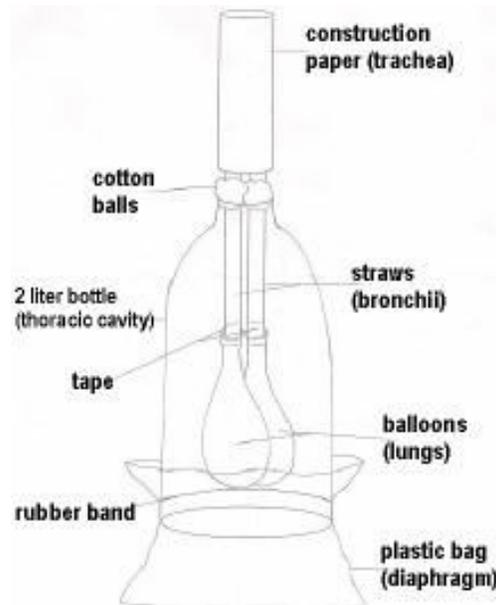
This experiment will show that there is oxygen in the air we breathe.

1. Place a small amount of water in the bottom of the pan, enough to cover the bottom of the pan.
2. Light the candle and place in the water on the bottom of the pan.
3. Cover the lit candle with the glass and observe what happens to the water.

### Part B

This model will show the action of the diaphragm in human respiration.

1. Insert straws into balloons and tape together at top (bronchi and lungs).
2. Insert these through open bottom of modified 2-liter soda bottle straw end first and bring ends of straws up through the neck of the bottle.
3. Stuff neck of soda bottle with cotton balls around straws until spaces are plugged.
4. Roll construction paper into a tube just round enough to fit over the tops of the straws. Tape closed and place over tops of two straws. This will be the trachea.
5. Place plastic bag over bottom end of bottle and use the rubber band to hold it in place. This will serve as the diaphragm.
6. Grasp bottom of plastic bag and pull down and push up. Watch as the "lungs" expand and contract as you do this. Students may even bend "trachea" and "bronchi" over so that the air supply is cut off and watch as nothing happens when the "diaphragm" is manipulated.



### Part C

This experiment will show that carbon dioxide is one of the major cellular metabolic waste products.

1. Place about a teaspoon of lime powder in a cup or glass of warm water and mix thoroughly. Cover the glass and let remain over night.
2. Next day drain the clear fluid off the top of the solution. This is the lime water for the experiment.
3. Place the straw in the lime water and blow into the straw. Observe what happens to the clear fluid.

### Part D

This experiment will demonstrate lung capacity by measuring the amount of air that can be forced out of the lungs.

1. Place a strip of masking tape down the side of the milk jug from the top to the bottom.
2. Fill the jug with water using a cup to measure amount of water it takes to fill the jug. Mark each cup on the tape (these measurements will serve to show the amount of water exhaled) and screw on the cap.
3. Fill the dish pan about 1/2 full with water.
4. Place the jug upside down in the water, and remove the cap.

5. Have a helper hold the jug. DO NOT allow air bubbles to enter the milk jug.
6. Place one end of the aquarium tubing inside the mouth of the jug.
7. Take a normal breath and exhale through the tubing. Mark the water level on the tape.
8. Refill the jug with water and return it to the dish pan.
9. Breathe in deeply and exhale all of the air in your lungs through the tubing. Mark the water level on the tape.

Your Report will answer the following questions:

1. What are the chief functions of the respiratory system?
2. Why do we need to breathe?
3. What's in the air we breathe?
4. How do you know there is oxygen in the air we breathe?
5. What would happen if your oxygen ran out?
6. What do the small balloons represent?
7. What do the two ends of the straw to which the balloons are attached represent?
8. What is the major difference between the balloon model and real life?
9. What does the longer piece of straw represent?
10. What do the sides of the cup represent?
11. What does the balloon sheet over the cup's opening represent?
12. What happened to the small balloons when you pulled down on the balloon sheet?
13. What happened to the small balloons when you push up on the balloon sheet?
14. What happens to the air once it's in the lungs?
15. What is cellular metabolic activity?
16. What is the primary gaseous waste product of cellular metabolic activity?
17. What's the stuff that comes out when you exhale?
18. What is lung capacity?
19. What happens in the plastic bottle as you exhale into the rubber tubing?
20. What effect does exercise have on the volume of air? Explain.

**Materials:** found materials and the following:

*Part A*

1. Candle
2. Matches
3. Pan
4. Clear Cup or Glass
5. Water

*Part B*

1. Pink or gray construction paper (trachea)
2. 2-liter soda bottle with black bottom cut off (thoracic cavity)
3. two round 9" or 12" pink balloons (lungs)
4. two drinking straws (bronchi)
5. medium-sized plastic bag large enough to fit over bottom end of bottle (diaphragm)
6. 3 or 4 cotton balls; transparent tape; medium-size, thin rubber band

*Part C*

1. Lime Powder
2. Water
3. Clear Cup or Glass
4. Straw

*Part D*

1. Plastic Dishpan
2. Two Feet (60cm) of tubing
3. One Gallon (4 Litres) plastic Jug With Cap
4. Masking Tape, Pen, Eight Ounce Cup

**Commissioning:** Were you successful in this project when you tried it out?

**Evaluation:** Did this project work as you expected it to?

**Reflection:** Did you enjoy this project? What were you most proud of? What would you do differently next time?

### Group List for Respiration System Project

Group 1	Group 2	Group 3	Group 4	Group 5

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## Respiratory System Observation Record

Record your results in the chart below.

<b>Part</b>	<b>Observation</b>
<b>Part A: Oxygen in the air we Breathe</b>	
<b>Part B: Model of Respiratory System</b>	
<b>Part C: CO<sub>2</sub> as Metabolic Waste Product</b>	
<b>Part D: Lung Capacity</b>	

Label the parts of the respiratory system on a detailed drawing or model that you have created (*see handouts folder for detailed information on Respiratory System A&P*)

Explain in detail Respiratory Function and the Mechanism for Breathing (i.e., “How does everything work”)