Lung Volume

Amount of time Demo takes: 3-5 minutes

Try this in the classroom!

Lesson's Big Idea

- The lungs are one of the main components responsible for exchanging oxygen and carbon dioxide in the blood.
- When you breath in your lungs expand to allow more air into your lungs and when you breath out they contract to help push air out of your lungs.
- The total lung volume of your lungs is not used when you breath normally.

Materials

- Spirometer (Portable Dry Spirometer - Carolina Biological Supply)
- Mouthpieces (Disposable Mouthpieces for Portable Dry Spirometer - Carolina Biological Supply)
- Rubber Gloves
- Alcohol sanitizer
- Whiteboard/Markers

SAFETY!

- Sanitizer - This demo involves children putting their mouths on our equipment. Please keep it very clean! You may elect to use gloves as well.

Background Information

- Lungs are the main component of the pulmonary system - which is responsible for exchanging CO_2 for Oxygen in the blood.
- Each person's lungs have a given volume and the ability to use your lungs fully depends on physical health. We measure the volume of your lungs with a device called a spirometer.
- When you take a breath, your rib cage expands and your diaphragm pulls downward, increasing the volume in the lungs and pulling air in. When

the breath is released, the pressure inside the lungs and contracting rib cage force air out.

- Total lung capacity is 5900 ml of air for men and 4400 ml of air for women. However, the amount of air that is inhaled and exhaled during a normal (or quiet) breathing cycle is only 500 ml. More air is inhaled and exhaled when a person is breathing more heavily, which often occurs during strenuous activities/exercises.
- Even when you forcibly inhale air you do not reach your total lung capacity. Similarly, when you forcibly exhale air, there is still air left inside your lungs.

Setup Instructions

1. Lay out materials. Test the spirometer and markers.

Instructional Procedure

1. Prepare device (sanitize and put mouthpiece on).
2. Invite the participant to take a big breath, like they're going to dive underwater. Then they should blow into the spirometer until they have exhaled completely.
3. The spirometer needle will spin to reflect the number of cubic centimetres of air the students' lungs can hold. For example, if a student's reading is 2,500 c^3, they can imagine two and a half 2-liter pop bottles filled with air, that was inside their lungs.
4. Record reading on whiteboard (you can host a friendly competition among students).
5. Reset the device (turn top part back to '0') and sanitize it.
6. Talk with students about what a higher or lower lung capacity might mean For example, swimmers tend to have very high lung capacity and people who smoke often have lower capacity.

Tips & Tricks

- Make sure you have a trash bag so you can throw away wipes after you sanitize the spirometer.

Careers & Real-World Applications

- The amount of air inhaled or exhaled from your lungs could indicate the health of your lungs and body.
- Careers:

    - Respiratory Therapists - These professionals may use incentive spirometers with their patients to teach you how to take slow deep breaths
    - Nurses/Doctor - Doctors and nurses may use spirometers to measure the health of your lungs after surgery or pneumonia.
    - Medical Researcher
    - Biomedical Engineer

Assessment Questions

- How do lungs work?
    - When you breath in your rib cage expands and your diaphragm gets pulled down to allow air into your lungs. When you breath out your rib cage contracts to help force air out of your lungs.
- What does a spirometer measure?
    - The volume of air inhaled or exhaled from the lungs.
- Why is it important to keep lungs healthy?
    - The lungs help bring oxygen into the body while expelling carbon dioxide. Oxygen is needed to keep all of the tissues within our bodies alive.

Clean Up

- Sanitize device and erase dry board.
- Place clean, dry equipment back into the demo bin.

References

- https://www.getbodysmart.com/spirometry/lung-volumes-capacities

Related Next Generation Science Standards

- K-5
    - 1-LS1 From Molecules to Organisms: Structures and Processes
    - 3-LS3 Heredity: Inheritance and Variation of Traits
    - 4-LS1 From Molecules to Organisms: Structures and Processes
- 6-8
    - MS-LS1 From Molecules to Organisms: Structures and Processes
- 9-12
    - HS-LS1 From Molecules to Organisms: Structures and Processes