Topic: Respiration

Teacher Information

Time Allowance
50 min.

Background
For people on Earth, normal pulmonary function is as natural as, well, breathing.

Aboard the International Space Station (ISS), however, astronauts are currently conducting a series of experiments to research the effects of spaceflight on pulmonary function and other breathing-related issues.

Materials (per group)
Student Sheets
1-liter plastic bottle
Two balloons
Two rubber bands
Scissors

Preparation
1. Cut bottles in half horizontally. The students can do the rest of the "breathing" bottle.
2. If you do not want them to use scissors, cut the neck off of one balloon per group.

Discussion/Wrap-up:
- Discuss the similarities between this experiment and your lungs.
- Ask students, "Was the outcome what you expected? Why or why not?"
- Answers to questions:
  a The balloon in the bottle fills with air when you pull down on the stretched balloon.
  b Muscles in the body contract and expand to allow air in the lungs based on the atmospheric pressure.
  c Diaphragm
  d Breathing rate increases with exercise.

A Breathing Bottle - Respiration

Student Worksheet

Background Information:

Have you ever thought about how you breathe? Most people say that your lungs "draw" in a breath of air, but that is not exactly true. Your breathing is based mostly on the atmospheric pressure. Muscles in your body push and pull to allow the air in. The diaphragm is the large muscle that does this. It causes there to be an imbalance in pressure by contracting. Air rushes into your body—inhaling. The diaphragm will then relax, or expand, causing another imbalance in pressure. The air in your body rushes out—exhaling. Your lungs do not actually bring in or push out the air. They are just storage tanks for the air, while your diaphragm does the "real" work.

To inhale, the pressure outside is larger than on the inside. The atmosphere pushes in the air. To exhale, the pressure inside becomes more than the outside. The air is pushed out by the imbalance of pressures. In a vacuum, there would be no atmospheric pressure, so there would be nothing to cause the air to go into your lungs. Your diaphragm would continue to contract, but nothing would happen. That is why it is so critical for spacesuits to work properly. They must maintain a pressure consistent with Earth; otherwise, the astronaut would be unable to breathe. She needs oxygen, but she has to have the atmospheric pressure to push and pull the air in and out of her.

Today's lesson will allow you to simulate the lungs and diaphragm. If done correctly, you should see how the breathing process works.

Procedure

1. Read through <u>all</u> instructions before beginning this activity.
2. Place the whole balloon through the opening of the bottle so that its neck sticks out of the bottle.
3. Stretch the balloon opening over the bottle opening.
4. Place a rubber band over the balloon to keep it in place.
5. Pull the half balloon over the bottom of the bottle.
6. Place a rubber band over the bottle to hold the balloon in place.
7. Without tearing the balloon, grab the center part of the stretched balloon. Pull it out slightly. Continue this motion and observe what happens to the balloon on the inside. Record your results on the back of this page.
8. Repeat procedure 7, only this time try it faster and slower than the first time. Record your observations on the back of this page.
9. Answer the following questions on the back of this page :
    - a What happens to the balloon in the bottle?
    - b How does this simulate breathing?
    - c What muscle is important for inhaling and exhaling?
    - d How would your breathing change based on your activity? Why?