



What's in Your Breath?

How is air we breathe in different from air we breathe out?

Description

We breathe in and out all the time. What's in the air we breathe out from our lungs (exhale), and how is it different than the air we breathe in (inhale)? Test to see if carbon dioxide is present in the air we breathe in and out.

Age Level: 10 and up



How is air we breathe in different from air we breathe out?

Materials

- Leaf of red cabbage
- 1 L of water
- Blender
- Liquid measuring cup or large container
- Strainer
- 4 large, clear drinking glasses or containers
- Marker
- Masking tape
- 4 drinking straws
- 3 large balloons (about 20-30 cm when inflated)
- Ruler
- Funnel
- 25 ml (5 teaspoons) of baking soda
- 60 ml (1/4 cup) of white vinegar
- Empty soda or water bottle, approximately 500 mL
- Bicycle tire or balloon pump
- Newspaper and/or paper towels
- Rubber band (optional)



Time

Preparation: 15 min
Activity: 30 min
Cleanup: 15 min

Step 1

Put a red cabbage leaf, about the size of a playing card, into a blender with 1 liter of water. Blend.



Step 2

Pour the mixture through a strainer and save the transparent blue-purple juice in a large measuring cup or container. If the juice is dark purple, add water so it matches the color in the picture. This liquid is a pH indicator—it can test acidity (and help identify chemicals) by changing its color when mixed with other substances.



Step 3

Pour about 60 ml ($\frac{1}{4}$ cup) of the cabbage juice into each of the 4 glasses or containers. Using the masking tape and marker, label the four: control, air, breath, and carbon dioxide.



Step 4

Blow up a balloon with your mouth (NOT with a pump) so the balloon is about 20 cm in diameter. (Pinch the balloon closed with your fingers but don't tie the balloon.) This balloon is now full of gases you exhaled from your lungs.



Step 5

Insert a straw into the mouth of the balloon, and pinch the mouth of the balloon around the straw with your fingers. Insert the other end of the straw into the cabbage juice in the glass/containers labeled "breath." Release the gases from the balloon into the liquid so it bubbles. Did the color of the cabbage juice change?



Step 6

Blow up a different balloon with a pump, so that it is also about 20 cm in diameter. This balloon is now full of gases from the air around you.



Step 7

Just as before, insert a straw into the mouth of the balloon. Release the gases from the balloon into the glass/container labeled “air.” Did the color of the cabbage juice change?



Step 8

For the “carbon dioxide” sample, you will produce pure carbon dioxide. Fill the empty soda or water bottle with about 60 ml of white vinegar. Insert the funnel into an empty balloon and put 25 ml (5 teaspoons) of baking soda into the funnel so all the baking soda enters the balloon.



Step 9

Without getting baking soda inside the bottle yet, carefully place the mouth of the balloon over the mouth of the bottle that has vinegar inside. While holding the mouth of the balloon tightly over the mouth of the bottle, lift the balloon up to dump the baking soda into the vinegar. The balloon will now inflate with carbon dioxide gas created by mixing the baking soda and vinegar.



Step 10

When the balloon is done inflating, carefully remove the balloon. Pinch the mouth of the balloon to keep the carbon dioxide gas from escaping. Insert one end of a straw into the mouth of the balloon and the other straw end into the glass/container labeled “carbon dioxide.” Release the gas from the balloon into the juice through the straw. Did the color of the cabbage juice change?



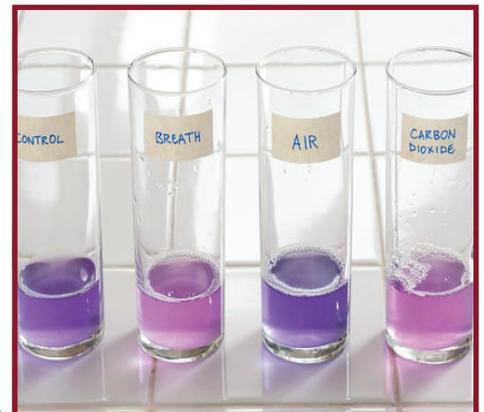
Step 11

Compare the four colors of the cabbage juice in the glasses/containers. Which colors are similar? Do you think you exhale carbon dioxide gas? What evidence is your hypothesis based on?



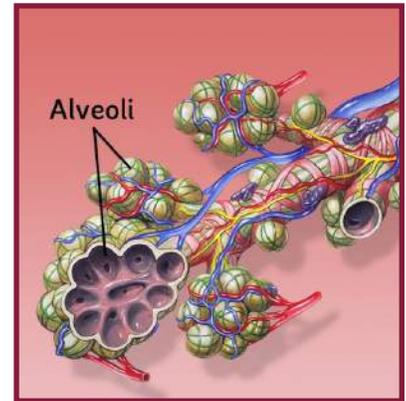
What's Going On?

The cabbage juice didn't change color when you added gas from the tire pump. The tire pump filled the balloon with air from the atmosphere, which is mainly nitrogen and oxygen. The cabbage juice changed from purple to pink with the gas produced by vinegar and baking soda—carbon dioxide. The gas from your breath should have also changed the cabbage juice to a pink color. This means the air you exhale probably contains carbon dioxide. It's different than the air you inhale! The trillions of cells that make up your body use oxygen to get energy from food you eat. One waste product from this process is carbon dioxide that you exhale.



Smoking and your lungs

When you breathe in, air fills tiny air sacs in your lungs, called alveoli. Blood cells moving around the alveoli absorb oxygen and release carbon dioxide. As you breathe out, the carbon dioxide leaves your body. If you smoke, the alveoli in your lungs become less stretchy, so it's more difficult for your lungs to take in oxygen and get rid of carbon dioxide. As alveoli are damaged, less oxygen moves to your blood, causing you to feel short of breath. Air pollution and secondhand smoke can damage your lungs. To keep your lungs healthy, stay away from cigarette smoke whenever possible, and try to avoid going outdoors on bad air days.



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Credits



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