

Detecting Carbon Dioxide

Overview: An oxygen and carbon dioxide exchange takes place in your bloodstream. When you breathe air into your lungs it brings in oxygen, which is carried from your lungs by red blood cells in your bloodstream. Cells of your body use the oxygen and carbon dioxide is produced as waste, which is carried by your blood back to your lungs. You exhale and release the CO_2 as waste. You will study this exchange in today's lab.

Materials

- bromothymol blue
- straw
- resealable baggie
- ammonia
- pipette
- water
- goggles, gloves, ventilation, and adult help!

Experiment

1. Pour about 2 ounces of water into the baggie and add two capfuls of the bromothymol blue. Close the baggie well and swish the solution around inside it gently to mix. Note the color of the solution for your data record.
2. Open the baggie a tiny bit and put the straw inside, ***but DO NOT drink the solution! It could make you sick.*** Close the bag tightly around the straw and gently blow into the solution. Again, *be careful not to suck on the straw.*
3. Watch the color of the solution closely as you continue to blow into the solution and create bubbles of carbon dioxide gas. The color will change to a sea green color and then eventually it will change to bright yellow. Note each color change in your records.
4. You can return the solution to blue by slowly adding a base – such as ammonia – to the solution in the bag. Bleach will also work. ***Please ask an adult to help with this.***
5. Add one drop at a time, shaking after each addition to mix the solution. You will be able to observe when the pH starts to change back by the color of the solution. It should turn back to green and then to blue.

Detecting CO₂ Data Table

Solution	Color Change	Acidic or Basic?

Reading

Bromothymol blue will change color in a pH range from 6.0 to 7.6. It is an acid/base indicator. Its basic solution is at a pH of 7.6 or above – this is when it is blue. In acidic conditions, it will turn yellow – this is a pH of 6.0 or below. And when it's in between the two, it will be the sea green color that you observed in your baggie.

Because carbon dioxide is a little acidic, when we breathe it out into the water and bromothymol blue solution its bubbles start to lower the pH. You saw a small change in pH with the sea green color, but as you continued to exhale and add carbon dioxide, the solution became more and more acidic. This eventually resulted in a pH at or below 6.0 and a bright yellow solution.

In order to exchange oxygen with carbon dioxide in your lungs, they have over 300,000,000 teeny little air sacs called alveoli. In one minute, you breathe approximately 13 pints of air.

Exercises

1. What is pH and how it is useful?
2. What does a yellow color indicate with bromothymol blue?
3. Is CO₂ acidic or basic?

Answers to Exercises: Detecting Carbon Dioxide

1. What is pH and how is it useful? (a measurable scale that lets us know how acidic or basic something is)
2. What does a yellow color indicate with bromothymol blue? (acidic solution)
3. Is CO₂ acidic or basic? (slightly acidic, so it changes the solution green)