Carry Out Science: Apple Browning

Description: Explore the chemical reaction behind apple browning.

Grades: 2+
Ability Level: Easy
Time: 6 hours

Tools:

- 1 apple, sliced into quarters
- 3 small bowls or cups
- Lemon juice
- Vinegar
- Pineapple juice
- 3 cotton balls
- Clock or timer

Experiment Instructions:

Before you start the experiment, discuss with your family: What happens when you cut or bite into an apple and leave it out? Why do you think it turns brown? How can we prevent the apple from turning brown?

1. Set one piece of the apple off to the side. This slice will be left alone and will serve as the "control" for the experiment.
2. Measure out each type of liquid into a separate bowl or cup.
3. Dip a cotton ball into the lemon juice and dab the juice all over the surface of one of the apple slices. If you don't have cotton balls, you can also dip the apple slice into the liquid for about 30 seconds.
4. Repeat this process with a fresh cotton ball for vinegar and one for pineapple juice. Apply one to each an individual slice.
5. Place the four apple slices on a plate and let sit out for a day. Make sure you remember which apples were coated with specific liquids – it might help to label them (see image above).

Discuss with your family: Which liquid do you think will be best for keeping the apple slice from browning? Why do you think that?

6. Throughout the day, check on the apple slices and record your observations on the other side of this sheet. Take pictures if you want. Compare the slices to each other: Which slice is the brownest? Which slice is the least brown? Do you notice a change in the smell or texture of the apples?
7. After about 6 hours, observe your final results! Which method would you use to preserve sliced fruit before eating it? Why?

Record Your Observations!

Scientists make observations to help answer questions about the world around them. Use this chart to help keep track of your own observations during the apple browning experiment!

Apple slice with:	**Time of Observation**	**Notes (e.g., what does each slice look, smell,feel)**
No Liquid (Control)		
Lemon Juice		
Vinegar		
Pineapple Juice		

The Chemistry Behind Apple Browning

Why do apples turn brown when you leave them out?

When you slice or bite into an apple, you are exposing it to oxygen in the air. Oxygen activates an enzyme in the apple called *polyphenol oxidase*. Enzymes speed up chemical reactions – in this case, speeding up the browning of the apple by releasing melanin. This chemical reaction, called "enzymatic browning," can be simplified to:

Polyphenol Oxidase (enzyme in the apple) + Oxygen (in the air) → Melanin (brown color)

Different apples will brown at different rates because their chemical contents vary. This reaction is not unique to apples! Pears, bananas, and eggplants have this reaction and the result is a similarly unappealing brown mush. You can try this experiment with different types of apples or even different types of fruit!

How can we prevent apples from turning brown?

To slow the chemical reaction, you can isolate the fruit in an *anaerobic* – or oxygen-free – environment. This is possible by placing lemon juice or pineapple juice on the apple. These liquids carry *antioxidants* which eliminate oxygen. Oxygen in the air reacts to ascorbic acid in the lemon and pineapple juice before it reacts with the enzyme in the apple.

Food for Thought

Share your experience! Scan the code on the left with your smart phone's camera to take a brief survey that will help us improve this experiment for families like yours!

https://kent.qualtrics.com/jfe/form/SV_401gFT0z9eogZox