



Secret Citrus Message

Did you know that everything God created is made up of *elements*? You may have heard of some elements like sodium, helium, gold, or oxygen. Another element is carbon. Carbon is one of the key elements in sugars, starches, proteins, fats, and oils—all the molecules that make up living things including humans, animals, and plants like fruits and vegetables. Even paper is made up of a carbon molecule (carbon combined with other elements) called *cellulose* (SEL-you-lows) *fibers*. These fibers also contain carbon-based sugars called *glucose*.

All this chemistry might be difficult to understand—but it can be fun! Let's use carbon molecules to write a secret message.



I'm **Roger Patterson**, the host of *Unlocking Science* on Answers TV. Let's have some fun as we investigate God's amazing creation.

Let's do it!

Materials

- Lemon juice
- Bowl or cup
- Cotton swab or paint brush
- White paper
- Clothes iron

Definition Key

Atoms: the smallest part of a substance that cannot be broken down

Element: the simplest substance made of only one kind of atom

Molecules: a connection of two or more atoms



Instructions

1. Squeeze some lemon juice into a bowl or cup.
2. Dip the cotton swab or paint brush into the lemon juice. Use the swab or brush to write on the paper.
3. Let the paper dry completely for about 15–20 minutes.
4. Ask an adult to help you iron the paper on low heat—just make sure the iron is not on the steam setting.
5. Watch your secret message appear.

How Does It Work?

The sour taste of lemon juice is caused by a carbon molecule called citric acid. When you add lemon juice to paper, the citric acid weakens the chemical bonds in the cellulose fibers (paper) to expose the sugars. When those sugars meet the heat and the oxygen in the air, a process called caramelization (car-mul-ih-ZAY-shun) turns the sugars a dark color. The same chemical process happens when you heat sugar to make caramel.



Secret Facts

- Next time, try writing with lime juice or orange juice.
- If you left the lemon juice on the paper without heating it, the message would eventually appear. The heat just reveals it faster.
- During World War I, German spies were caught sending secret messages with lemon juice.

