

LESSON 13:

CITRUS VOLCANOS

SUPPLIES

TEACHER BRINGS

- Lemons (10)

PENCIL BOX

- Pencils
- Markers


MAIN BIN

- Cutting Board (1)
- Paper Cups (40)
- Spoons (20)
- Popsicle Sticks (20)
- Plastic Cups (10)
- Dish Soap (for extension)
- Knife (1)
- Tablecloth (2)

OBJECTIVES


- Identify different signs that a chemical reaction has occurred
- Explain which way we could tell that a chemical reaction happened today!

INTRODUCTION

 2-3 min

Today, we're going to explore how volcanoes erupt by creating our own mini volcanoes with citrus fruit and baking soda! First, we'll make predictions and create hypothesis about what reaction will occur when we mix these two ingredients. Then, we'll watch a chemical reaction as it replicates a real volcano! Today's class may even erupt with excitement!

HOOK

 1-2 min

Ask students what they know about volcanoes. What happens when they erupt?

- Have you ever played "The Floor Is Lava"?
 - Why can't you touch the floor?

Ask students if they have any idea how a volcano works.

COLOR FACTOR

A chemical reaction occurs when baking soda hits the natural acids of the fruit.

- We used food coloring to see a stronger visual of the bubbles formed when the reaction takes place! The bubbles produced are actually carbon dioxide!

SIGNS OF A CHEMICAL REACTION

- color change
- temperature change
- smell change
- production of gas
- production of a solid
- emission of light

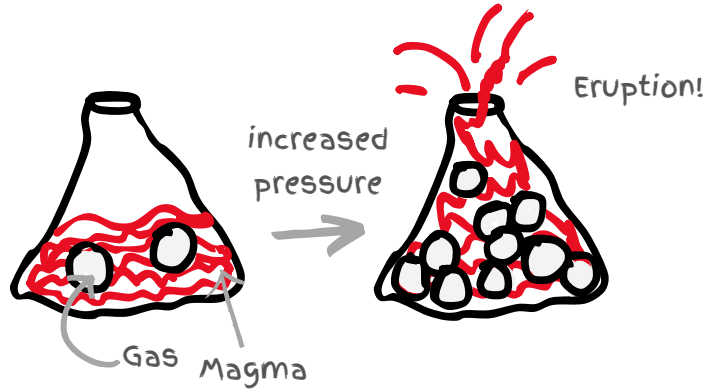


VOLCANIC ERUPTIONS 3-5 min

Explain that in a volcano, there is hot liquid rock called magma. Over time, pressure builds up from gas that forms inside the volcano. Eventually, so much gas builds up inside the volcano that there is no space left! As the gas tries to escape, the magma is forced through the opening of the volcano, and the volcano erupts. Once magma leaves the volcano, it is known as lava.



Sample Whiteboard Drawing



INTRODUCTION CONT'D 5-7 min

Review the signs of a chemical reaction (see Color Factor) with students. Then ask:

- What do you know about lemons? How might they create a chemical reaction?
- How might this chemical reaction look like a volcano? Which signs of a chemical reaction would you see?

Lava can be up to 2,200 degrees!




Today, we are going to be making volcanos using our three fruits and baking soda. A lemon contains citric acid, which is a type of acid. Acids taste sour and can react with certain other chemicals. Baking soda is also called sodium bicarbonate. This is a base. Bases often feel slippery and can react with acids.

Discuss the hypothesis questions and write the class's answers on the board. Wait to fill out the observation sections until you have done the experiment.

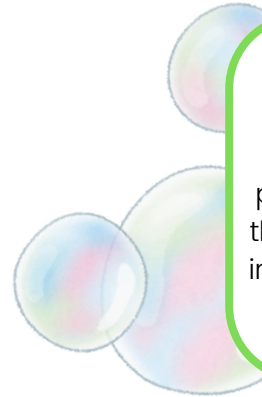


DISCUSSION

 3-5 min


Using their ideas from the hook, have students predict:

- What do you think will happen when we add baking soda to the lemon?
- Will the lemon make more or less bubbles than water would? Why do you think that?



TIP

To speed up the reaction, use the popsicle stick to poke the baking soda down into the lemon, lime, or orange.

 20-25 min

EXPERIMENT

1. Roll the lemons, limes, and oranges on a hard surface to release the juices and cut them in half
2. Pass out a paper cup and markers to each student
3. Have the students color the paper cups to look like volcanos
4. When the students are done coloring place half of a lemon inside of their cup
5. Have the students use popsicle sticks to poke hole in there lemons to help with the chemical reactions
6. Pass out 4 tables spoons, or a 1/4th cup, of baking soda and a spoon to each group. Instruct the class to, on the count of three, add a large spoonful of baking soda to the top of the lemon. **NOTE: make sure to use tablecloths to protect tables.**
7. Have the students observe what happens.



MOVEMENT BREAK

States of Matter Freeze

In this game, the teacher calls out “solid,” “liquid,” or “gas,” and students act out each state with their bodies. For “solid,” they freeze in place like a rock. For “liquid,” they move slowly and smoothly around the room. For “gas,” they move quickly and freely like bouncing molecules. To add extra fun, when the teacher yells “plasma,” students can jump and wiggle. This game is a great way to get students moving while reinforcing science concepts about states of matter.

CITRUS VOLCANOS

EXTENSION

If you have the time and materials, try this extension activity!

Ask the students if they think that adding dish soap to the baking soda will produce a bigger or smaller reaction. Add your hypothesis to the whiteboard.


Then, repeat the experiment using the lemons, but add dish soap to the fruit before adding the spoonful of baking soda.

Ask students:

- How does adding the dish soap change the reaction?
- Why do you think this happens?

Explain that the bubbles and foam are bigger because the dish soap traps some of the carbon dioxide that is produced by the chemical reaction. The chemical reaction is the same size as it was before, but it looks bigger because of the gas-filled bubbles!

OBSERVE & EXPLAIN

 5-10 min

Discuss the following questions with students, then give them the explanations.


Question:

How do you know a chemical reaction occurred?

Explanation:

We could tell that a chemical reaction occurred because of the production of gas— that's what created the bubbles! Some students may have noticed a slight temperature change, as well, but we don't recommend touching the foam to check!

OBSERVATION

 5-10 min

When you mix an acid like lemon juice with a base like baking soda, they react in a chemical reaction that creates carbon dioxide gas, or, CO_2 . This is the same type of reaction that helps real volcanoes erupt!

Discuss the following questions with students and add the observations to your table on the whiteboard:

- What happened when the baking soda was added to the lemon?



VOCABULARY

Chemical Reaction

When two or more things (called chemicals) mix together and make something new, because their tiny parts (molecules) change.



DISCUSSION & EXPLANATION (cont.)

Question:

How do you think this is similar to a volcano erupting?

Explanation:

The chemical reaction of our fruits and baking soda formed bubbles, which pushed the citrus juice upwards. In a volcano, gas also builds up, but the pressure is way higher, causing the magma to explode out the top!



Question:

Why do you think this chemical reaction occurred?

Explanation:

A chemical reaction occurred here because gas was creating when the acid (citrus juice) and base (baking soda) mixed to neutralize each other

Lemons, limes, and oranges are acidic and contain citric acid.

- Citric acid consists of many hydrogen ions. Baking soda is a base and contains many hydroxide ions. When acids and bases mix, they create a neutral substance

When the baking soda was added to the fruit and met the citric acid in the juice, a chemical reaction began as the ions neutralized.

- A byproduct of this reaction was carbon dioxide gas. The gas was in the liquid mixture and began to try and escape.

As the pressure of carbon dioxide built up in the fruit, it began to overflow. The bubbling foam was the carbon dioxide releasing into the air. The reaction stops when the juice and baking soda mix completely and neutralize each other, meaning no more carbon dioxide gas is being created.



EXIT TICKET



Ask each student the following questions as they walk out the door.

Why do you think bubbles formed during the eruption?

What did you like most about making your volcano?

Can you tell me what a “reaction” is in your own words?

CLEAN UP & DISMISSAL

Students must then clean their workspace. Materials can be disposed of safely in the sink or trash can. Make sure everything is clean and wiped down before you leave.

