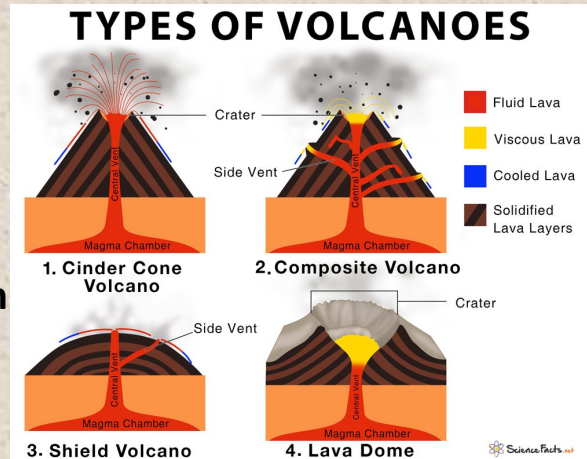


STEM Challenge: Make a Lemon Volcano

Volcanoes are made of unique rocks called **extrusive igneous rocks**.

A **volcano** is formed when **hot molten rock, ash and gases** escape from an opening in the Earth's surface. The **molten rock and ash** solidify as they cool, forming one of **4 distinctive volcano shapes**.



Geologists and professional **volcanologists** classify **volcanoes** into these **4** different types based on **shape, magnitude, structure, material and type of eruption**.



As a **volcano** erupts, it spills **lava** that flows downslope. **Hot ash and gases** are thrown into the air.

Some **volcanoes** are covered with snow and ice. If they erupt, melted snow and ice mixes with mud and volcanic ash and flows down mountain. **Volcanic flows** are called **lahars**.

Volcanoes can produce different types of **lava**.

Pahoehoe lava is runny and flows downslope; it has a smooth, ropey, wrinkled texture.

Aa lava is more explosive and produces hot gasses and much thicker rough textured lava that is sticky.

Pillow Lava erupts under water and forms shapes like pillows.

Using the directions on the next page, build your own Lemon Volcano!

What you need:

Pan or tray

Lemons/other citrus fruits

Cutting knife

Butter knife

Spoon

Measuring cup

Baking soda

Food coloring



1. Ask an adult to cut the top and bottom off of the lemon and use a butter knife and spoon to partially scoop out the inside of the lemon.
2. Add a few drops of food coloring to the inside of the lemon.
3. Pour some baking soda on top of the lemon.
4. Use the butter knife to mix the baking soda with the inside of the lemon.
5. Keep mixing periodically with the knife, adding more baking soda, until the reaction stops.



Test with other citrus fruits—which fruit works the best?

Citrus fruits taste sour because their flesh contains a lot of citric acid. Citric acid is a chemical that has lots of hydrogen ions (H^+). These hydrogen ions are what our taste buds recognize as a sour taste. Acids like to get rid of their hydrogen ions, & do this by reacting with other chemicals, called bases, that contain lots of hydroxide ions (OH^-). When an acid & base combine (this is called an acid-base reaction), they neutralize each other.

Baking soda ($NaHCO_3$) is a base, so it contains hydroxide ions. When it comes in contact with an acid, a chemical reaction starts. The reaction neutralizes the acid and releases carbon dioxide (CO_2) gas. This gas wants to escape the liquid, creating bubbles. The citric acid is released into the lemon juice when mashed & reacts with the baking soda that you pour over the lemon. As soon as they combine, carbon dioxide gas is produced & creates bubbly foam. Once the citric acid & the baking soda have neutralized each other, the reaction stops, so eventually your volcano will stop erupting.