

# Forces of Nature



## Overview

In this lesson, students will investigate the process of building volcanoes and the threats that volcanoes pose to their surrounding communities.

## Education Standards

### Science

#### (3.7) Rapid Changes in Earth Surface

The student is expected to investigate rapid changes in Earth's surface such as volcanic eruptions, earthquakes, and landslides.

## Materials

- Teacher Background handout (for teacher reference only)
- Active Volcanoes in Russia handout (one set per team)
- Safety goggles
- Hard boiled eggs (one per team or one as a teacher demo)
- Wipes
- Paper towels
- Baking pan (per team)
- A bag of soil (5-6 cups per team)
- Baking soda (one tablespoon pre-measured per team for easier distribution)
- Vinegar (one cup pre-measured per team)
- Red food dye

# Vocabulary

**Volcano:** A vent in the surface of the Earth through which magma and associated gases and ash erupt; also, the form or structure (usually conical) that is produced by the ejected material.

**Vent:** The opening at the earth's surface through which volcanic materials issue forth.

**Magma:** Molten rock beneath the surface of the earth.

**Lava:** Magma which has reached the surface through a volcanic eruption. The term is most commonly applied to streams of liquid rock that flow from a crater or fissure. It also refers to cooled and solidified rock.

**Crater:** A steep-sided, usually circular depression formed by either explosion or collapse at a volcanic vent.

**Eruption:** The process by which solid, liquid, and gaseous materials are ejected into the earth's atmosphere and onto the earth's surface by volcanic activity.

**Extinct Volcano:** A volcano that is not presently erupting and is not likely to do so for a very long time in the future.

**Active Volcano:** A volcano that is erupting. Also, a volcano that is not presently erupting, but that has erupted within historic time and is considered likely to do so in the future.

**Destructive Forces:** the process by which rock is broken down, such as erosion and weathering either through the violent actions of volcanoes and earthquakes or by the steady flow of a river.

# Student Objectives

Students will understand what volcanoes are and how they are formed.

Students will recognize key characteristics of volcanoes and volcanic eruptions.

Students will understand how volcanic eruptions change the Earth's surface.

# Activity

## Before the activity:

1. Make copies of hands for each team, including a set of vocabulary cards.
2. Intro. Activity: Prepare one medium cooked eggs per team or one if you do a teacher model.
3. Have supplies for Part Two Activity ready for easy distribution to teams.

### **Introduction Activity:**

Divide the students in small groups (3-5 per group). This will help facilitate conversation within the team about volcanoes.

1. Start the lesson by giving students an overview of volcanoes using the teacher background information handouts. Hand each group a set of the Active Volcanoes in Russia handouts. Allow students a few minutes to talk in their groups about what they notice in the pictures. Call on a few groups to share.
2. Tell students that they are going to create a model of the Earth by using a boiled egg. Before you hand out the eggs, show students what they will be doing. Take a medium boiled egg and roll it gently on a paper towel, so the shell cracks but does not break off. Give each team one hard boiled egg and a paper towel. Ask each group to roll their egg gently on a paper towel to crack the shell.
3. Explain that the broken eggshell is like Earth's crust – it is not one solid piece, instead it is broken up into smaller chunks called plates.
4. Next, ask each team to gently squeeze the egg (you may want to model first). Explain that the movement on the eggshells represents the Earth's plates and they are constantly moving. The plates float on top of the liquid mantle.
5. The following will get a tad bit messy (and the students will love it!). Ask students to squeeze the egg harder. They will begin to notice material oozing out of the cracks. All them to get messy. Allow 1-2 minutes for them to discuss what they think happened in their model.
6. Explain that on Earth, sometimes when the plates move, magma escapes from between the cracks, and causes a volcanic eruption.
7. Distribute wipes and have students clean up.
8. **Teacher demo:** Explain that hotspots occur when magma pushes through the middle of a plate, not in the cracks between plates, as if a hole was poked through the shell of an uncooked egg and liquid oozed out. Demonstrate on an uncooked egg for the class.

### **Part Two Activity (outdoors preferred):**

*Can be done in teams (as described below) or as a Teacher Demo*

*Distribute safety goggles*

1. Tell students that they will be making a model that demonstrates a volcanic eruption.
2. Have students place the baking pan on the ground, and set the soda bottle in the middle of the pan.
3. Mound and shape the moist soil around the bottle to form a mountain. Bring the soil right up to the top of the bottle's opening, but don't get the soil inside the bottle.
4. Have students pour one tablespoon of baking soda into the bottle.
5. Have students color one cup of vinegar with red food coloring (or have it pre-mixed ahead of time).
6. Have one student (safety goggles on) pour the colored vinegar into the bottle.
7. Stand back and watch red foam spray out of the top and down the mountain like lava from a volcano.
8. **Ask:** How does a volcanic eruption affect the surrounding communities? Can anything good come from a volcanic eruption?

### **Teacher explanation:**

**What's happening?** The baking soda is reacting with the vinegar to produce carbon dioxide gas. The gas builds up enough pressure to force the foaming liquid out of the top of the bottle.

The violent separation of gas from lava may produce rock froth called pumice. Some of this froth is so light—because of the many gas bubbles—that it floats on water. In many eruptions, the froth is shattered explosively into small fragments that are hurled high into the air in the form of volcanic cinders (red or black), volcanic ash (commonly tan or gray), and volcanic dust.

**\*Refer to the Teacher Background handout for a more detailed explanation to help guide students in their discussions.**

## Extension

Ask the students to think about what might make predicting a volcanic eruption difficult and what problems might result from inaccurate predictions.

Is it possible for scientists to predict when a volcano will erupt so they can call for the evacuation of the area around it? If so, what kind of evidence do the scientists need to make such a prediction?