LESSON 4:
LIVING NEAR A VOLCANO

GRADE LEVEL 3-5

VOLCANOES EDUCATOR GUIDE

An SK Films Release

DIGITAL CROSSING FILMS

Volcanoes Educator Guide

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GRADE LEVEL 3-5
(1) 15 MINUTE PREP LESSON
(3) 45 MINUTE LESSONS

LESSON OVERVIEW:

Is it possible to build a volcano-safe home?
In this lesson, students will learn about the challenge engineers face when designing homes for people living close to volcanoes. First, students will learn about the environmental issues that face individuals living near active volcanoes. Afterwards, students will create a plan for engineering a safer building in volcanic areas, build a model, and then test its effectiveness at withstanding hazards.

SCIENCE STANDARDS:

- 4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

SCIENCE AND ENGINEERING PRACTICES:

- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

FROM THE FILM:

In the film ***Volcanoes***, photographers visit several towns situated near active volcanoes. Some towns are archaeological sites whilst others still have thriving communities living in close proximity. In this lesson, students learn how environmental engineers think about building structures near volcanoes so they have a better chance of withstanding forces, perhaps allowing people to return after eruptions.

MATERIALS:

- Crayons/colored pencils
- Scissors
- Cardboard or foam board, cut into square foot pieces (1 per group of students)
- Materials for Building:
  Please note, these are materials that are easy to build with and frequently found in classrooms. They are useful, but not an exhaustive list of things you might offer students to use. Teachers should feel free to add or subtract from this list
  - Card stock
  - Cardboard
  - Construction paper
  - Aluminum foil
  - Wax paper
  - Tape
  - Glue
  - Paper clips
  - Toothpicks
  - Pipe cleaners
  - Straws
- Materials for testing:
  - Fan
  - Cup of sand
  - Cup of mud

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TEACHER PREP:

DAY 1:

During this lesson, you are introducing students to the design challenge of building a structure for the town of Capas near Mount Pinatubo in the Philippines. If you find it to be helpful, you may want to locate some images of the Mount Pinatubo eruption for students to see the kind of damage/legacy it left behind.

DAY 2:

Before class, cut out 1 square foot cardboard or foam board pieces for student groups to build on. You will need one piece per group. When students are planning their design, it is helpful for them to be able to touch and manipulate the materials, even if they aren't allowed to build yet. Consider creating material sample bags. Inside each bag, place a small piece of the materials that will be available for them to build with later.

Set up the materials tables and decide on any material limitations you are going to set. (This can range from only allowing students to take 3 materials or only allowing them to take certain lengths of materials).

DAY 3:

Prepare to test the students' house designs. Set up a desk at the front of the room. Using a couple of books, create an inclined area for students to place their square foot foundations. Make sure the area is close enough to an outlet that you can plug in a fan. Fill a bucket with sand and have a cup ready for scooping. Create a bucket of "mud" by mixing equal parts dirt and water. This will be the lahar of the volcano. Have a cup ready for scooping. It is recommended that you get a large deep baking pan for students to hold at the low end of the inclined plane. The pan will then collect any of the excess sand and mud (ash and lahar) that falls downward.

TO DO:

BEFORE VIEWING THE FILM:

1. Ask students:

   Do they think it's possible to live near an active volcano?

   Why or why not?

Allow several students to share their ideas with the class. Inform students that amazingly enough, many people live close to active volcanoes on Earth. As they will soon see in the film ***Volcanoes***, these active geologic sites are rich areas for mining minerals and growing crops. Because of the wealth of natural resources, many people take the risk of working and living near active volcanoes. Challenge students to imagine what it would be like to live near an active volcano. Give students 10 minutes to do a stop and jot of their predictions. Challenge them to be creative, remind them that there is not a right or wrong answer, we are just imagining!

DAY 1:

1. Ask students to share what they remember about towns near active volcanoes. Have several students share their thoughts with the class.

2. Tell students that living near an active volcano is hazardous, but still possible. People must expect to evacuate their home if the volcanic flow ever changed directions. Typically, however, people have to learn how to adapt to the more regular and daily challenges of living in a volcanic zone.

3. Inform students that they will be building a structure for the town of Capas. Capas is located near the volcano Mount Pinatubo. After 500 years of lying dormant, Mount Pinatubo erupted in 1991. At the time, the towns surrounding the volcano were largely unprepared for the eruption. Most structures failed and whole cities had to be evacuated. Today, Capas is once again growing in population and needs your help. *Can we help build a safer city?*

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DAY 1 CONTINUED:

4. To begin, students will learn about the different hazards that occurred during the Mount Pinatubo eruption in the "Volcanic Hazards" activity page(s). Students will read about each hazard and use their imagination hat. After they read each hazard, they should imagine a home in their head. What would happen to the home when this hazard reached it? They should then draw and write a short description of their predictions. Do a think aloud for the first hazard, "lateral wind". The term "lateral winds" refers to the rapidly traveling super-heated gases of a pyroclastic flow

5. Put students in groups of 3-4. Ask them to visit their drawings and brainstorm the question: *what could they do to protect a building from this hazard?*

5. Tell students that first, they must create a plan. As a team, decide on the design of the building and any surrounding protective structures. They must draw their plan on the "Our Plan" activity page(s) and list the materials they will need. Give students 10-15 minutes to arrive at a plan.

6. Inform students that they will be constrained in the amount of time they have to build. After they gather their materials they will have the remainder of this class period to build their idea (minus five minutes for clean up). Tomorrow, however, they will have 20 more minutes to complete their building. Afterwards, you will begin testing their designs!

DAY 2:

1. As a warm up, have students share ideas from the brainstorm yesterday. *How could you build buildings that might survive volcanic eruptions?* Remind students that the buildings have been evacuated.

2. Give each group a building chip, found in the "Capas City Building Chips" activity page(s). This will be the building they must create for the town.

3. Show students the materials that will be available to them and any constraints you decide to include. (You can do this by displaying the material names on the board. Or give each group "samples" of the materials to allow the students to physically manipulate the materials when planning but is more time intensive to prepare).

4. Show students how they will test the design. Each group will get a 1 square foot piece of cardboard or foam board. The will need to build the building so that it is attached to this flat piece. You will then tilt the piece 20 degrees to simulate the angle of living on the side of a mountain. Then you will stress test their designs to mimic the hazards of a volcano:

- You will create lateral winds with a fan to see if it stands still.
- You will pour sand on the roof to see if the ash collects or falls off.
- You will pour a muddy lahar (see teacher prep notes) from the high side of the board to see if the building stands up or any gets in.

Mt. Vesuvius looms in the background of the city of Naples, Italy. It's infamous eruption in 79 AD destroyed the nearby towns of Pompeii and Herculaneum.

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DAY 3:

1. As a warm up, ask students to share challenges they faced while building yesterday. After a few groups have shared their ideas, remind students that scientists and engineers encounter challenges every day. They never view these as failures but as ways to re-imagine a new solution.

2. Allow students another 20 minutes to build.

3. Bring the class back together. One group at a time, bring them to the front and ask them about their design. *How do they think it will work?* Test their design with the following procedure:

- You will create lateral winds with a fan to see if it stands still.
- You will pour sand on the roof to see if the ash collects or falls off.
- You will pour a muddy lahar (see teacher prep notes) from the high side of the board to see if the building stands up or any gets in.
- At the end, ask students, *how are they thinking differently now about living next to a natural hazard like a volcano?*
- *What would they do differently if they got a chance to rebuild their design?*

A home sits next to a fissure spewing lava from the active Kilauea volcano on the Big Island of Hawaii. Hundreds of homes were destroyed during the 2018 eruption.

Volcanic Hazards

Directions:

Read the descriptions for hazards. Imagine a home in your mind. What would happen to the home during that hazard? Draw your idea. Write your idea as a sentence.

Volcanic Hazards:	What Would Happen To A Home?
Ash Cloud: **The volcanic explosion pulverizes rock. The mountain bursts open. Some of the rock of the mountain turns to ash. The ash cloud expands upwards. Eventually, the ash cloud will rain down. Because the ash is rock, it is very heavy. Ash is twice as heavy as rain and snow.** 	**Draw Your Idea:** **Write Your Idea:** _____ _____
Lahars: **Lahars are large mudslides. Falling dirt and rock from the volcano mix with water. The super hot mud will flow down the mountain. When a lahar dries, it's like cement.** 	**Draw Your Idea:** **Write Your Idea:** _____ _____

Volcanic Hazards

Directions:

Read the descriptions for hazards. Imagine a home in your mind. What would happen to the home during that hazard? Draw your idea. Write your idea as a sentence.

Volcanic Hazards:	What Would Happen To A Home?
Lateral Winds: **Volcanic eruptions release a lot of pressure, which can be felt as a strong wind. The wind travels parallel to the ground and flows from the center of the volcano outward.**	**Draw Your Idea:** **Write Your Idea:** _____ _____

Capas City Building Chips

City Bank:
2 stories tall

Movie Theatre:
3 stories tall

Hotel:
2 stories tall

Grocery Store:
2 stories tall

Home:
1 story tall

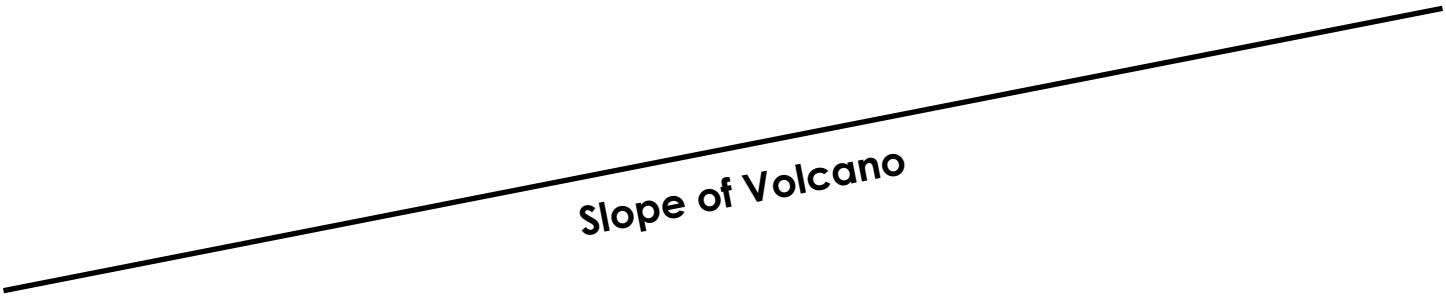
Home:
1 story tall

Our Plan

Directions:

Decide as a team, how you will build your building.
Draw your idea below. List the materials you will need.

Drawing:



Materials: