

Celebrating Science: Volcanoes
Grade: 9-12



Celebrating Science: Volcanoes

Description:

An exploration of volcanoes would not be complete without studying Hawaii. Hawaii Volcanoes National Park showcases the results of 70 million years of volcanism, migration, and evolution – “processes that thrust a bare land from the sea and clothed it with complex and unique ecosystems and a distinct human culture.” Students will virtually visit the world’s most active volcano, Kilauea, to learn about the birth of the Hawaiian Islands and the new land that is currently forming. A park ranger will share information about the structure and effects of volcanoes as well as Hawaiian legends that tell the cultural story of Hawaii’s volcanoes.

Video Link: (Use the following link to view the *Celebrating Science Volcano* video)
http://easylink.playstream.com/21_CenturyLearning/journeys/hawaii/hi_volcanoesmbr.rm



This photo shows lava entering the ocean on the south flank of Kilauea. Lava has been extending the coastline on this part of the island for over 10 years.

Photograph copyrighted by [Paul Buklarewicz](#).

Discussion:

Lesson at a glance: Students will use world, state, and county maps to learn the location of the volcano in their assigned region of Hawaii. Students will discuss the basic structure of Hawaiian volcanoes, and the potential effects of an eruption in their area. Students will discuss potential dangers and concerns that would effect their environment due to an eruption.

Key Concepts: Hawaii is a remote island chain in the Pacific Ocean. Most of the population lives on five major islands. The Island of Hawaii is made of five volcanoes. The potential for an eruption at a given location is determined by the status of the volcano (active, dormant, or extinct) and, for the dormant and active volcanoes, the proximity to the summit or rift zones.

Lesson Outcomes:

The students will:

1. Locate their assigned town/region on a county map of Hawaii
2. Name the volcano on which they live
3. Describe the basic structure of Hawaiian volcanoes
4. Discuss the likelihood of an eruption or lava flows in their region and potential environmental effects

Activity:

Volcanic Features

1 a). Define and match these volcanic features with the correct photo (next page):

- lava fountain
- fissure eruption
- lava pond

2 a). Students will create an informational PSA announcement on the three volcanic features. The learner will describe the physical characteristics of each feature using various classroom resources (web, books, information from video, encyclopedia). Students will then use the pictures to cut out and label with each identifying brief description they have researched on each volcanic feature.

Volcanic Features

1.



2.



3.



3 b). How Hot Does It Get? (Grades 9th) *Worksheet on next page and answer key below.

Students will use calculate lava degrees using conversion equations to convert degrees Fahrenheit to Celsius and degrees Celsius to degrees Fahrenheit.

Equations:

- **Degrees Fahrenheit to Degrees Celsius** - $F = (C \times 9/5) + 32$
- **Degrees Celsius to Degrees Fahrenheit** - $C = (F - 32) \times 5/9$

Answer key:

Lava pouring out of the lava tube is about 1150 C. How hot is the lava in F? **2,100 F.**

Steam generated at the interface between lava and water is estimated to be 135 C. How hot is the steam in F? **275 F**

The maximum water temperature measured in front of the lava entry was 70 C. How hot is the water in F? Could you go for a comfortable swim in this water? Hint: Convert your body temperature (98 F) to C and compare to the water temperature.

Your body temperature is about 36 C. If you fell into 70 C water, it would burn you.

About 60 feet (200 m) offshore, the water that was heated by the lava has been diluted by colder ocean water, and temperatures are typically 36 C. Could you go for a comfortable swim in this water? **Yes. This temperature is equivalent to about 97 F, about the temperature of a hot tub. Note that a swim in front of the lava entry would be a dangerous excursion. Not only is the lava dangerous; but so are the currents, surf, and bench collapses.**

Tephra from the Puu Oo high fountains glowed yellow and orange. These colors indicate a temperature of about 1000 C. What was the temperature of the lava fountain in F?

On some days, rangers take visitors out to see cooling lava flows. The flows typically have cracks in a thick, black crust. Deep in the cracks, the lava still glows red. The temperature of the red lava beneath the crust is about 500 C. What is the temperature of the red lava in F? **930 F.**

How Hot Does It Get?

Eruptive products of Hawaiian volcanoes span a wide range of temperatures. To familiarize yourself with these temperatures and the temperatures scales answer the following questions. To convert degrees Celsius to degrees Fahrenheit, use this equation:

$$F = (C \times 9/5) + 32$$

To convert degrees Fahrenheit to degrees Celsius, use this equation:

$$C = (F - 32) \times 5/9$$

Students can check the equation by remembering that $100\text{ C} = (212\text{ F} - 32) \times 5/9$. Use the equations to answer these questions.

1. Lava pouring out of the lava tube is about 1150 C. How hot is the lava in F?
2. Steam generated at the interface between lava and water is estimated to be 135 C. How hot is the steam in F?
3. The maximum water temperature measured in front of the lava entry was 70 C. How hot is the water in F? Could you go for a comfortable swim in this water? Hint: Convert your body temperature (98 F) to C and compare to the water temperature.
4. About 60 feet (200 m) offshore, the water that was heated by the lava has been diluted by colder ocean water, and temperatures are typically 36 C. Could you go for a comfortable swim in this water?
5. Tephra from the Puu Oo high fountains glowed yellow and orange. These colors indicate a temperature of about 1000 C. What was the temperature of the lava fountain in F?
6. On some days, rangers take visitors out to see cooling lava flows. The flows typically have cracks in a thick, black crust. Deep in the cracks, the lava still glows red. The temperature of the red lava beneath the crust is about 500 C. What is the temperature of the red lava in F?

Research Project

Your mission is to find information and report on a volcano that has erupted in the last 100 years. Your reports must include:

1. Type of volcano
2. Geographic location
3. Name, distance, and population of nearest major city
4. Date of most recent eruption and date of most destructive eruption
5. Other events associated with the last eruption (earthquakes, floods, mudslides, etc)

Challenge: Then, attach a one page description of the major hazards to humans in the vicinity of this volcano. Speculate on what you would do if you were in charge of minimizing the risk to the population.

References

Use these references to start your research:

- Alaska Volcano Observatory - <http://www.avo.alaska.edu/>
- Cascades Volcano Observatory - <http://vulcan.wr.usgs.gov/home.html>
- The Electronic Volcano - <http://www.dartmouth.edu/~volcano/>
- Michigan Tech Volcanoes Page - <http://www.geo.mtu.edu/volcanoes/>
- Volcano/Earth Science-Oriented Servers - http://vulcan.wr.usgs.gov/Servers/earth_servers.html
- US Geological Survey Volcanic Hazards Program - <http://volcanoes.usgs.gov/>
- Global Volcanism Program (GVP) - <http://www.volcano.si.edu/>
- VolcanoWorld - <http://volcano.und.edu/>
- What to do if a Volcano erupts - <http://vulcan.wr.usgs.gov/Hazards/Safety/framework.html>

Challenge Questions:

1. Use the picture to describe the effects and damages caused by the volcanic eruption. How do you think life living near this volcano was affected?
2. To what effect do the media alter the way the public feels and reacts to volcanoes?
3. The "Plus Side" of Volcanoes – (use the following link to disperse any myths and check students responses)

<http://vulcan.wr.usgs.gov/LivingWith/PlusSide/framework.html>

- a. Have students brainstorm in groups or pairs how many different “Positive” ways volcanoes can benefit the environment and its people economically, physically, tourism, resources obtained from volcanic eruptions...



Prompts/Responses:

1. Begin the class discussion by talking about recent natural disasters that students have seen or heard about such as hurricanes, flooding, dust storms, earthquakes and tremors, tornadoes, and drought. Discuss the effects these disasters have had on their environment physically (buildings, terrain, crops, homes, school, playgrounds), economically (grocery stores, businesses, water, gas, and electricity), and emotionally (how does it impact the moral of the people). You can either continue as a class discussion or have groups of students predict the outcome the pictured volcanic eruption had physically, economically, and emotionally. Encourage the students to "think outside of the box".
2. Possible responses - entertainment (list as many movies/books/comics that portray volcanoes in a negative fashion), news - (stories on television, in magazines, or the newspaper). Discuss with the students what it means to have the media sensationalize something. Have students discuss reasons why the media might sensationalize volcanoes (profit, audiences, dramatic affect).
3. <http://vulcan.wr.usgs.gov/LivingWith/PlusSide/framework.html> Have students use the following link to read and research the numerous "Positive" outcomes of volcanoes and volcanic eruptions.

- **Volcanoes and People**
The "Plus Side" of Volcanoes ... Volcanoes both harass and help mankind.
- **New Land**
Volcanoes build new land.

- **Fertile Soils**
Volcanic materials ultimately break down and weather to form some of the most fertile soils on Earth.
- **Geothermal Energy**
The internal heat associated with young volcanic systems has been harnessed to produce geothermal energy.... includes Newberry Caldera, The Geysers Geothermal Field, Casa Diablo, Salton Sea Geothermal Field
- **Mineral Resources**
Most of the metallic minerals mined in the world, such as copper, gold, silver, lead, and zinc, are associated with magmas found deep within the roots of extinct volcanoes located above subduction zones.
- **Industrial Products**
People use volcanic products as building materials, as abrasive and cleaning agents, and as raw materials for many chemical and industrial uses.
- **Business Opportunities**
Advertisements, Arts and Crafts, Food and Lodging, etc.
- **Spas and Resorts**
Rotorua-Whakarawarewa, New Zealand
- **Recreation and Tourism**
America's National Parks and Monuments ... includes Yellowstone Caldera - First National Park, Mount Rainier - Fifth National Park, Mount St. Helens National Volcanic Monument, etc.