Name _____ Class _____ Date _____

CHAPTER 9 Volcanoes

SECTION 2

Effects of Volcanic Eruptions

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

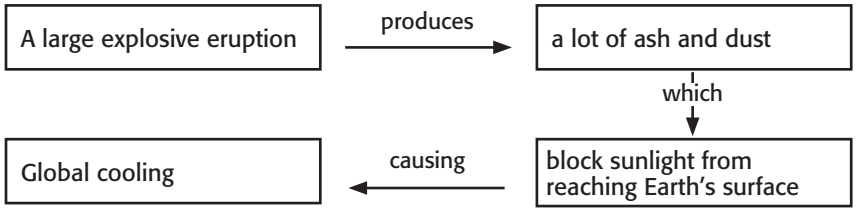
- How can volcanoes affect climate?
- What are three kinds of volcanoes?
- What are three structures that volcanic eruptions can form?

National Science Education Standards
ES 1c

How Can Volcanoes Affect Climate?

In 1815, a huge volcanic explosion happened on Mount Tambora in Indonesia. Historians estimate that the explosion killed 12,000 people. As many as 80,000 people died from hunger and disease following the explosion. However, the explosion did not affect only the people living in Indonesia. It also affected the climate worldwide.

Ash and dust from the explosion flew into the upper atmosphere. There, they spread across the Earth. They blocked sunlight from reaching the Earth's surface. As a result, global temperatures dropped. In 1816, there was a snowstorm in June! The colder temperatures caused food shortages in North America and Europe.



In 1991, an explosive eruption on Mount Pinatubo caused global temperatures to drop. Explosive eruptions may cause global temperatures to decrease by 0.5°C to 1°C. This may seem like a small change, but even small temperature changes can disrupt world climates.

How Can Volcanoes Affect the Earth's Surface?

In addition to affecting climate, volcanoes can have important effects on the Earth's surface. Volcanoes produce many unique *landforms*, or surface features.

The most well-known volcanic landforms are the volcanoes themselves. There are three main kinds of volcanoes: shield volcanoes, cinder cone volcanoes, and composite volcanoes.

STUDY TIP

Compare After you read this section, make a chart comparing the three kinds of volcanoes. Describe how each type of volcano forms and what it looks like.

TAKE A LOOK

1. Identify What causes global temperatures to drop after a large explosive eruption?

STANDARDS CHECK

ES 1c Land forms are the result of a combination of constructive and destructive forces. Constructive forces include crustal deformation, volcanic eruption, and deposition of sediment, while destructive forces include weathering and erosion.

2. Describe How do shield volcanoes form?

_____

_____

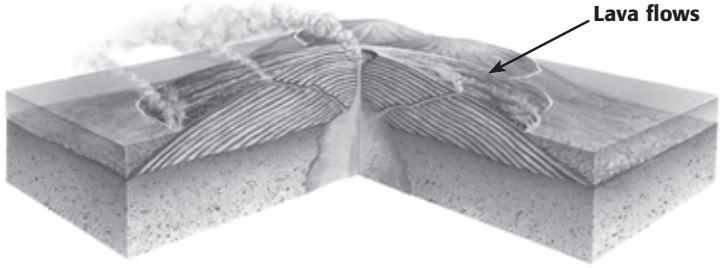
_____

_____

SHIELD VOLCANOES

Shield volcanoes form when layers of lava from many nonexplosive eruptions build up. The lava that forms shield volcanoes is thin and runny. Therefore, it spreads out in thin layers over a wide area. This produces a volcano with a wide base and gently sloping sides.

Shield volcanoes can be very large. For example, Mauna Kea in Hawaii is a shield volcano. Measured from the base on the ocean floor, Mauna Kea is taller than Mount Everest!



Shield volcanoes form when many layers of lava build up over time.

CINDER CONE VOLCANOES

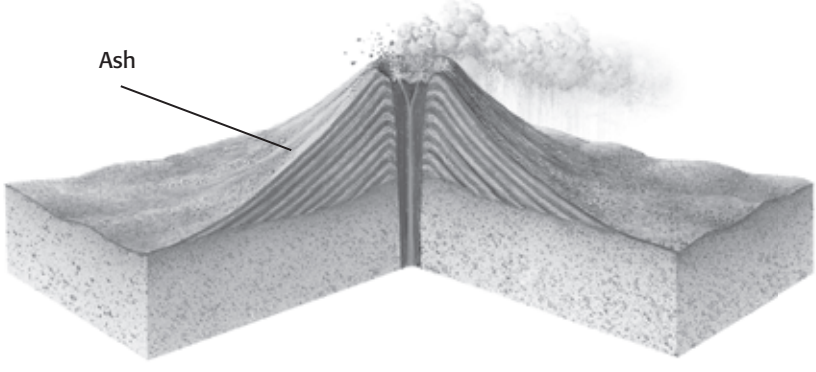
Cinder cone volcanoes are made of pyroclastic material. The pyroclastic material is produced from explosive eruptions. As it piles up, it forms a mountain with steep slopes. Cinder cones are small. Most of them erupt for only a short time. For example, Paricutín is a cinder cone volcano in Mexico. In 1943, Paricutín appeared in a cornfield. It erupted for only nine years. ☑

READING CHECK

3. Identify What are cinder cone volcanoes made of?

_____

Most cinder cone volcanoes are found in clusters. They may be found on the sides of other volcanoes. They erode quickly because the pyroclastic material is loose and not stuck together.



Cinder cone volcanoes form when ash from explosive eruptions piles up. Most cinder cones are small.

TAKE A LOOK

4. Identify Which type of volcanic eruption produces cinder cone volcanoes?

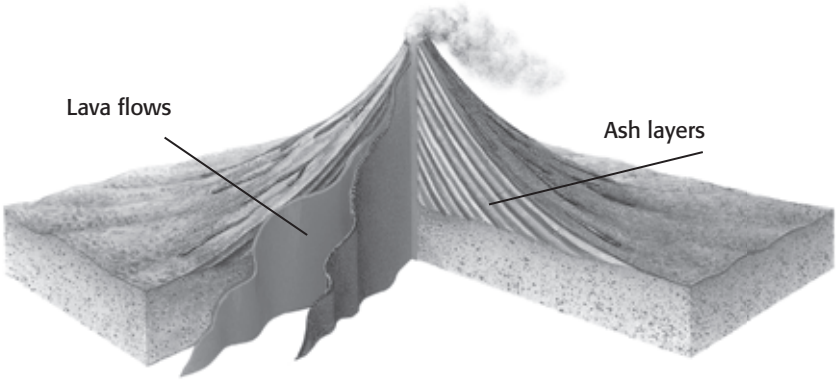
_____

COMPOSITE VOLCANOES

Composite volcanoes are the most common type of volcano. They form when a volcano erupts both explosively and nonexplosively. They have layers of lava flows and pyroclastic material. They usually have a broad base and sides that get steeper toward the top. Mount St. Helens is a composite volcano.

Critical Thinking

5. Infer The word stratum means "layer." Why are composite volcanoes sometimes also called stratovolcanoes?



Composite volcanoes form from layers of ash and lava. Most have steep sides.

TAKE A LOOK

6. Identify What two materials are composite volcanoes made of?

What Are Other Types of Volcanic Landforms?

In addition to volcanoes, other landforms are created by volcanic activity. The landforms include craters, calderas, and lava plateaus.

CRATERS

A **crater** is a funnel-shaped pit around the central vent at the top of a volcano. Lava and pyroclastic material can pile up around the vent. This produces a crater in the middle of the cone. ☑

READING CHECK

7. Define What is a crater?

CALDERAS

A **caldera** is a large *depression*, or pit, that forms when a magma chamber collapses. The ground over the magma chamber sinks, forming a caldera. Calderas can look similar to craters, but calderas are much larger.

LAVA PLATEAUS

A **lava plateau** is a large area of land covered by a huge volume of lava. Lava plateaus are the largest volcanic landforms. They do not form at tall volcanoes. Instead, lava plateaus form when a large volume of lava erupts from a crack in the crust. Most of the lava on the Earth's surface is found in lava plateaus.

Name _____ Class _____ Date _____

Section 2 Review

NSES ES 1c

SECTION VOCABULARY

caldera a large, circular depression that forms when the magma chamber below a volcano partially empties and causes the ground above to sink	**crater** a bowl-shaped depression that forms on the surface of an object when a falling body strikes the object's surface or when an explosion occurs **lava plateau** a wide, flat landform that results from repeated nonexplosive eruptions of lava that spread over a large area

1. Compare Explain how a crater is different from a caldera.

2. Describe How can volcanoes affect climate?

3. Identify What are the three main types of volcanoes?

4. Explain Why do shield volcanoes have wide bases?

5. Explain Why do cinder cone volcanoes erode quickly?

6. Identify What is the largest kind of volcanic landform?

7. Apply Concepts Does the lava that forms shield volcanoes probably have a lot of silica or water in it? Explain your answer.

SECTION 3 EARTHQUAKES AND SOCIETY

1. Answers will vary.
2. about 50 times more
3. If an active fault hasn't had a strong earthquake in a long time, pressure is building up. More pressure leads to stronger earthquakes.
4. height, mass, composition, location
5. A mass damper is placed at the top of a building. An active tendon system is in its basement.
6. You will know what to do in an earthquake.
7. Possible answers: doorway, under a desk or table
8. any nonperishable food
9. Possible answers: under the desk, in the doorway
10. a parent, teacher, police officer, or firefighter

Review

1. Earthquakes are more likely to occur in seismic gaps than in other places.
2.

If you are...	Then you should...
...inside a building	...crouch or lie face down under a desk or table, away from glass or heavy objects; cover your head with your hands
...outside	...lie face down on the ground with your hands on your head, far from power lines or fire hazards
...in a car or bus	...ask the driver to pull over and stop; stay inside the car or bus until the earthquake is over

3. They look at the damage to other buildings from earthquakes.
4. Small earthquakes occur much more often than large earthquakes.
5. Possible answers: The car is on fire; the car is in a dangerous location (e.g., railroad tracks).

Chapter 9 Volcanoes

SECTION 1 VOLCANIC ERUPTIONS

1. a body of magma below a volcano
2. hardened lava flows
3. nonexplosive
4. Explosive eruptions are less common. Explosive eruptions produce ash and dust instead of lava.
5. magma composition
6. It can block the volcano's vents, causing pressure to build up.
7. Water: More water makes explosive eruptions more likely.

   Silica: More silica makes explosive eruptions more likely.
8. hardened magma that is blasted into the air
9. They both have sharp edges.
10. Small pieces of lava harden before they hit the ground.
11. about 120 mi/h

Review

1. Lava is magma that flows on the Earth's surface.
2. explosive and nonexplosive
3. Magma with a lot of water is likely to erupt explosively.
4. It is thinner and runnier, so gases can escape more easily.
5. Both are lava flows with smooth surfaces. Pillow lava forms underwater. Pahoehoe forms on land.
6. Large blobs of magma harden in the air.
7. Pressure builds up inside bubbles in magma. When the pressure gets high enough, the bubbles shatter, producing tiny fragments of rock.
8. a fast-moving "river" of hot ash and dust from a volcano
9. explosive

SECTION 2 EFFECTS OF VOLCANIC ERUPTIONS

1. Ash and dust in the atmosphere block sunlight, preventing it from reaching Earth's surface.
2. Layers of lava from nonexplosive eruptions build up into a mountain.
3. pyroclastic material
4. explosive eruptions
5. They are made of layers of different materials.
6. ash and lava
7. a funnel-shaped pit around the central vent of a volcano

Review

1. A crater is a funnel-shaped pit around the central vent at the top of a volcano. A caldera is a large semicircular depression that forms when the magma chamber of a volcano collapses.

2. A large volume of gases and ash may be released during a volcanic eruption. These gases and ash can prevent sunlight from reaching the Earth. This can cause global temperatures to decrease.
3. cinder cones, composite volcanoes, shield volcanoes.
4. The lava that forms them is thin and runny and spreads out over a large area.
5. The material in them is loose and not cemented together.
6. lava plateaus
7. No, because it is thin and runny. Silica and water tend to produce thick, stiff lava and explosive eruptions.

SECTION 3 CAUSES OF VOLCANIC ERUPTIONS

1. It is under high pressure.
2. It will melt.
3. at tectonic plate boundaries
4. a decrease in pressure
5. Magma erupts from the mantle at divergent boundaries and hardens.
6. Oceanic crust is more dense.
7. Water released from the subducting plate mixes with the mantle and causes it to melt.
8. a place where volcanoes form far from plate boundaries
9. Dormant volcanoes may erupt again, but extinct volcanoes probably won't.
10. Gas dissolved in the magma may bubble out and be emitted at the volcano.
11. Rising magma pushes it up.

Review

1. at divergent plate boundaries
2. Three points that are far from plate boundaries should be circled.
3. a decrease in pressure
4. As plates move apart, the pressure on the mantle below them decreases. This causes the hot rock in the mantle to melt and form magma.
5. increase in earthquakes, change in emitted gases, ground swelling, increase in surface temperatures

Chapter 10 Weathering and Soil Formation

SECTION 1 WEATHERING

1. breaking down rock by physical means
2. No, because it is the expansion of ice that causes ice wedging.
3. Running water moves rocks around. As the rocks are moved by the water, they bump into one another. This bumping causes abrasion.
4. Their tunneling breaks rocks into small pieces. It also exposes more surfaces to weathering.
5. water, air, and acid
6. The minerals in granite dissolve very slowly in water. It takes a long time for enough minerals to dissolve for the rock to break down.
7. active volcanoes and burning fossil fuel
8. the presence of acidic groundwater and rock that can be dissolved
9. Acids weaken the rock and make it crack. The rock in weakened areas is more likely to be removed by mechanical weathering.
10.

Factor	How does it cause chemical weathering?
Water	Water can dissolve mineral grains in rock and cause the rock to break down.
Acid precipitation	Acids are more reactive than plain water. Acids in precipitation can quickly dissolve rocks.
Acids in groundwater	Acids in groundwater can dissolve rock and carve huge caves underground.
Acids from living things	Living things leave acids behind when they touch rock. The acids can weaken the rock and cause it to crack.
Air	Oxygen in the air can react with metals and other compounds to form new compounds. This can weaken rock.

Review

1. water, wind, and gravity
2. (clockwise from the top)
   Water seeps into cracks in the rock.
   Water freezes.
   Ice pushes on the cracks.
   The cracks expand.
   The ice melts.
3. Acids can break the bonds between minerals in rocks. They can also dissolve rocks.