

Chapter 20 EARTHQUAKES AND VOLCANOES

Chapter 20 Assessment

Vocabulary

Select the correct term to complete the sentences.

body waves	crystallization	Richter scale
fault	earthquake	Moment Magnitude scale
lava	intrusive rock	Modified Mercalli scale
magma	surface waves	focus
volcano	composite volcano	shield volcano
epicenter	seismograph	magma chamber
	cinder cone	extrusive rock

Section 20.1

- The place on Earth's surface above the location that rock breaks during an earthquake is the _____.
- Stick-slip motion between lithospheric plates causes a(n) _____.
- The point below the epicenter is called the _____.
- A(n) _____ is a place where rocks break and there is movement.
- These seismic waves travel at Earth's surface: _____.
- _____ are seismic waves that travel through the planet.
- The instrument used to record seismic waves is a(n) _____.
- Each number change on the _____ means a 10-fold increase in seismic wave amplitude.
- Eyewitness accounts of earthquake damage are incorporated into this earthquake measurement scale: _____.
- The _____ rates the total energy of an earthquake.

Section 20.2

- A(n) _____ is formed by an eruption that includes a high amount of gas and comparatively little lava.
- The products of an eruption can build a mountainous _____.
- _____ is magma that has reached Earth's surface.
- _____ is melted rock within the mantle and Earth's crust.
- Because low-silica lava is runny, it can't build up a tall, cone-shaped _____. Low-silica, runny lava will result in a(n) _____, which is a flat and wide volcano.
- A(n) _____ is a place where magma collects underground.

Section 20.3

- A(n) _____ results from magma that cools underground.
- A(n) _____ results from magma that cools at Earth's surface.
- A process that occurs when magma or lava cools to form an igneous rock: _____.

Concepts

Section 20.1

- What geographic region has the most earthquakes? Explain your answer.
- Why is the motion between two plates that are sliding past each other described as stick-slip motion?
- Why is *plastic* a good term to describe the upper mantle?
- Describe stick-slip motion and give an example.
- When an earthquake takes place at a transform plate boundary, does it occur at every place along the boundary or in one location? Explain your answer.

6. How is potential energy involved in how one earthquake triggers another earthquake?
7. Compare and contrast surface waves to P- and S-waves.
8. Why is a seismograph useful for measuring the magnitude of an earthquake on the Richter scale?
9. Is it possible that an earthquake could happen and you would not know it? Explain your answer.
10. Compare and contrast the Moment Magnitude scale and the Richter scale.
11. After an earthquake, one person says that the intensity of the quake was VI on the Modified Mercalli scale. Another person says that the intensity was III. Why might these individuals have had different experiences?
12. Do volcanoes ever form away from plate boundaries within plates? Explain your answer.
13. Volcanoes found near subduction zones have which of the following?
 - a. magma with high silica content
 - b. an explosive eruption
 - c. large amounts of gas released during the eruption
 - d. all of the above
14. Which of the following describe volcanoes on islands above a hot spot?
 - a. made up of layers of granitic lava
 - b. are shield volcanoes
 - c. are made from thick, high-silica magma
 - d. all of the above

Section 20.2

12. What is the difference between a conduit and a vent?
13. Describe the three phases in the life cycle of a volcano.
14. What factors affect the melting of solid rock in the mantle?
15. What is the main factor that affects the consistency of magma.
16. Where do composite volcanoes tend to be found?
 - a. at subduction zones
 - b. at a transform plate boundary
 - c. at a divergent plate boundary
 - d. where two continental plates come together
17. Mount St. Helens formed at which kind of plate boundary?
 - a. convergent
 - b. transform fault
 - c. divergent
 - d. mid-ocean ridge

Section 20.3

22. Explain the role of crystallization in the formation of igneous rocks. Is it possible for an igneous rock to lack crystals? Why or why not?
23. Magma is the source material for all igneous rocks.
 - a. How is it that magma forms so many different kinds of igneous rocks?
 - b. Describe how the magma that forms andesite, rhyolite, and granite becomes silica rich.

Problems**Section 20.1**

1. You need three seismic stations to determine the location of the epicenter of an earthquake. Why wouldn't just two stations provide enough information? Hint: You might need to make a diagram to help you answer this question.

Chapter 20

EARTHQUAKES AND VOLCANOES

2. In 1960, an earthquake occurred in Chile that had a Richter scale magnitude of 9.5. How would the energy of this quake compare to one that had a 7.5 magnitude?
3. You can use the time-distance graph below to determine the distance to an epicenter.
 - a. The arrival time difference between P- and S-waves is 1 second. What is the approximate distance to the epicenter?
 - b. The arrival time difference between P- and S-waves is 4 seconds, what is the approximate distance to the epicenter?
 - c. If the distance to an epicenter is 10 kilometers, how long after the P-waves did S-waves arrive at a seismic station?
 - d. How would you describe the relationship between arrival time difference and distance to the epicenter?

S-P Time Difference vs. Distance to the Epicenter

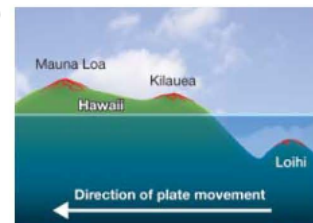


Section 20.2

4. How do the sizes of volcanoes compare to the sizes of other types of mountains? First, research the size range for shield, composite, and cinder cone volcanoes. Then, find the height of the world's highest mountain. Is it taller or shorter than the world's highest volcano? Provide data that supports your answer.

5. The island of Hawaii sits on top of a hot spot. The hot spot has also formed the Mauna Loa and Kilauea volcanoes on the island. Currently, the hot spot is building the undersea volcano Loihi to the southeast of the island. When Loihi gets bigger and reaches the ocean surface, it will increase the size of Hawaii.

- a. What kind of lava forms these volcanoes? Justify your answer.
- b. Which volcano is older? Mauna Loa or Kilauea? Justify your answer.
- c. Loihi is 3,000 meters above the floor of the Pacific Ocean. How does its height compare to the height of Mount St. Helens?
- d. Prior to the 1970s, scientists thought Loihi was an oceanic feature called a seamount. Research and describe the events that led up to Loihi being described as an active volcano.
- e. How are scientists currently studying Loihi?



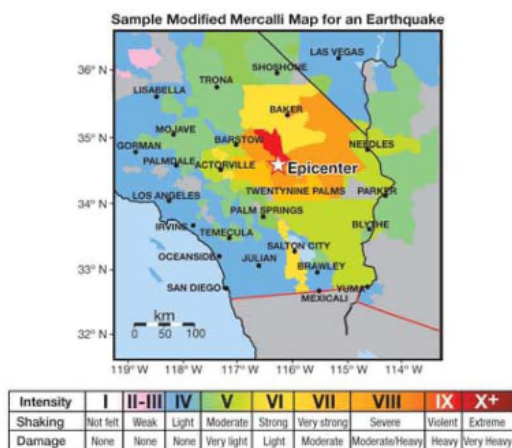
Section 20.3

6. Igneous rocks vary by color and the size of their crystals. Identify the conditions of formation that would lead to the following igneous rocks.
 - a. a light-colored rock with large crystals
 - b. a dark-colored rock with sharp edges and no crystals
 - c. a dark-colored rock with large crystals
 - d. a light-colored rock with small crystals

Applying Your Knowledge

Section 20.1

1. This United States Geological Survey (USGS) map illustrates how a 1999 earthquake in Hector Mine, California, was felt by surrounding communities. The magnitude of the quake at the epicenter was 7.1. The map is based on the Modified Mercalli scale.
 - a. Why does the distribution of color on this map make sense?
 - b. List two communities that experienced an intensity of IV and two that experienced an intensity of V.
 - c. Use the scale at the bottom of the map to estimate the area in square kilometers that experienced an intensity of IX.



2. If you feel an earthquake, you can report what you experienced on the USGS website page entitled "Did You Feel It?" (www.usgs.gov). Making sure that the public understands hazards such as earthquakes is part of the mission of the USGS. Imagine that you have just been hired as an employee of the USGS. Your first task is to explain the ratings for earthquakes. Make a one-page informational sheet that describes the differences among the Richter scale, the Moment Magnitude scale, and the Modified Mercalli scale.

Section 20.2

3. In the text, you learned that at some point in the future, the valleys created from both Iceland and Ethiopia being pushed apart will fill with ocean water. This is the same way that the supercontinent Pangaea began to break up 200 million years ago. Can we better understand how Pangaea broke up by studying Iceland and Ethiopia? Why or why not? Justify your answer.
4. At the beginning of the chapter, you learned a little about the ways in which earthquakes and volcanic eruptions can be predicted. It turns out that this is very challenging to do.
 - Step 1: Pick either earthquakes or volcanoes. Explain your choice.
 - Step 2: Research what scientists are doing to improve their ability to predict an earthquake or a volcanic eruption.
 - Step 3: Write a paragraph about your findings.

Section 20.3

5. Yosemite National Park is known for features called granite domes. Find out how these features are formed and write about them. What kind of plate boundary is associated with their formation?