

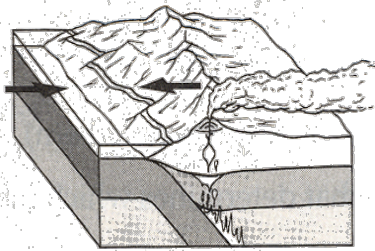
WHERE DO VOLCANOES FORM AND WHY?

What is a Volcano?

A volcano is a weak spot in the crust where molten material, called magma, erupts to the surface. Magma is a mixture of rock-forming minerals, gases and hot water from the mantle. When magma reaches the surface, it is called **lava**. When lava has cooled, it forms a type of rock called **igneous rock**, which means "from fire". Volcanoes can form in 3 major ways:



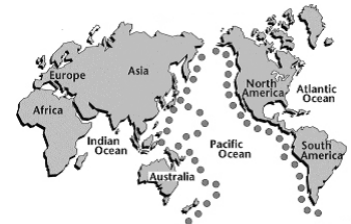
1. Volcanoes at Convergent Boundaries



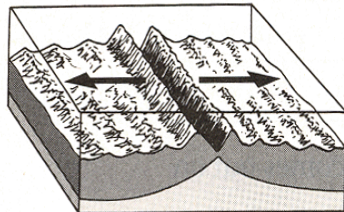
Most volcanoes form at **convergent boundaries** called subduction zones. At these boundaries, **oceanic plates subduct below continental plates**. As the denser oceanic plate sinks down, heat from the Earth melts the plate and the rock becomes magma. Since magma is less dense than the surrounding rock, it rises to the surface through cracks in the crust. Eventually, the magma breaks through the continental crust, creating volcanoes.

Some volcanoes form at convergent boundaries where **two oceanic plates collide**. As the denser of the two oceanic plates subducts, the magma rises toward the surface. Eventually, it breaks through the ocean floor to form a string of volcanoes called an **island arc**. Island arcs form chains of volcanic islands away from major coastlines.

Over 80 percent of all the active volcanoes above sea level occur along subduction zones that rim the Pacific Ocean. The volcanoes in this region form a belt called the **Ring of Fire**. Some of these volcanoes are found in the western United States and Canada.



2. Volcanoes at Divergent Boundaries



Volcanoes also form along **divergent boundaries** where tectonic plates pull apart, allowing magma to rise from the mantle. Some of these types of volcanoes are in Africa's Great Rift Valley. However, most of the volcanoes of this type are under the ocean. Magma erupts along **ocean spreading centers** and cools to form new crust.

3. Volcanoes at Hot Spots



Less commonly, volcanoes can form over a **hot spot** in the middle of a tectonic plate. A hot spot is an area where hot magma comes very close to the surface. Heat from the magma melts the rock above it, forming volcanic mountains. The **Hawaiian Islands** formed one by one over millions of years as the Pacific plate drifted over a hot spot. Hot spots can also be found under continents. Yellowstone National Park in Wyoming is above a hot spot under the North American plate.

REVIEW QUESTIONS: WHERE DO VOLCANOES FORM AND WHY?

1. What is a volcano?

2. A mixture of rock-forming minerals, gases and hot water from the mantle is called what?

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3. When magma reaches the surface, it is called _____.

4. Where do most volcanoes form? What happens at this boundary?

5. Volcanoes at boundaries where two oceanic plates collide create a string of islands called a(n) _____.

6. Describe how volcanoes form at divergent boundaries.

7. What is a hot spot?

8. Circle the letter of the types of plates that collided to form the Rocky Mountains on the west coast of North America.

a. two oceanic plates

c. a continental and island plate

b. a continental and oceanic plate

d. two continental plates

9. How did the Hawaiian Islands form?

PARTS OF A VOLCANO

How a Volcano Forms

Lava begins as magma in the asthenosphere. Magma flows up through cracks in the rock until it becomes trapped or reaches the surface to form a volcano.

Parts of a Volcano

Inside a volcano, magma collects in a large pocket called a **magma chamber**. The magma moves through a **pipe**, which is a long tube that connects the magma chamber with the Earth's surface. There, the magma leaves the volcano through an opening called a **vent**. The area covered by lava as it pours out of a vent is called a **lava flow**. Lava may collect in a **crater**, a bowl-shaped area around a volcano's central vent.

Types of Eruptions and Activity

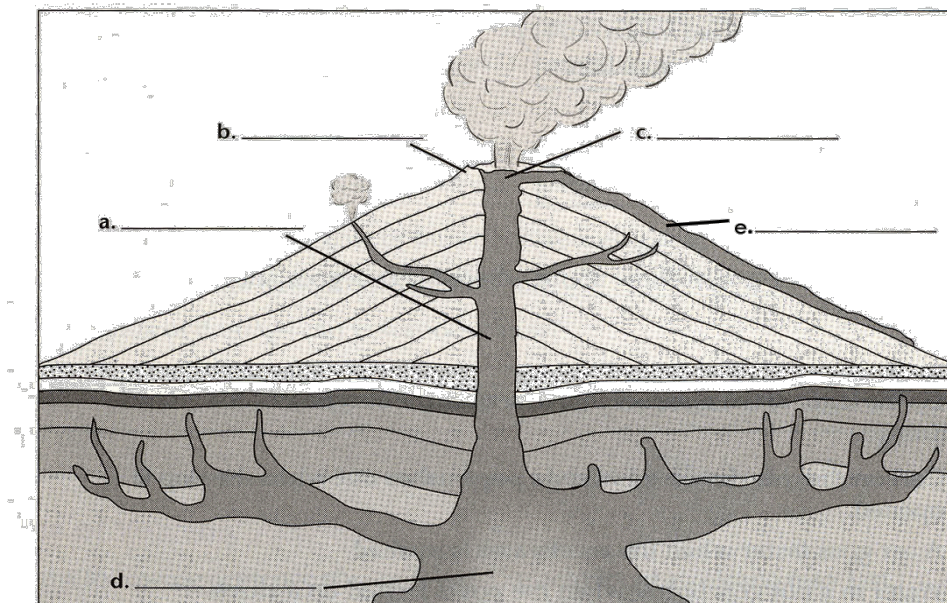
Geologists classify volcanic eruptions as **quiet** or **explosive**. If the magma is thin, it flows easily and the volcano erupts quietly. The gases bubble out gently and the lava oozes out quietly.

If the magma is thick, a volcano erupts explosively. The dense magma does not flow out of the chamber easily, but builds up in the pipe. The trapped gases build up pressure until they explode with incredible force.

Geologists use the terms **active**, **dormant** or **extinct** to describe a volcano's activity. An **active** volcano is one that is erupting or has shown signs that it may erupt in the near future. A **dormant** volcano is not active now but may become active in the future. An **extinct** volcano is unlikely to erupt again.

REVIEW QUESTIONS: PARTS OF A VOLCANO

1. Label the diagram below with the terms found in the reading.

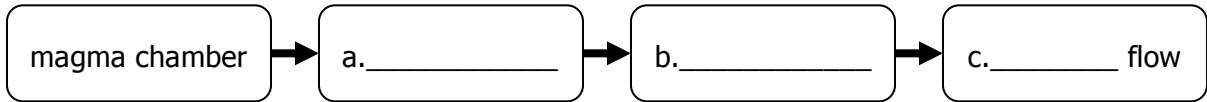


2. What is a lava flow?

3. Where does a crater form?

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4. Complete the flowchart to show the sequence of how magma moves through a volcano.



5. Circle the letter of the sentence that is the best analogy of how a volcano erupts.

- a. A car goes faster when the accelerator is pushed.
- b. Carbon dioxide dissolved in soda rushes out when the soda can is opened.
- c. Water in a pot gets hotter until the water evaporates.
- d. Clay hardens when it is baked in an oven.

6. What determines the force of a volcanic eruption?

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7. True or false? A volcano erupts quietly if the magma is thick and sticky. _____

8. What is a pyroclastic flow?

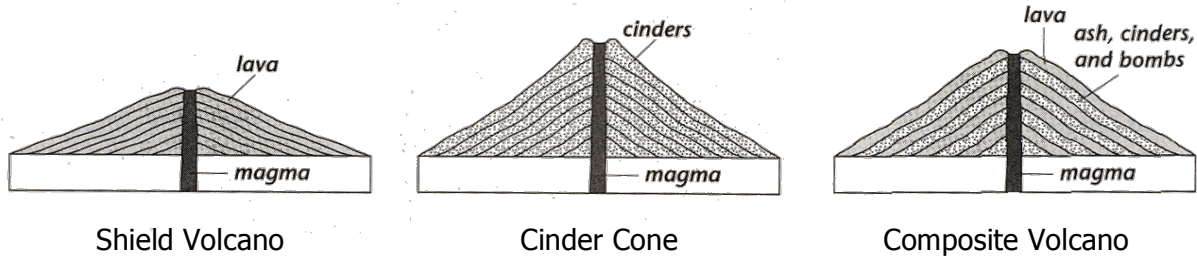
9. What are the kinds of hazards produced when a volcano erupts? List them.

10. Complete the table below to show the different activity stages of a volcano.

Stage	Description
a.	Unlikely to erupt ever again.
b.	Erupting or showing signs that it will soon erupt.
c.	No longer erupting but may erupt again.

TYPES OF VOLCANIC LANDFORMS

Volcanic eruptions create landforms made of lava, ash and other rock. These landforms include shield volcanoes, composite volcanoes, cinder cones and calderas.



1. Shield Volcanoes

A shield volcano is shaped like a wide, flat dome. It is built up many eruptions of runny lava that flows easily and spreads out in thin layers. The largest volcano on Earth, Mauna Loa in Hawaii, is a shield volcano. Shield volcanoes erupt frequently, but the eruptions are relatively quiet and calm compared to other types of volcanoes.

2. Cinder Cones

A cinder cone volcano is a steep, cone-shaped hill formed by the eruption of cinders and other small rock fragments that pile up around a single crater. Cinder cones are tens to hundreds of meters tall. Many of them form on the sides of other types of volcanoes. Cinder cones erupt frequently, but their eruptions are short and relatively small.

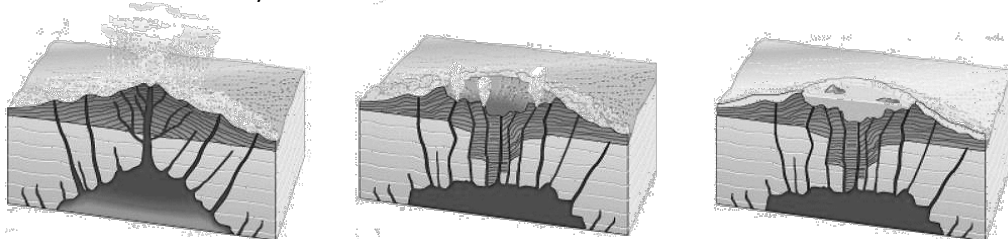
3. Composite Volcanoes

A composite volcano is a cone-shaped volcano built up from alternating layers of lava and rock fragments. Because the hardened lava adds strength to the rock fragments (like glue), composite volcanoes can grow much larger than cinder cones.

Composite volcanoes have violent and unpredictable eruptions for two reasons. First, gases trapped inside the rising magma can cause explosions. Second, hardened lava from earlier eruptions can plug the volcano opening, much like a cork in a wine bottle. This rock **plug** must be blown out of the way before the gases and magma can escape. The 1980 eruption of Mount St. Helens is an example of the power of composite volcano eruptions.

4. Calderas

Both shield and composite volcanoes can create a feature called a **caldera**. A caldera is a huge hole left by the collapse of a volcano. Calderas form when a major eruption empties a volcano's main vent and magma chamber. With nothing to support it, the top of the mountain collapses inward. Sometimes, new volcanic cones and lakes form inside a caldera.



REVIEW QUESTIONS: TYPES OF VOLCANOES

1. List 4 landforms created from volcanic eruptions.

a.	c.
b.	d.

2. Circle the letter of each sentence that is true about shield volcanoes.

- a. They form from many thin layers of runny lava.
- b. They result in quiet eruptions.
- c. They are very steep mountains.
- d. They are formed from ash, cinders and bombs.

3. True or false? The Hawaiian Islands are cinder cone volcanoes. _____

Match the landform with its correct description.

- | | |
|----------------------------|---|
| _____ 4. shield volcano | a. Mountain formed by lava flows alternating with explosive, rocky eruptions. |
| _____ 5. cinder cone | b. Cone-shaped mountain formed from ash, cinders and rock fragments. |
| _____ 6. composite volcano | c. Hole left by the collapse of a volcanic mountain. |
| _____ 7. caldera | d. Gently sloping mountain formed by repeated lava flows. |

4. True or false? A composite volcano has explosive eruptions. _____

5. A mass of rock formed when a large piece of magma cools inside a composite volcano is called a(n) _____.

6. Describe how calderas are formed.
