Chapter 9 Volcanoes

Section 1

Objectives

- **Distinguish** between nonexplosive and explosive volcanic eruptions.
- **Identify** the features of a volcano.
- **Explain** how the composition of magma affects the type of volcanic eruption that will occur.
- **Describe** four types of lava and four types of pyroclastic material.

Volcanic Eruptions

- A **volcano** is a _____ or fissure in the Earth's surface through which molten rock and gases are expelled.
- Molten rock is called **magma.**
- Magma that flows onto the _____ _____ is called **lava.**

Nonexplosive Eruptions

- Nonexplosive eruptions are the most _____ type of volcanic eruptions. These eruptions produce relatively _____ flows of lava in huge amounts.
- Vast areas of the Earth's surface, including much of the _____ _____ and the Northwestern United States, are covered with lava from nonexplosive eruptions.

Explosive Eruptions

- While explosive eruptions are much _____ than non-explosive eruptions, the effects can be incredibly destructive.
- During an explosive eruption, clouds of hot _____, ash, and gas rapidly shoot out from a volcano.
- An explosive eruption can also blast millions of tons of lava and _____ from a volcano, and can demolish and entire mountainside.

What Is Inside a Volcano?

- The interior of a volcano is made up of two main features.
- The **magma chamber** is the body of molten rock deep _____ that feeds a volcano.
- The **vent** is an _____ at the surface of the Earth through which volcanic material passes.

What Makes Up Magma?

- By comparing magma from different eruptions, scientists have learned that the _____ of the magma affects how _____ a volcanic eruption is.
- The key to whether an eruption will be explosive lies in the _____, water, and gas content of the magma.
- **Water and Magma Are an Explosive Combination** If the water content of magma is _____, an explosive eruption is more likely.
- While underground, magma is under intense pressure and water in it stays dissolved. If the magma quickly moves to the surface, pressure suddenly _____ and the water and other compounds become gases.
- As gases _____ rapidly, an explosion can result.
- **Silica-Rich Magma Traps Explosive Gases** Magma with a high silica content also tends to cause explosive eruptions.
- Silica-rich magma has a stiff _____, so it flows slowly and tends to harden in a volcano's

vents. As a result, it _____ the vent.

- As more magma pushes up from below, pressure _____. If enough pressure builds up, an explosive eruption takes place.

What Erupts from a Volcano?

- Magma erupts as either lava or _____material.
- **Lava** is liquid magma that flows from a volcanic vent.
- **Pyroclastic material** forms when magma is _____ into the air and hardens.
- **Types of Lava** The _____ of lava, or how it flows, varies greatly. Lava that has high viscosity is stiff. Lava that has low viscosity is more _____.
- The viscosity of lava affects the surface of a lava flow in different ways.

Types of lava

- **Aa**
  - Pours out quickly and forms a brittle crust. The crust is torn into jagged pieces as molten lava continues to flow underneath.
- **Pahoehoe**
  - Flows very slowly, like wax dripping from a candle. It's glassy surface has rounded wrinkles.
- **Pillow lava**
  - Forms when lava erupts underwater. As the lava cools it forms rounded lumps that look like pillows.
- **Blocky lava**
  - Usually oozes from a volcano and cools forming jumbled heaps of sharp-edged chunks

What Erupts from a Volcano?

- **Types of Pyroclastic Material** When magma explodes from a volcano and solidifies in the air, pyroclastic material is formed.
- Pyroclastic material also forms when powerful eruptions _____ existing rock.
- There are four types of pyroclastic material:
- **Volcanic bombs** are large _____ of magma that harden in the air.
- **Volcanic blocks** are pieces of solid rock erupted from a volcano. Volcanic blocks are the _____ pieces of pyroclastic material.
- **Lapilli** are small, pebblelike bits of magma that hardened before they hit the ground.
- **Volcanic ash** forms when the gases in stiff magma expand rapidly and the walls of the gas bubbles explode into tiny, glasslike _____. Ash makes up most of the pyroclastic material in an eruption.
- **Pyroclastic flows** are _____ volcanic flows that are produced when enormous amounts of hot ash, dust, and gases are ejected from a volcano.
- Pyroclastic flows can race downhill at speeds of more than _____ km/h.
- The temperature at the center of a pyroclastic flow can exceed _____°C.

Section 2

Objectives

- **Explain** how volcanic eruptions can affect climate.

- **Compare** the three types of volcanoes.
- **Compare** craters, calderas, and lava plateaus.

Volcanic Eruptions and Climate Change

- During a large-scale volcanic eruption, enormous amounts of volcanic ash and gases are ejected into the _____ _____.
- As volcanic ash and gases spread throughout the atmosphere, they can block enough sunlight to cause _____.

Different Types of Volcanoes

- Volcanic eruptions can cause profound changes in climate, but the changes to the Earth's surface are more familiar.
- Perhaps the best known of all volcanic landforms are the _____ themselves.

There are three basic types of volcanoes:

- **_____ Volcanoes**
- **Cinder Cone Volcanoes**
- **_____ Volcanoes**
- **Shield volcanoes** are built of layers of lava that are released from repeated _____ eruptions. The lava spreads out over a wide area, creating a volcano with _____ sloping sides.
- **Cinder cone volcanoes** are made of _____ material usually produced from _____ eruptions. The pyroclastic material forms _____ slopes.
- **Composite volcanoes** are formed from _____ eruptions of pyroclastic material, followed by quieter flows of lava. These formations, among the _____ types of volcanoes, have broad bases and sides that get _____ toward the top.

Other Types of Volcanic Landforms

- In addition to volcanoes, there are other landforms produced by volcanic activity.
- **Craters** are funnel-shaped pits near the top of the _____ of a volcano.
- **Calderas** are large, _____ depressions that form when the magma chamber below a volcano partially empties and causes the ground above to sink.
- Calderas can appear similar to craters, but are many times _____.
- **Lava Plateaus** are wide, flat landforms that result from repeated _____ eruptions of lava that spread out over a large area.

- The lava that formed lava plateaus usually erupted from long cracks, or _____, in the crust over a period of millions of years.

Section 3

Objectives

- **Describe** the formation and movement of magma.
- **Explain** the relationship between volcanoes and plate tectonics.
- **Summarize** the methods scientists use to predict volcanic eruptions.

The Formation of Magma

- Understanding how _____ forms helps explain why volcanoes erupt. Magma forms in the _____ regions of the Earth's crust and in the uppermost layers of the mantle.

Where Volcanoes Form

- The _____ of volcanoes give clues about how volcanoes form.

When Tectonic Plates Separate

- At a divergent boundary, tectonic plates move _____ from each other, forming a set of deep _____ called a **rift zone** between the plates.
- Mantle rock rises to fill the gap opened by the separating tectonic plates. When mantle rock nears the surface, _____ decreases, which causes the mantle rock to _____ and form magma.
- **Mid-Ocean Ridges Form at Divergent Boundaries** Lava that flows from undersea rift zones produces volcanoes and mountain chains called _____.
- At these mid-ocean ridges, lava flows out and creates new _____. Most volcanic activity on Earth occurs at mid-ocean ridges.

When Tectonic Plates Collide

- Convergent boundaries are places where tectonic plates _____.
- When an oceanic plate collides with a continental plate, the oceanic plate usually slides _____ the continental plate. This is a process called **subduction.**
- **Subduction Produces Magma** As descending oceanic crust scrapes past the continental crust, the temperature and pressure _____.

Hot Spots

- Not all magma develops along tectonic plates boundaries. Some volcanoes are located at places known as _____.
- **Hot spots** are volcanically active places on the Earth's surface that are far from plate boundaries.
- Some scientists think that hot spots are directly above columns of rising magma, called _____.
- A hot spot often produces a _____ of volcanoes. One theory is that the mantle plume stays in the same spot while the tectonic plates move over it.
- Other scientists think that hot spots are the result of _____ in the Earth's crust.

- The theory argues that hot-spot volcanoes occur in chains because they form along the cracks in the Earth's crust.

Predicting Volcanic Eruptions
Volcanoes are classified in three categories:

- **_____ Volcanoes**
- **Dormant Volcanoes**
- **_____ Volcanoes**
- **Measuring Small Quakes and Volcanic Gases** Most active volcanoes produce small earthquakes as the magma within them moves upward and causes the surrounding rock to _____.
- Just before an eruption, the number and _____ of the earthquakes increase. Monitoring these quakes is one way to predict an eruption.
- Studying the _____ of certain gases in a volcano also may help predict eruptions.
- **Measuring Slope and Temperature** As magma moves upward prior to an eruption, it can cause the Earth's surface to _____, and the side of a volcano may even _____.
- Scientists can use instruments and satellite technology to detect changes in a volcano's _____.
- Infrared satellite images record changes in surface _____ and gas emissions of a volcano to watch if the magma below is rising.