Chapter 22 General Science

The Earth’s Crust

22-1 Plate Tectonics

**earthquake**- a sudden, violent shaking of the Earth

**geologist**- a scientist who studies rocks to learn about the history and structure of the Earth

**plate tectonics**- the scientific theory that the Earth’s crust is made up of plates that slowly shift position

**trench**- a deep, long valley in the ocean floor

**magma**- melted rock formed in the Earth’s mantle

**volcano**- an opening in the Earth’s surface that releases magma from the mantle

**lava**- magma that has reached the Earth’s surface

Explain what you think happens when a volcano erupts. Use detail. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* List substances that might exit a volcano. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* What can these materials do to the atmosphere? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* The Earth’s features can be grouped into certain categories. For example:

1.) Types of rock (igneous, sedimentary, metamorphic)

2.) Types of landforms (trench, volcano, glacier)

3.) Processes that change Earth’s surface (earthquake, weathering, erosion)

\* The Earth’s crust moves. Most of the time, we do not feel the movements. **Earthquakes**, for example, are one example.

\* In California, there is at least one earthquake per week. Earthquakes are caused by shifting pieces of the Earth’s crust.

\* Most earthquakes are so small that only scientists notice them. There are machines used to detect them.

\* Some earthquakes are so big that every 50 or 100 years, a big one comes along and does a lot of damage.

\* **Geologists** study the history and structure of Earth as well as the movements of the Earth’s crust and what causes them.

\* Most geologists think that all the continents were once part of one big supercontinent called *Pangaea.*

\* About 200 million years ago, pieces of land began breaking free from Pangaea.

\* These landmasses came together and separated many times. Eventually, they drifted into the positions they are in today.

\* Many scientists believe in **plate tectonics**. A plate is a large piece of the Earth’s crust. The movement of these plates causes earthquakes.

\* Some of the plates are very large and some are rather small. A plate can include a landmass, such as a continent, as well as a section of the ocean floor.

\* The plates are moving all the time. However, they move very slowly. Most of the United States is on the North American plate, which is drifting westward.

\* Continental drift is the theory that the Earth’s large landmasses are carried along, or drift, because of the movements of the plates. Geologists think they know why pieces of the Earth’s crust are moving. It is because the crust floats on the hot, softer rock of the mantle. The plates are carried along in the flow.

\* Because of the movement of plates, the Atlantic Ocean is slowly getting larger, while the Pacific Ocean is slowly getting smaller.

\* The plates of the Earth’s crust may bump into each other, or collide. As they collide, one plate may be forced under the other. The plate gets pushed into the mantle, where the crust melts.

\* When one plate gets pushed down under another beneath the sea, a **trench** forms beneath them.

\* Sometimes two colliding plates pile up against each other on land. This is how some mountain ranges are formed.

\* Mountains build up very, very slowly. Over millions of years, the plates push against each other. The Alps in Europe were formed this way. So were the Andes in South America and the Himalayas in Asia. Mount Everest, in the Himalayas, the highest point on Earth, was formed this way.

\* Sometimes, instead of two plates pushing into each other, they slide past each other. This is true of the Pacific and North American plates.

\* Many earthquakes occur along this coast. Each time there is a sudden slip between plates, an earthquake occurs.

\* Two huge pieces of the Earth’s crust may rub against each other. As you can imagine, these do not slip by each other smoothly.

\* Friction is the force that holds the upper layers of the crust together. However, the plates continue to move deeper down. As this occurs, pressure builds up on the surface.

\* When the strain becomes too great, the plates slip. The sudden movement causes a shockwave that is the earthquake.

\* The deepest part of the Earth’s surface is the Pacific Ocean’s Marianas Trench. It is more than 36,080 feet below sea level.

\* Los Angeles, on the Pacific plate, is slowly moving northwest and will be next to San Francisco in about 11 million years.

\* **Volcanoes** occur when an opening in the Earth’s crust is formed and **magma** is released from the mantle.

\* *Volcano* is also used to describe the mountain that builds up around the opening.

\* The Earth has more than 1,500 active volcanoes. Most are beneath the sea.

\* When volcanoes occur on the ocean floor, they can create an island. The Hawaiian Islands formed this way.

\* There are so many volcanoes near the Pacific plate that it is called “Ring of Fire.”

\* Some volcanoes erupt violently. Lava, ash, and hot gas explode high into the air. Other volcanoes erupt more gently. The lava flows quietly onto the surface.

*22-2 Rocks and Minerals*

**igneous rock**- a type of rock formed by magma

**sedimentary rock**- a type of rock formed by pressing together of smaller particles of rock or the remains of living things

**metamorphic rock**- a type of rock formed when igneous or sedimentary rock changes under very high temperatures or pressure

**weathering**- a process that breaks down rocks and minerals

**soil**- rocks on Earth’s surface broken down by weathering to very tiny pieces that mix with nutrients from living and once-living things

**erosion**- the wearing away of rock and soil

**glacier**- a large, slow moving field of ice

\* The Earth’s crust is made of rock. Maybe you collect or once collected rocks. Please name as many rocks as you know. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* Rocks vary in size, color, shape, hardness, and texture.

\* Three types of rocks are **igneous, sedimentary,** and **metamorphic.**

\* When igneous rock reaches the surface as magma, it hardens into rock. Some examples are *obsidian, basalt,* and *granite*.

\* Igneous rocks make up about 95% of the Earth’s crust.

\* There are two types of igneous rock. *Intrusive* rocks form slowly in the crust and appear on the surface only after rock above them is eroded. *Extrusive* rocks such as obsidian form quickly when lava cools and hardens on the Earth’s surface.

\* It takes a very long time for sedimentary rock to form. Beds of clay, sand, or gravel may harden to make sedimentary rock.

\* *Shale* is a kind of sedimentary rock made of hardened clay.

\* *Sandstone* is a kind of sedimentary rock made of sand.

\* Sandstone formed from the sand of different beaches, riverbeds, and sand dunes. The different shades of yellow, red, and brown in sandstone are caused by small amounts of iron in the cementing minerals.

\* *Coal* is a sedimentary rock formed from plant fossils.

\* *Limestone* forms from shells and bones of tiny animals in the sea. These are the most common rocks on Earth.

\* Metamorphic rock is a rock that changed from its original type. Some igneous or sedimentary rock changes chemically when it becomes extremely hot.

\* Two examples of metamorphic rock are *marble* and *slate*.

\* Marble is metamorphosed limestone. Pure marble is white, but small amounts of different minerals produce the colorful swirls found in most marble.

\* All rocks are made of minerals. There are at least 2,000 different kinds of minerals.

\* Each mineral has a unique (different) chemical makeup.

\* Many mineral are pure elements. Some examples include talc, gold, quartz, and bauxite.

\* New minerals are still being discovered. No one knows exactly how many minerals actually exist in the Earth’s crust.

\* Rocks can take many different paths through the rock cycle. For example, an igneous rock might break down into tiny grains of sand. A stream might carry these grains to the ocean where they settle into layers and harden into sedimentary rock. Or the igneous rock might become buried and, under tremendous heat and pressure, change to metamorphic rock.

\* Rocks change from one type to another many times as they break down, wear away, get pressed, melt, and cool. The changing of rocks is known as the rock cycle.

\* Running water, ice, rain, plants, animals, snow, and chemicals all help to **weather** rocks and minerals.

\* If a river flows, it washes away little bits of rock from the riverbed. These bits of rock are swept downstream. As they move, they bump into other rocks and tumble along the bottom. Slowly, they break into smaller and smaller pieces.

\* Ice can also cause weathering in rocks. Rocks have many cracks. Water fills the cracks. As water freezes, it expands. The ice acts like a wedge and breaks the rock into smaller pieces.

\* Rain causes weathering, too. Raindrops beat on rocks like millions of little hammers. Eventually, the rocks wear down. Rain also causes weathering by mixing with gases in the air to make a weak acid. This acid dissolves certain minerals in the rocks. Over time the rocks crumble.

\* Even plants help weather rocks. Some plants start to grow in the cracks of rocks. As the roots grow, they push on the rocks and help break them apart.

\* Soil is a product of weathering. Soil is made up of rocks on the Earth’s surface broken down by weathering to very tiny pieces that mix with the nutrients from living and once-living things.

\* The Appalachians used to be much higher than the Rockies, but erosion has worn down the Appalachians.

\* Over millions of years, weathering and erosion can wear down entire mountain ranges. Older mountains are usually lower than newer mountains.

\* A layer of soil takes thousands of years to form.

\* Erosion is the wearing away of rock and soil. Like weathering, a river can cause erosion. Very slowly, a river valley can be carved out of rock by moving water. Valleys cut by rivers are V-shaped.

\* Wind can also erode soil by blowing the rich top layer away.

\* A glacier is a large, slow-moving field of ice. Glaciers cause erosion, too. As they move, they clear out everything in their paths. Valleys cut by glaciers are U-shaped.

Tectonics webquest

[www.kidsgeo.com/geology-for-kids/0043-plate-tectonics.php](http://www.kidsgeo.com/geology-for-kids/0043-plate-tectonics.php)

Plate Tectonics

1.) What is the lifetime of crust? (100 million years)

2.) What is plate tectonics? (As new crust is created in a particular spot on Earth, it forms what resembles giant plates. One side of the plate is where new crust is being formed and the other side is where older crust is being destroyed)

Plate Boundaries

3.) What are the three types of boundaries? (transform, convergent, and divergent)

4.) Draw a picture of each.

Earthquakes

5.) What is the point at which plates shift known as? (hypocenter)

6.) How is the size of an earthquake measure? (Richter scale)

7.) How many earthquakes occur every year? (500,000)

8.) How many are actually felt? (10,000)

9.) How many cause damage? (100)

Liquefaction

10.) What is liquefaction? (Loose soil acting like a liquid during an earthquake)

11.) What happened to the road at the bottom of the page? (It split in half)

Divergent Boundaries

12.) What does it mean if two things diverge? (the move away from each other)

13.) Where can these form? (Bottom of oceans and on continents)

Convergent Boundaries

12.) What does it mean if two things converge? (come together)

Transform Boundaries

13.) What are transform boundaries? (Slide against each other in a sideways motion)

Hot Spots

14.) Where is one of the most famous hot spots located? (The Hawaiian Islands)

15.) Why are these volcanoes “dead” or no longer active? (The crust moved them away from the hot spot)

Volcanism

16.) What is volcanism? (Hot molten magma escapes from the Earth’s core becoming cooler, and forms hard rocks)

Extrusive Volcanism

17.) What do we call magma that reaches the surface of the Earth? (Lava)

18.) What happened in 1883 at Krakatua? (The island was completely destroyed by a volcano)

Terrifying Explosions Versus Calm Eruption

19.) What determines the power of a volcano? (Substances found in magma determine how it will erupt)

Volcanic Activity

20.) How is a volcano considered active? (If it erupted within the past 1,000 years)

21.) How many active volcanoes exist? (Around 500)

Volcanoes and Plant Life

22.) How is magma BAD for plants? (The immediate impact of the heat kills the plants the magma comes in contact with)

23.) How is magma GOOD for plants? (Rich source of nutrients that plants need to survive. Ash, for example, acts as a fertilizer)

Other Types of Volcanic Activity

24.) What is a way that lava can reach the Earth’s surface without leaving through a volcano? (Through fissures in the Earth’s crust)

Volcanoes and Land Formation

25.) What are the four landform types? (lava flows, volcanic peaks, calderas, and volcanic necks)

Lava Flows

26.) How did the lava flow get its name? (The way it flows out parallel to the surface of the Earth)

Volcanic Peaks

27.) What is a volcanic peak? (A volcano that has formed a large cone shaped hill, or mountain)

Calderas

28.) How are calderas created? (When volcanoes explode with terrible destruction, completely destroying the original volcano, and surrounding area)

Volcanic Necks

29.) What causes the remnants of the volcanic neck to be removed? (Erosion)

Tectonics webquest

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Plate Tectonics

1.) What is the lifetime of crust?

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2.) What is plate tectonics?

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Plate Boundaries

3.) What are the three types of boundaries?

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4.) Draw a picture of each.

Earthquakes

5.) What is the point at which plates shift known as?

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6.) How is the size of an earthquake measure?

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7.) How many earthquakes occur every year?

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8.) How many are actually felt?

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9.) How many cause damage?

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Liquefaction

10.) What is liquefaction?

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11.) What happened to the road at the bottom of the page?

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Divergent Boundaries

12.) What does it mean if two things diverge?

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13.) Where can these form?

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Convergent Boundaries

12.) What does it mean if two things converge?

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Transform Boundaries

13.) What are transform boundaries?

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Hot Spots

14.) Where is one of the most famous hot spots located?

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15.) Why are these volcanoes “dead” or no longer active?

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Volcanism

16.) What is volcanism?

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Extrusive Volcanism

17.) What do we call magma that reaches the surface of the Earth?

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18.) What happened in 1883 at Krakatua?

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Terrifying Explosions Versus Calm Eruption

19.) What determines the power of a volcano?

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Volcanic Activity

20.) How is a volcano considered active?

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21.) How many active volcanoes exist?

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Volcanoes and Plant Life

22.) How is magma BAD for plants?

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23.) How is magma GOOD for plants?

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Other Types of Volcanic Activity

24.) What is a way that lava can reach the Earth’s surface without leaving through a volcano?

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Volcanoes and Land Formation

25.) What are the four landform types?

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Lava Flows

26.) How did the lava flow get its name?

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Volcanic Peaks

27.) What is a volcanic peak?

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Calderas

28.) How are calderas created?

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Volcanic Necks

29.) What causes the remnants of the volcanic neck to be removed?

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The amount of time that it takes for crust to be created and later destroyed is approximately 100 million years.

The amount of time that it takes for crust to be created and later destroyed is approximately 100 million years.