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Chapter 8
Plate Tectonics

Lesson 1 - "What are Earth's layers made of?"

I. Earth's Variety

a. One type of landform is a plateau. A plateau is raised, flat land.
b. Landforms such as the Grand Canyon are a result of water washing away some of the rock over thousands of years.
c. Other landforms include: mountains, plains, and valleys.
d. Some of Earth's features are hidden by water. Beneath the Atlantic Ocean is a ridge of towering mountains and volcanoes.
e. A trench is a long, narrow canyon.
f. All of these features are formed by a process that begins deep inside the earth.

II. Earth's Layers

a. Above Earth's surface is the atmosphere that consists of the gases we breathe.
b. The Earth's crust is the part of earth that we live on. It includes the soil and rock that covers Earth's surface.

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c. The layer of Earth just below the crust is the mantle, where most of Earth's mass is located.
    i. The outer part of the mantle is solid, like the crust.
    ii. The inner part of the mantle is so hot the rock can flow very slowly over time.

d. The core is the innermost layer of Earth.
    i. The Earth's outer core is a very dense liquid because of all the rock above it.
    ii. The inner core is a solid.

III. **Earth's Plates**
a. Earth's crust and the upper solid part of the mantle form the lithosphere.
b. The lithosphere is broken into pieces called tectonic plates of different sizes and shapes that fit together like a jigsaw puzzle.
c. Continental crust is the crust that makes up the continents.
d. Oceanic crust is the crust that makes up the ocean floor.

e. Earth's tectonic plates float on top of the lower mantle, the part of the Earth that is so hot it can flow very slowly.

IV. "Seeing" Inside Earth

a. Scientists use indirect evidence to study the Earth's interior.
b. Scientists can study the Earth's interior two ways:
   i. The first is to study the speed at which an earthquake moves through certain materials.
   ii. Another way is to use seismic tomography to detect earthquake waves and use the data to make three-dimensional pictures of what the Earth's interior looks like.

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Lesson 2 - "How do Earth's plates help create landforms?"

I. Continental Drift

a. It wasn't until the 1600's when scientists began to discover that the Earth's continents fit together like a jigsaw puzzle.

b. Alfred Wegener, a German scientist suggested that about 225 million years ago the continents were joined in one large continent called Pangaea, meaning "all earth".

c. Alfred Wegener also introduced the idea of continental drift, the theory that continents drifted apart in the past and continue to do so.

d. Plant and animal fossils found along the eastern coast of South America closely matched those found along the western coast of Africa which suggested that the continents were joined at one time.

e. Other evidence can be found in the layers of rocks on coastlines. The layers of rocks

along the eastern coast of South America match layers of rocks along the eastern coast of Africa.

II. The Spreading Ocean Bottom

a. The oceanic ridge and mountain range in the Atlantic Ocean is called the Mid-Atlantic Ridge.

b. In 1960 scientist Harry Hess suggested that new crust forms at ocean ridges where magma pushes up though Earth's crust to fill the gap. As the magma cools, it forms new crust. As more magma comes up, it pushes the old magma out, spreading the seafloor.

c. The process that moves Earth's tectonic plates occurs in the mantle and is called convection.

- **i.** This is the idea that hot liquids weigh less and float above cooler liquids. As the hot liquid rises and cools, it becomes heavier and again sinks and more hot liquid can rise above it.

d. The mantle is not a flowing liquid, but rather a layer rocks that are so hot, they are allowed to flow very slowly.

III. Proof of Continental Drift

a. Alternating magnetism in the rocks of the Mid-Atlantic Ridge is proof that rock has been slowly spreading out as new crust is formed over millions of years.

IV. SONAR

a. SONAR stands for SOund Navigation And Ranging

b. It is the method of bouncing sound waves off objects and measuring the time it takes for the waves to return to where they started.

c. A computer gathers the information and builds a digital image like the one shown in our book of Crater Lake.

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Lesson 3 - "How do scientists explain Earth's features?

I. Theory of Plate Tectonics

a. Today, scientists use the theory of plate tectonics to explain why Earth's features appear as they do.

b. According to the theory of plate tectonics, Earth's lithosphere is broken into about 20 moving plates that make up the continents and the ocean floor.

c. The North American Plate and the Eurasian Plate are moving about two centimeters a year away from each other.

d. The theory of plate tectonics explains many of Earth's features:

i. Continents may break apart.

ii. Mountain chains may form where plates move together.

iii. Volcanoes may form where plates move apart and magma rises to the surface.

iv. Oceans may become larger or smaller.

e. Some scientists believe that one day the continents could come together once again to create another Pangaea-like continent.

II. Plate Boundaries

a. A plate boundary is where two plates meet.

b. Plates can move apart from each other, collide, or slide past each other.

c. At spreading (divergent) boundaries, plates move away from each other, gaps form between plates and huge valleys can form.

i. This type of movement is responsible for seafloor spreading.

d. At fracture (_____) boundaries, plates slide past each other. This break in the Earth's crust is called a fault.

i. The movement along this type of boundary can cause strong earthquakes.

e. The area where two plates push against each other is called a colliding (convergent) boundary. When plates collide, one plate might slide beneath the other.

i. When plates carry continents into each other, towering mountains form.
ii. Other times, deep ocean trenches, earthquakes, and volcanoes can result.

Lesson 4 - "What causes earthquakes and volcanoes?"

I. Earthquakes

a. The reason most earthquakes occur along plate boundaries is because jagged rock edges in the lithosphere sometimes stop the movement of a plate, and over time, pressure builds up, until suddenly the pressure is strong enough to make the rocks lurch forward and an earthquake happens.

b. Earthquakes cause damage when the pressure that builds up along a fault is suddenly released.

c. The underground point where the earthquake occurs is called the focus.

i. The point on Earth's surface directly above the focus is called the epicenter.

d. The energy from an earthquake is carried by waves that spread out from the focus and the epicenter.

II. Earthquake Magnitude

a. As the waves spread out, they lose energy. The possibility of earthquake damage is greatest closest to the epicenter.

b. Almost all of the major earthquakes in the United States have occurred in California and Alaska because these states are on a plate boundary.

c. The strength of an earthquake is given as its magnitude. The number shows how much energy was released.

i. The Richter scale is one example of a scale. For each increase of 1 on the scale, about 31 times more energy is released.

ii. The magnitude of an earthquake doesn't always indicate how much damage will result.

iii. The effect of an earthquake depends on many factors such as the size of the earthquake, its distance from the epicenter, the kind of rock in the area, and the types of buildings there.

III. Volcanoes

a. A volcano is an opening in the surface of one of Earth's plates through which magma rises.

b. Most volcanoes occur near plate boundaries.

c. When one plate sinks beneath another at a plate boundary, the sinking crust melts into magma. Pressure can build up and when the crust can no longer withstand the pressure, magma explodes through it as a volcano.

d. Magma that reaches the Earth's surface is called lava

e. Most volcanoes are located on the ocean floor. You never hear about them because

they spew lava out quietly onto the ocean floor.

IV. Predicting Volcanoes and Earthquakes

a. Scientists can use a variety of tools to make predictions about when and where volcanoes and earthquakes will happen.

i. Seismometers detect shaking movements in Earth's crust. The tremors may be a signal that magma is rising in a volcano or that Earth's plates are shifting.

ii. Tiltmeters detect changes in the slope of the land. This change tells scientist that magma is rising within a volcano.

iii. Seismographs detect ground movement as it occurs, helping scientists predict when ground will suddenly shift.