Plate Tectonics

Earth Layers:

*The Earth’s layers are layered according to their densities!*

* Inner Core

Ball of solid (because of pressure) metals

* Outer Core

Liquid ball of metals surrounding the inner core

* Mantle

The thickest earth layer. It is cooler and rigid toward the surface. The mantle is like a giant layer of hot paste.

* Crust (*Broken up intoTectonic Plates*)

Thin layer of cool rock surrounding the earth like an egg shell.

* + - 1. Continental Crust
      2. Oceanic Crust

###### Lithosphere

* The earth’s crust + the very top of the mantle
* The lithosphere sits on the asthenosphere

###### Asthenosphere

A layer of softer, hotter rock below the lithosphere

The lithosphere is part of the top of the mantle.

earthquakes  
**Definition**: Earthquakesare the shaking, rolling or sudden shock of the earth’s surface.

**Cause of an earthquake**

* Earthquakes are caused by the sudden movement of large blocks of rock along a fault.
* This movement is the result of built up stress in the rock that is suddenly released.

**What determines the strength of an earthquake**?

* The amount of stress built up!
* The distance plates move when they finally slip.

**Where do quakes occur**?

* mostly at plate boundaries,
* and along fault lines,
* and near volcanoes.

**Quake Vocabulary**  
**Fault:**

* Fracture or break in the earth’s crust
* Most are along plate boundaries

**Seismic wave:** Waves created by Earthquakes

**Focus:** The exact location in the Earth’s crust where rock slips.

**Epicenter**: The location on earth’s surface directly above the focus.

**P – wave or Primary wave**

-Fastest and first seismic wave to arrive

-Travels through solid, liquid, gas

**S – wave** or **Secondary Wave**

-This wave causes the most damage!

-Second wave to arrive

-Travels through rock (solid) only

**L – Wave or Surface Wave**

Moves only through the earth’s surface

**Volcano**

A **volcano** is an opening in the earth where molten rock (lava), rock fragments, cinders, ash, and hot gasses erupt. Volcanoes form mountains (not all mountains)

# Magma: Molten rock inside the earth.

# Lava: Molten rock on top of the earth

**Plate Tectonics**

**Tectonic Paltes**

* The Earth’s lithosphere is cracked and broken into massive giant sections called tectonic plates.
* Like an egg with a completely cracked shell.
* Tectonic plates are made of continental crust and ocean crust

**Continental Drift**

The theory that our tectonic plates move.

**Pangaea**  
The name given to the super continent when all of the continents were joined together.

**We know the location of plate boundaries because they match the locations of earthquakes and volcanoes.**

**Why our Plates Move**

**Convection in the Mantle:**

* **Convection = Energy transfer by the movement of a large number of particles in a liquid or gas.**
* **This happens because of heat and temperature differences.**
* **Remember, as particles heat up, they spread apart decreasing density. These less dense particles rise up. Cooler particles go down. This creates a circular movement.**

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**. Convection Current in the Mantle:**

1. **Hot magma rises pushing the cooler magma aside.**
2. **This magma begins to cool near the Earth’s surface.**
3. **As it cools the magma becomes more dense.**
4. **This denser magma flows back toward the hotter core.**
5. **As it gets closer to the core it heats up.**
6. **Now warmer, this magma is less dense and begins to rise again!**

* **In magma this current is very slow!**

**EVIDENCE THAT OUR PLATES MOVE**

or Evidence of Continental Drift

*Background…*

*A German scientist, Alfred Wegener studied The Earth’s continents. After studying he made a hypothesis that the plates were once joined into a single landmass that gradually moved apart. This movement continues today.*

**Wegener’s Evidence of the Continental Drift:**

**2. Fossils**:

270 million year old fossils of a Mesosaur were found in Africa and South America and nowhere else on earth. *How could the exact dinosaur be on two separate continents unless they were once joined?*

**3. Climate**:

Greenland is covered with ice, yet fossils of tropical plants can be found upon the shore. *How could tropical plants ever grow on ice covered Greenland unless it was once closer to the hot equator?*

South Africa has a warm climate, yet its rock is deeply scratched by ice sheets. *How could hot Africa have glacier ice scrapes unless it was once closer to the cold South Pole?*

**4. Geology:**

**This is Weneger’s most convincing evidence.**

* **Limestone in the Appalachian Mountains matches exactly limestone found in Scotland.**
* **Rock in Brazil matches rock in Africa**

***How could the exact same rock be in two different continents unless the continents were once together then split apart?***

**TEST I INFORMATION ENDS HERE  
TEST2 INFORMATION BEGINS HERE**

**Other evidence of Continental Drift**

1. **Age of the Sea Floor or Sea Floor Spreading**

* ***The sea floor is all different ages so it must be moving or it would all be the same!***
* **The farther you get away from the ridge (divergent boundary) the older the crust. *So it must be moving or it would all be the same age.***
* **The closer you get to a trench (convergent boundary) the older the crust. *So it must be moving or it would all be the same age.***

6**. Hot Spot** There are fixed hot spots on the earth’s mantle. The spots stay put while the plates move. *These are spots where magma rises into the ever- drifting earth plates. The Hawaiian Islands and Yellowstone Park are two places currently over hot spots.*

Plate Boundaries…

**Plate Boundary**

Where the edges of two plates meet.

**Convergent Boundary**

Locations where plates push together.

**Divergent Boundary**

Locations where plates move apart.

-*Most divergent boundaries are under the ocean*!

**Transform Boundary**

Locations where plates scrape past each other.

**Convergent Boundaries**

When 2 tectonic plates converge (come together)

1. **Continental-Continental Collision**
2. **Oceanic-Oceanic Subduction**
3. **Oceanic-Continental Subduction**

**Subduction**

* A dense ocean plate sinks under the other plate.
* This can take place at convergent boundaries
* *Based on Latin prefix “sub” meaning under*

**Continental-Continental Collision**

* Two continental plates collide
* This forms very large mountains
* Both plates have the same density
* Neither plate is able to push the other down.
* They push together causing the crust to fold and crumple
* This can form very large mountains
* Himalayas (Indian plate vs. European plate)
* Alps (European plate vs. African plate)

**Oceanic-Oceanic Subduction (convergent boundary)**

* The denser ocean plate sinks under the less dense plate.
* This can form deep-ocean trenches and island arcs

**Ocean Trenches (convergent boundary subduction)**

* Like deep canyons that form as the crust sinks
* Most are in the Pacific Ocean
* Mariana Trench: deepest place in the world’s oceans

**Island Arcs**

* Chain of volcanic islands that form at the boundary.
* As one plate sinks it melts and the magma rises forming volcanic islands.
* Examples: Philippines & Aleutian

**Oceanic-Continental Subduction**

* Denser ocean crust sinks under the continental crust.
* The Pacific Plate is sinking under the North American Plate.

**Coastal Mountains**

* The continental crust buckles to form mountain ranges.
* The Cascade Mountains in Washington and Oregon. Mt. St. Helens is part of this range)

**Divergent Boundary**

* Seafloor Spreading Occurs here.
* New crust forms at these locations.

**-Mid-ocean ridge**

* Longest chain of mountains on earth (divergent boundary)
* ***Mid-Atlantic Ridge****: the world’s longest ridge. It runs in the Atlantic, from Iceland to Antarctica.*

*-It is 4 miles deeper than the Grand Canyon!*

**TRANSFORM BOUNDARIES**

* Occur mostly on the ocean floor.
* New crust is neither formed nor destroyed.
* Plates grind past each other in opposite directions causing lots of earthquakes
* Example: The San Andreas Fault in California

What is a Rock**?**

Definition:

1. A rock is a naturally formed solid
2. Rocks are usually made up of one or more minerals.

**Why are rocks important?**

1. Rocks make up our world.
2. Rocks are useful

**The Rock Cycle**

* The rock cycle is the way nature forms, changes, break downs, and re-form rocks.
* The rock cycle is ongoing, and has no beginning or end
* We classify the three types of rocks based on how they are formed!

Igneous Rock

Rocks that are formed when molten rock or magma cools and becomes solid. Forces = Melting, cooling

Often have visible crystals

Igneous means… *Formed from FIRE!*

Sedimentary Rock  
Rocks Made when sediments (pieces of plants, animals, or other rocks) collect into layers.   
***Forces*** *=* ***weathering + erosion + layering + compacting + cementing*** + lithification  
Weathering and erosion break down rock into smaller pieces (sediment).

-Often have visible pieces of old animals, plants and   
 other rock.  
 -Lithification: When layers of sediment are cemented   
 into rock.

-Often have visible layers

Metamorphic Rock  
Heat and pressure deep inside the Earth, cause old types of rock to change into new types of rock.  
***Forces = Heat & Pressure***  
 - Sometimes have very straight bands or stripes

-They are very hard dense rocks

**SOIL**

**Definition: Soil is a mixture of weathered rocks and minerals, organic matter, water, and air.**

**Soil Equation!**

**Minerals**

**Rocks**

**Air & water fill spaces between the rocks  
once living**

**Pore Spaces**

**Humus = Organic Matter**

**Living Organisms**

**+ Living Microorganisms**

**Soil**

**Characteristics of good fertile soil**

1. Dark color
2. High mineral content
3. Lots of humus (organic materials)
4. Good soil particle size and lots of pore spaces that hold water.

**Characteristics of poor quality soil.**

1. Light in color
2. Low mineral content
3. Little of no humus (organic materials).
4. Particle size to large or small, and few pore spaces

Soil particle size determines a soil’s ability to hold water

**How farmers protect soil.**

* 1. **Crop Rotation**

Planting different crops in the same field during different years.

Example: wheat uses up nitrogen, beans contain bacteria the restores nitrogen.

* 1. **Conservation Tillage**Fields are plowed less, or are not plowed at all.
  2. **Terraces**Steps are built into a hillside.
  3. **Contour plowing**Plowing on a slope is done in curves so that rain water cannot run straight down the hill.
  4. **Windbreaks**Rows of trees are planted along fields (like a giant fence) to protect the soil from erosion (being blown or washed away).