Oreo Cookie Plate Tectonics

TECTONICS:

- From the Greek "tecton"
  - builder
  - architect

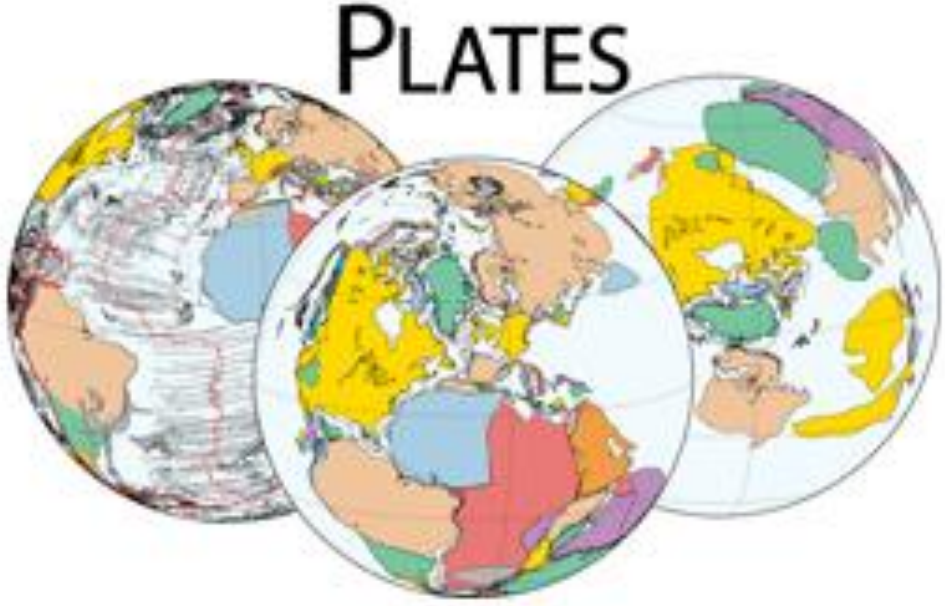
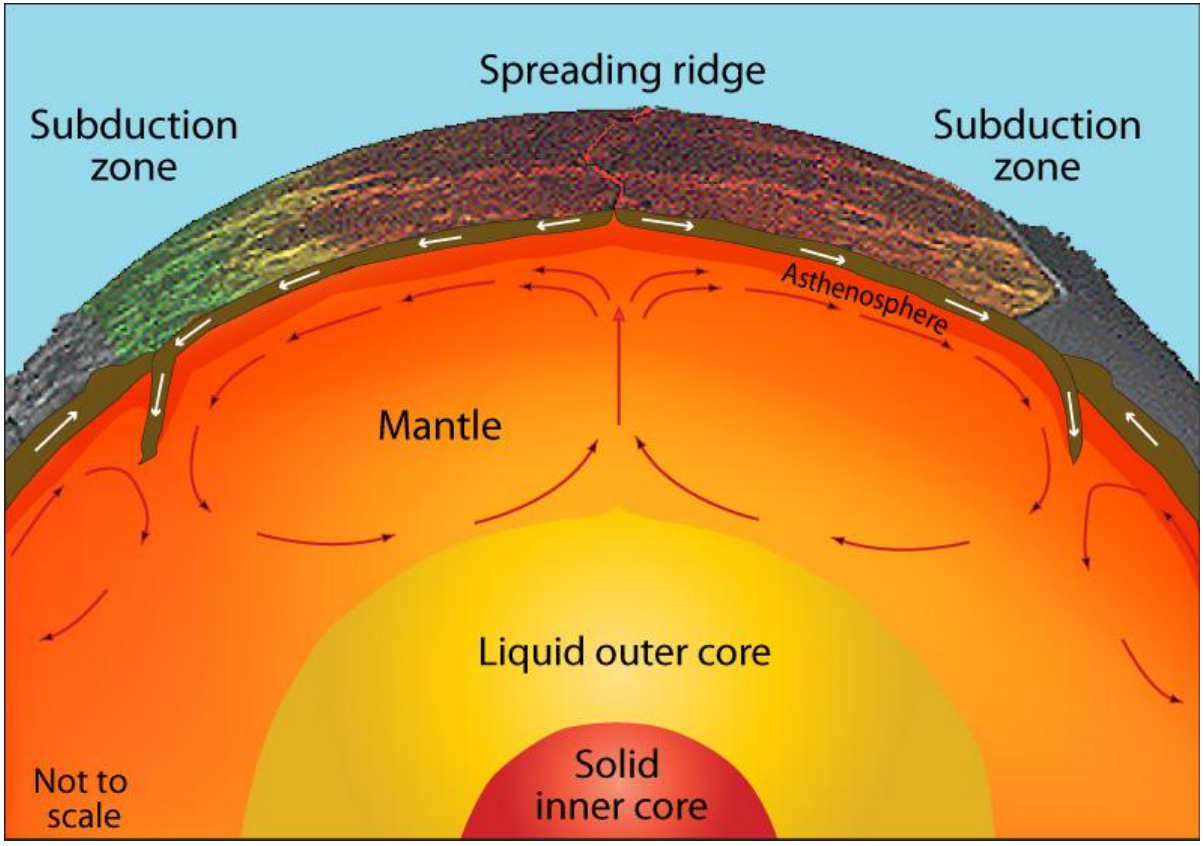


Plate Tectonics

Plates are driven by cooling of Earth (convection)
Gravity provides additional force to move plates.

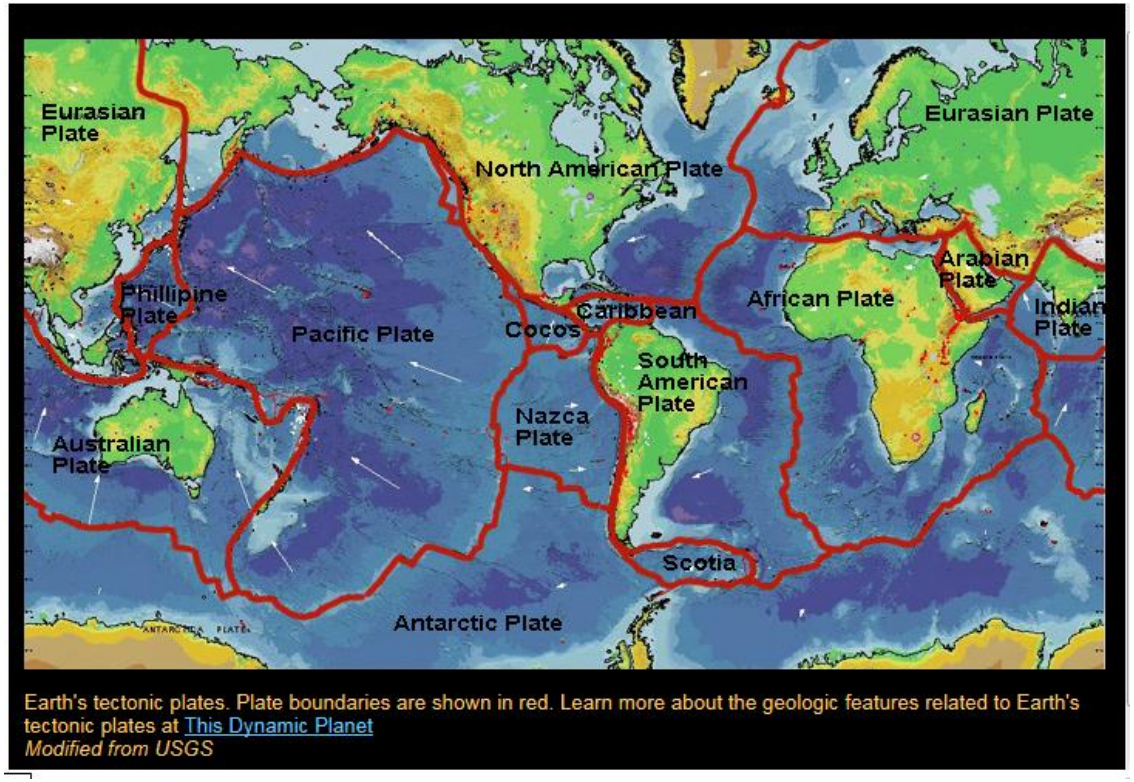


Convection is like a boiling pot. Heated soup rises to the surface, spreads and begins to cool, and then sinks back to the bottom of the pot where it is reheated and rises again.

Modified from USGS Graphics

Theory of Plate Tectonics

- The Earth's lithosphere is made up of huge plates, or slabs of rock, that move over the surface of the Earth.

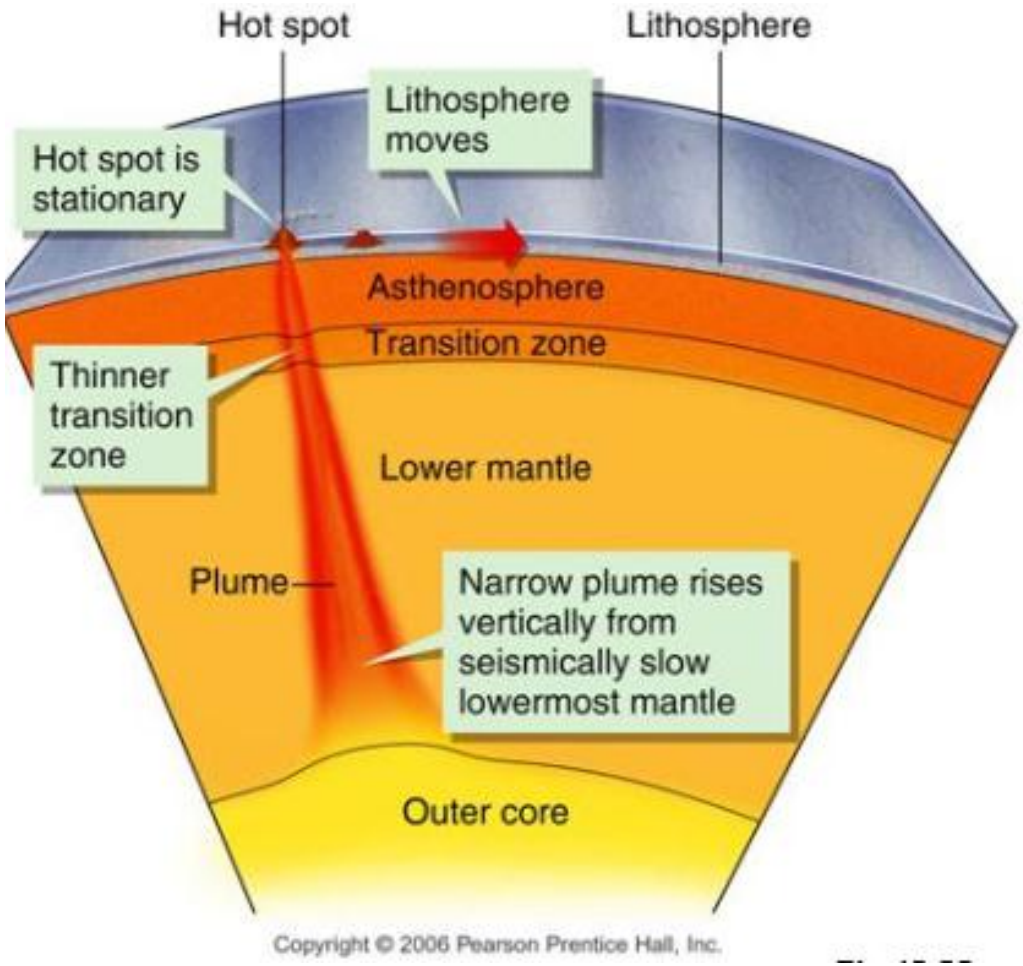


Earth's tectonic plates. Plate boundaries are shown in red. Learn more about the geologic features related to Earth's tectonic plates at This Dynamic Planet
Modified from USGS

Include Continental crust and oceanic crust

Lithospheric Plate

- The ~100-km-thick surface of the Earth;
- Contains crust and part of the upper mantle;
- It is rigid and brittle;
- Fractures to produce earthquakes.



Asthenosphere

Asthenosphere:

- Is the hotter upper mantle below the lithospheric plate;
- Can flow like silly putty; and
- Is a viscoelastic solid, *NOT* liquid!!

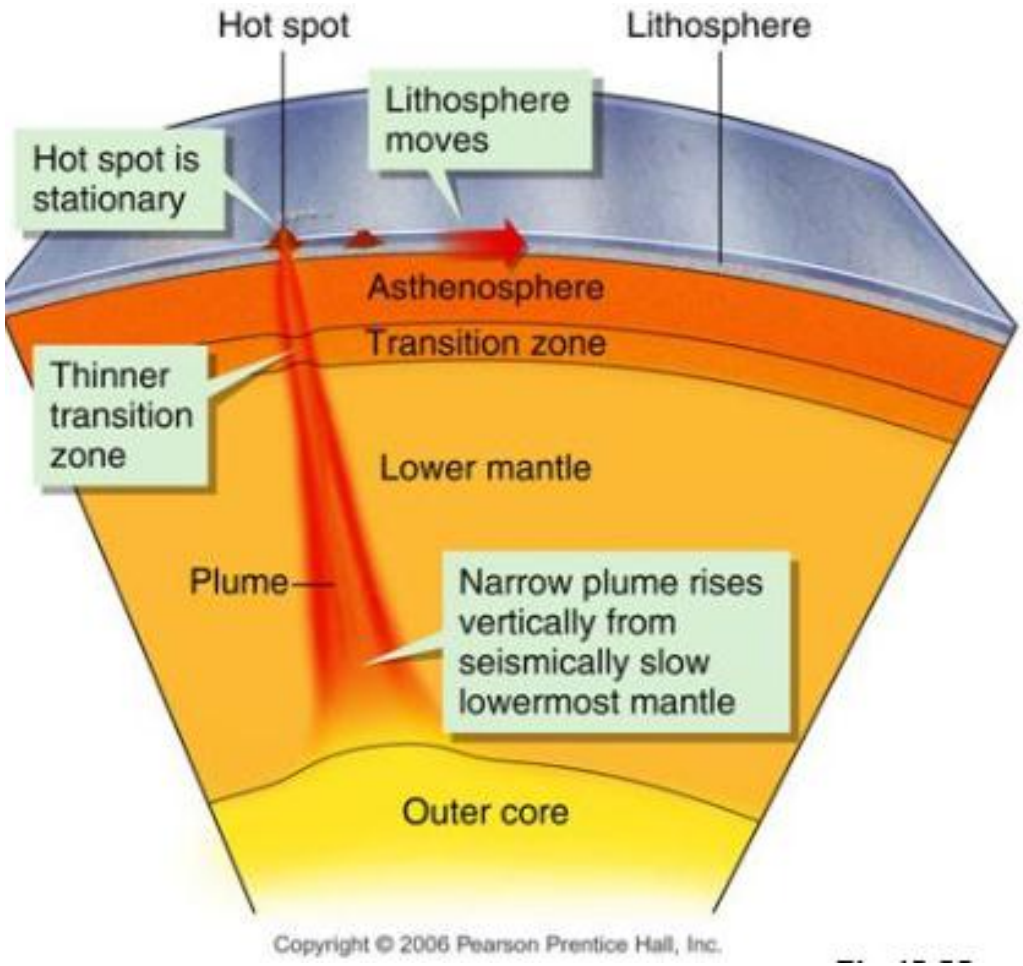


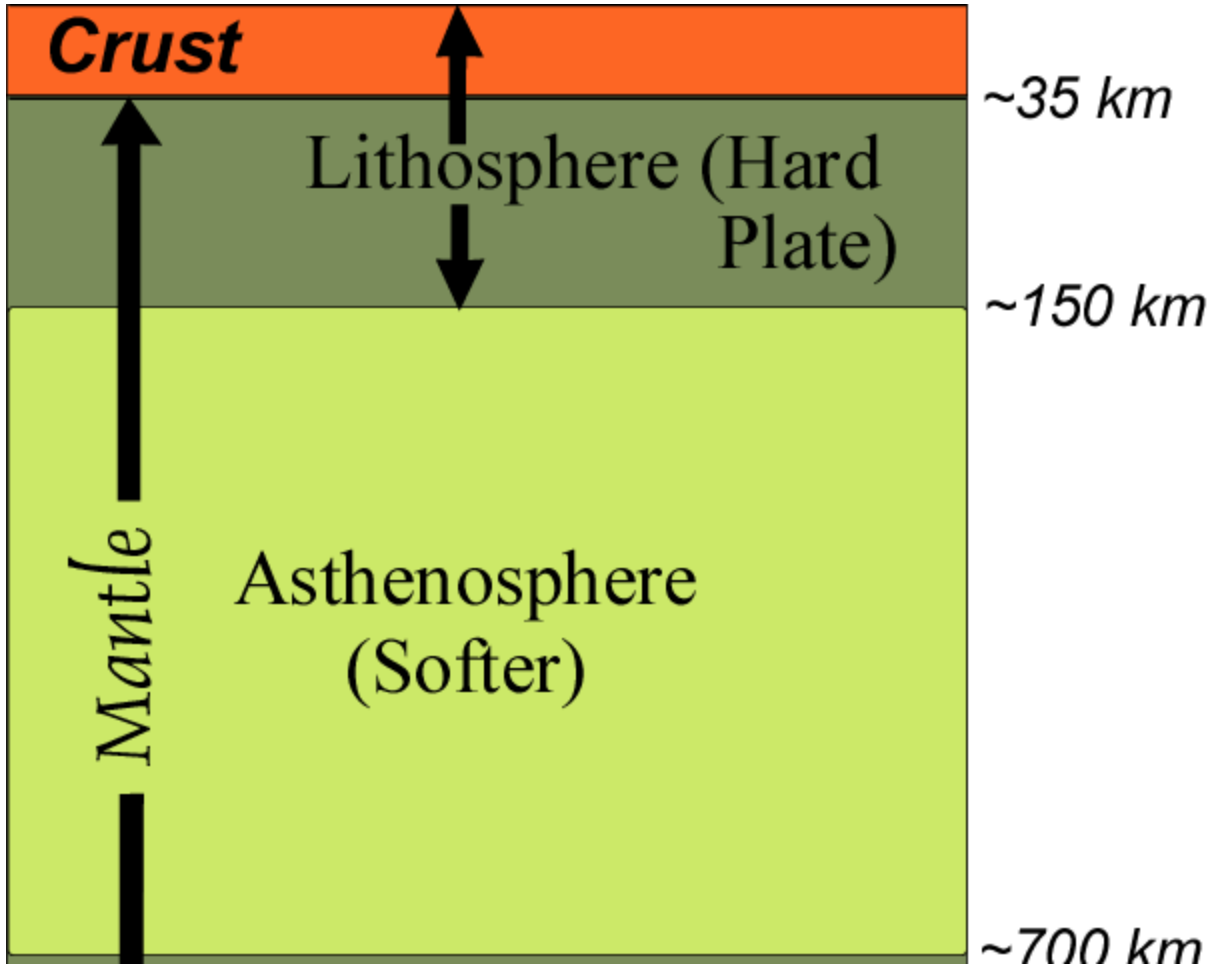
Plate Tectonics

- The term **tectonics** originates from the Greek word "tektõn," referring to a builder or architect. **Plate tectonics** suggests that large features on Earth's surface, such as continents, ocean basins, and mountain ranges, result from interactions along the edges of large plates of Earth's outer shell.
- The outer shell is the lithosphere from the Greek "lithos," meaning hard rock. The plates, composed of Earth's crust and uppermost mantle, ride on a warmer, softer layer of the mantle, is the asthenosphere. The Greek "asthenes" means weak.

Twist Apart

Oreo Cookie


Hard
Upper
Cookie
Creamy
Filling


Crust
~35 km
Lithosphere (Hard
Plate)
~150 km
Mantle
Asthenosphere
(Softer)
~700 km

Cookie Model

- First, twist the cookie apart so that one side has the cream filling and the other side does not.
- The upper cookie represents the lithosphere - hard, brittle, and crumbly.
- The cream filling represents the asthenosphere. - soft, pliable, a solid that can move like a liquid.

Sliding Plates

Slide the upper cookie over the cream filling, This motion simulates the movement of a rigid lithospheric plate over the softer asthenosphere.

- What happens at the plate boundaries?
- Plates move and interact with each other creating geologic activity.
- What does the break represent?
  Plate boundaries

Sliding Plate

Divergent boundary is where two plates move apart.

Divergent means moving apart.

Divergent Plate Boundary

Convergent boundary is where plates push together.

Convergent means moving together.

Convergent Plate Boundary

Transform Plate Boundary:

Transform Plate Boundary is when plates scrape past each other.

Subduction is when one plate sinks below another.

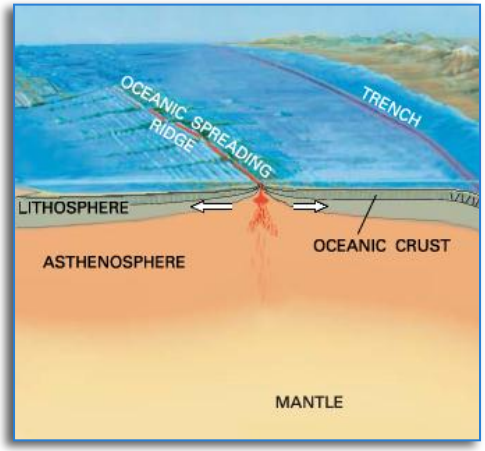
Subduction

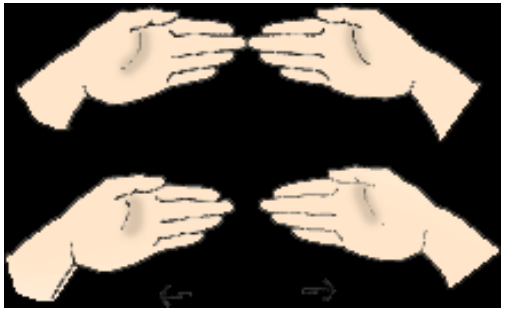
Some of Earth's landforms are created by **hotspots** where a plate rides over a fixed "plume" of hot mantle, creating a line of volcanoes. Imagine if a piece of hot, glowing coal were imbedded in the creamy filling – a chain of "volcanoes" would be burned into the overriding cookie.

Hot Spot

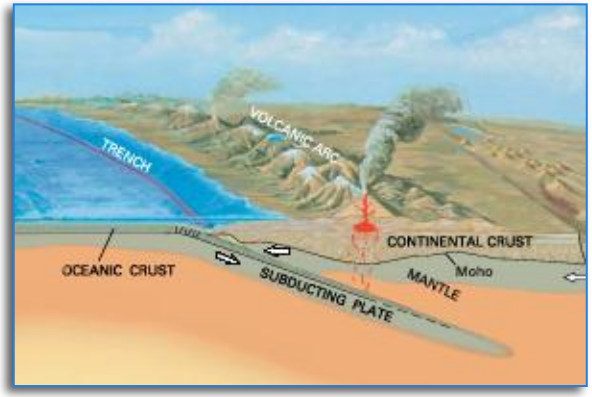
Types of Motion

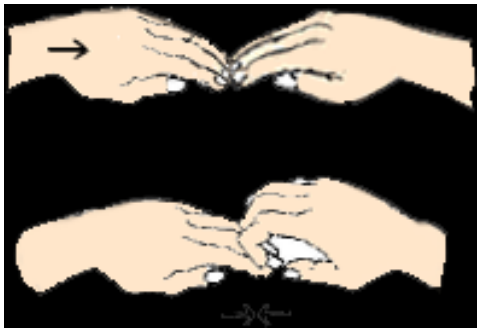
Divergent

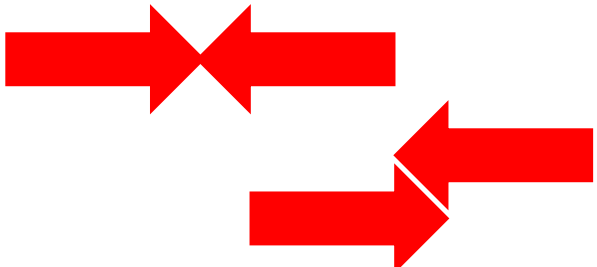




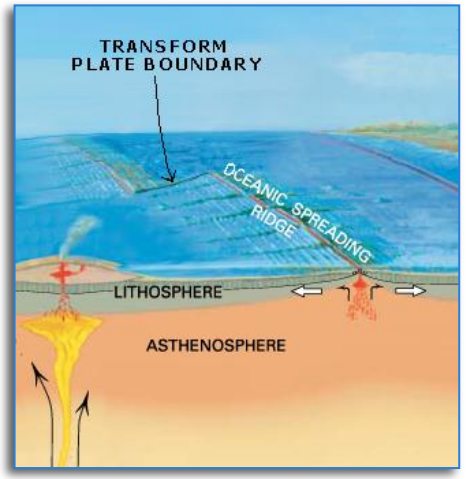
Convergent

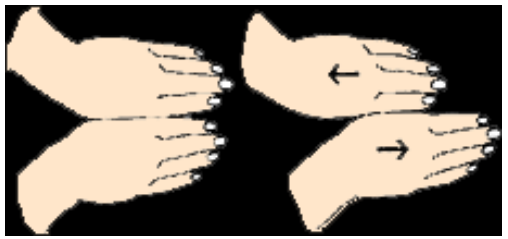


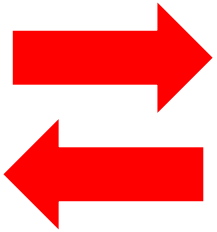




Transform







USGS Graphics

Directions

- Complete the lab using the other cookie.
- Use Chapters 1.3 and 1.4 in The Changing Earth to complete the worksheet. (pages 22-36)
- Complete Questions 1-9: Analyzing a Diagram (Page 41)
- HW if not done ☺

Answer Key

Lab Sheet

Divergent Plate Boundaries

- Divergent boundary is where two plates move apart.
- Divergent means moving apart.

- Push down gently on the two broken cookie halves and slide them apart. What happens to the creamy filling?
- Creates a ridge

-
- What does this represent?
  Mid-ocean ridges, rift valleys and new crust.
-

Convergent Plate Boundaries

- Convergent boundary is where plates push together. Convergent means moving together.
- What happens to the cookies as they push against each other?
- Create a mountain
- What are the three types of convergent boundaries? Continental-continental collision, Oceanic-oceanic subduction, Oceanic-continental subduction
- What does this represent?
- Mountains

Transform Plate Boundary

- Transform Plate Boundary is when plates scrape past each other.
- Take the two cookie halves and slide them up and down past each other. What do you notice about the cookie edges?
- They do not pass smoothly. There is friction, crumbs
- What does this represent?
- Friction, earthquakes, land displacement.
-

Subduction

- Subduction is when one plate sinks below another.
- Stack both pieces of cookie top on top of one another Break the bottom cookie piece in half, removing the frosting from one of the pieces. The free frosting piece represents the oceanic crust. When the oceanic crust and continental crust collide, the denser oceanic plates subduct below the continental plate **What does this represent?**
- Deep-ocean trenches, island arcs, coastal mountains

Analyzing a Diagram p. 41

1. d
2. d
3. a
4. a
5. c
6. d
7. c
8. b
9. a