Name: _____   Section: _____   Date: _____

Plate Tectonics PhET Simulation

Learning Objectives:

- Describe the differences between oceanic and continental crust, including their respective properties of density, composition, temperature and thickness.
- Predict how changes in composition and temperature change crust density and buoyancy.
- Predict tectonic movement based upon compositional and physical characteristics of each plate.

★ Part 1: Describing differences between oceanic and continental plates

1. Open the Plate Tectonics simulation by clicking on the link on my web site (or going to this address: https://phet.colorado.edu/en/simulation/legacy/plate-tectonics)
2. Play with the sim (**both tabs**) for 5 minutes. *Move* **all** dials and buttons!
   The items in the Toolbox can be dragged out to take readings on different parts of the simulation (like the pictures on the right)
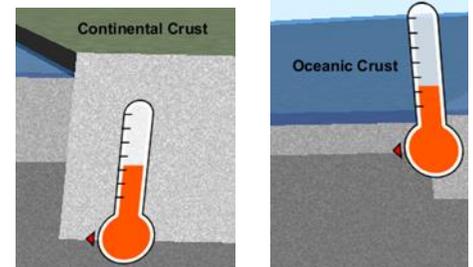
★ Crust Tab

1. Look at the pictures on the right. Which type of crust is hotter at its base?

2. Why would the base of that type of crust be hotter?

3. Drag the density meter over the middle crust that is not labeled and drop it in the light gray area. Use the adjustments in the "My Crust" box to try the following:
   a. What happens to the density when you <u>add more iron</u> to the crust? _____

   b. If you change the composition by <u>adding more silica</u> to the crust (sliding the rule to the right), what happens to the density? _____

      Click the yellow "Reset All" button at the bottom.

   c. Put the density meter on the middle crust again. If you <u>add heat to the crust</u>, what happens to the density of the material? _____

   d. What happens to the density of the material if you make the crust cooler by <u>taking away heat</u>? (Slide Temperature rule to the left) _____

4. Use the density meter to compare the oceanic and continental crusts. Which is more dense and why might it be more dense (look back at your results from part c)? _____

   _____

   _____

5. List <u>all the ways you can find</u> to change oceanic crust into continental crust using the sliders.

Three Main Types of Plate Boundaries

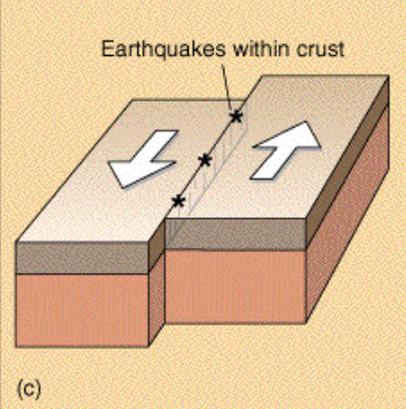| Type of Margin	Divergent	Convergent	Transform
Motion	Spreading	Subduction	Lateral sliding
Effect	Constructive (oceanic lithosphere created)	Destructive (oceanic lithosphere destroyed)	Conservative (lithosphere neither created or destroyed)
Topography	Ridge/Rift	Trench	No major effect
Volcanic activity?	Yes	Yes	No
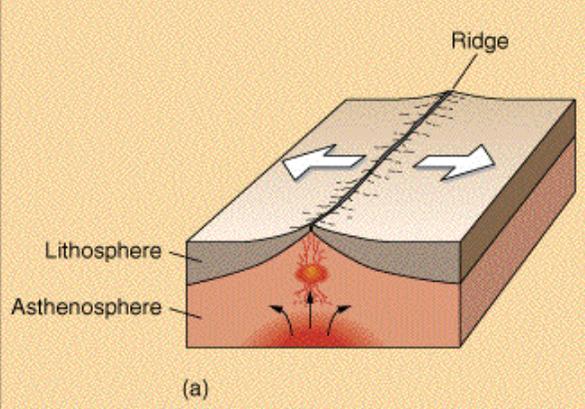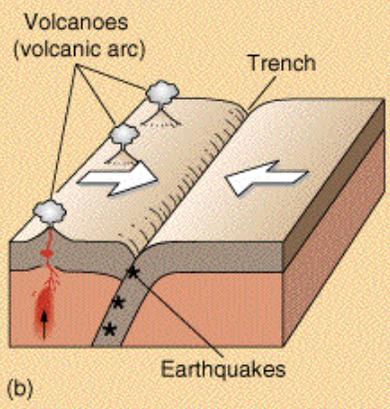
Image source: http://www.age-of-the-sage.org/tectonic_plates/boundaries_boundary_types.html

✵ Plate Motion Tab

Always view "Both", "Show Labels", and "Show Seawater" (when possible).

Click on "Manual Mode".   [○ Automatic Mode   ⦿ Manual Mode]   Complete the table below <u>using only Manual Mode</u>.

*Note: To see the same action happen again click "Rewind." To start over click "New Crust."

Example 1: Drag 1 oceanic crust (either young or old) & 1 continental crust onto the screen. Drag the plate in the direction of the GREEN arrow.		
Draw it!	**Type of Boundary?** □ Divergent □ Convergent □ Transform	What is the effect/outcome of this plate movement?

Example 2: Drag 2 old oceanic crusts onto the screen. Drag the plate in the direction of the RED arrow.		
Draw it!	**Type of Boundary?** □ Divergent □ Convergent □ Transform	What is the effect/outcome of this plate movement?

Example 3: Drag an oceanic (either young or old) crust and continental crust onto the screen. Drag the plate in the direction of the GREEN arrow.		
Draw it!	**Type of Boundary?** □ Divergent □ Convergent □ Transform	What is the effect/outcome of this plate movement?

1. **Find a way to create a volcano on a continent.**

   - Volcanoes form when _____

   - What type of plate boundary is this? _____

   - Use the ruler: How many kilometers (km) below Earth's surface does oceanic crust <u>begin</u> to melt and form

     magma that rises to the surface? _____

   - The process of oceanic crust sinking underneath continental crust is called _____

   - *Critical Thinking:* What causes the oceanic crust to melt and rise to the surface? _____

   - **Circle one:** Oceanic crust has a (higher / lower) density than continental crust.

   - **Circle one:** This allows oceanic crust to (sink underneath / float on top of) continental crust.

   - *Critical Thinking:* Why do you think you aren't able to make a divergent oceanic/continental boundary?

     _____

     _____

2. **Find a way to create mountains in the middle of land.**

   - What type of crust is needed to form these mountains? _____ and _____

   - What type of plate boundary is this? _____

   - *Critical Thinking:* Why would a volcano NOT be likely to form underneath these mountains? _____

     _____

     _____

3. **Find a way to create islands in the ocean.**

   - What two types of crust are needed to form these islands? _____ and _____

   - What causes the islands to form? Be as detailed as possible. _____

     _____

     _____

4. **Find a way to make new crust form in the middle of an ocean.**

   - What type of plate boundary is this? _____

   - **Circle one:** The oldest crust is (nearest / farthest away from) the boundary where the two plates meet.

5. **Click the yellow "Reset All" button.**

   - Drag and drop **Old Oceanic** crust on the left and **New Oceanic** crust on the right side of the plate boundary.

   - Check the box labeled "Show Seawater".

   - Click and hold the <u>green</u> arrow until the plates stop moving.

   a. What forms at this boundary? _____

   b. How many years did it take for this to form? _____

   c. If both plates were made of oceanic crust, how is it possible for one of the plates to slide under the other?

      _____

      _____

6. **Click the yellow "Reset All" button.**

- Drag and drop **Continental** crust on **both** sides of the boundary.

- Check the box next to the label "Show Seawater".

- Click and hold the <u>red</u> arrow until the plates no longer move.

a. What type of plate boundary is this? _____

b. What geographical features are created at this type of boundary? _____

c. Describe the process that is occurring underneath the crust that allows new crust to form. _____

   _____

   _____

   _____

7. **Click the yellow "Reset All" button.**

- Drag and drop **Continental** crust on **both** sides of the boundary.

- Click and drag the <u>blue</u> arrow until the plates no longer move.

a. What type of boundary is this? _____

b. Movement of the plates at this boundary causes what type of natural phenomenon? _____

8. **Click "Automatic Mode".** Create as many plate boundaries and timelines as you wish!

   Record any interesting combinations and observations here: