Oreo Earth; That’s How the Earth Crumbles

**Standard 8-3** The student will demonstrate an understanding of materials that determine the structure of Earth and the processes that have altered this structure.

**Standard 8-3.6** Explain how the theory of plate tectonics accounts for the motion of the lithospheric plates, the geologic activities at the plate boundaries, and the changes in landforms over time.

**Objective:** To model the movement of lithospheric plates at the three major boundary types; divergent, convergent, and transform. Reinforce the movement and interactions of lithospheric plates at boundaries using an Oreo cookie as a model.

**Knowledge Basis:**
Students will have discussed and formed an understanding of the layers of the Earth. Students will know the make-up of the lithosphere and asthenosphere and how the two interact with one another. Students should have previous knowledge of the Theory of Plate Tectonics and understand that the Earth is made up of lithospheric plates that float on top of the asthenosphere. Students will have learned the three major plate boundaries, the way the plates move at these boundaries and the resulting geologic activity or landforms associated with this movement.

**Vocabulary:** Lithosphere, asthenosphere, lithospheric plates, plate boundaries, convergent, divergent, and transform

**Materials:**
- One Oreo cookie per student (if possible with Halloween orange filling)
- Accompanying PowerPoint presentation

**Lesson:**
Using a model helps to ensure students understand the way in which plates move and interact with one another as well as the resulting landforms or geologic activity that accompanies plate movements. It will help to example the proceedings with your own Oreo to the class while walking them through the steps. Briefly review the information learned about lithospheric plates and how they move.
- What are the lithospheric plates?
- What does the lithosphere float on top of?

1. Hand out an Oreo cookie to each student, INSTRUCT STUDENTS NOT TO EAT IT...yet!
2. Ask students if the Oreo was the Earth what part of the cookie would represent the lithosphere and asthenosphere.
   a. Cookie top represents the lithosphere. Compare the cookie to the lithosphere. Hard, brittle, crumbly like the crust
   b. Frosting represents the asthenosphere. Compare the frosting to the asthenosphere. Soft, pliable, a solid that can move like a liquid.

3. Have students twist the top (lithosphere) off the frosting of the cookie.
4. Place the top back on the frosting and twist the top around, slide it back and forth. The cookie floats and moves on top of the frosting just like the lithosphere on the asthenosphere.

5. Ask students
   a. What is the lithosphere broken into? (Lithospheric plates)
   b. How would we model this? (By breaking the cookie top in half)

6. Break the cookie top in half to break the lithosphere into two plates. DO NOT BREAK THE ENTIRE COOKIE IN HALF
   a. What does this 'break' represent? (Plate boundary)
   b. What happens at the plate boundaries? (Plates moves and interact with each other creating geologic activity)

   Representing the Divergent Boundary

7. Ask Students
   a. What is a divergent boundary? (Where two plates divide)
   b. How would we represent this? (Pulling the two cookie pieces away from each other)

8. Instruct students to press down gently while pulling the two Oreo pieces apart.
   a. What happens here? (Volcanoes, spreading zones)
   b. What is the result? (Magma released from Earth’s interior, mid-ocean ridges are formed)
   c. What will happen to this magma overtime? (Cools and becomes igneous rock, forms new earth)

   Representing the Convergent Boundary
9. Have students imagine a LONG time has passed and the magma (frosting) released at the divergent boundary has cooled.

10. Ask students
   a. *What is a convergent boundary? (Where two plates collide)*
   b. *How will we represent this? (By pushing the two cookie pieces together)*

11. Instruct students to gently press down on the two cookie pieces and push them together.
   a. *What is the resulting landform? (Mountain)*
   b. *What kind of lithospheric plates collided? (Two continental plates)*

Representing a Transform Boundary

12. Ask students to identify the last major boundary type
   a. *What happens at a transform boundary? (Plates slide against one another)*
   b. *How would we represent this? (Slide the two cookie pieces against one another)*

13. Instruct students to slide the two cookie pieces against each other.
   a. *What is the result? (Friction, earthquakes, land displacement)*

Representing Subduction

This will be difficult to have students do but you can show them the PowerPoint picture and do it with your own cookie as an example. (See ppt slides for clarification on the following steps)

14. Stack both pieces of the cookie top on one another on top of the frosting.

15. Break the bottom cookie piece in half, removing the frosting from one of the pieces. The frosting free piece will represent the oceanic crust.

16. Discuss the difference between oceanic and continental crust, ask students
   a. *What happens when oceanic crust and continental crust collide? (The denser oceanic plate subducts below the continental plate)*
   b. *What is the resulting landform? (Subduction zone, trenches, volcanic mountains)*

17. Push the oceanic crust into the frosting below the continental crust at an angle representing subduction.
Conclusion:
Review the information discussed, students should be able to fill out the following table. Time permitting you can have students label the Oreo pictures on the PowerPoint slides representing each boundary type with hand-outs, smart board, or iPads.

<table>
<thead>
<tr>
<th>Boundary Type</th>
<th>Action of Plates</th>
<th>Resulting Landform or Geologic Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Divergent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convergent (Continental-Continental)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transform</td>
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<td></td>
</tr>
<tr>
<td>Convergent (Oceanic-Continental)</td>
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