Name: _____ Class: _____ Date: _____

Snack Tectonics

Learner Outcomes:

- Investigate and interpret patterns in the structure and distribution of mountain formations
- Describe evidence for crustal movement, and identify and interpret patterns of these movements

Key Terms:

Plates	Sea floor spreading	Normal Fault
Converging plates	Subduction zone	Reverse fault
Diverging plates	Fault	Transform fault

Background Information:

The Earth's crust is broken up into a number of pieces, called plates. These plates are continually on the move because they rest on top of the Earth's semi-liquid mantle. As the plates push together, pull apart, and slide past each other they re-sculpt the surface of the earth.

Research Questions: What happens when the Earth's tectonic plates move together, pull apart and slide against each other? What is the best "food model" to illustrate plate tectonics?

Materials:

One large graham cracker	Plastic knife or spoon
Two 3-inch squares fruit roll up	Mini Mars chocolate bar
Plastic cups	Oreo cookie
Frosting	Plastic knife
Sheet of wax paper	Water

Accessed and adapted from:
http://jclahr.com/science/earth_science/cr06/workshop/activities/snack/snack_tectonics.html

Procedure:

Part A: Graham Cracker Model

1. Make the graham cracker model
    a. Obtain about a square foot of wax paper and a large dollop of frosting. Spread the frosting into a layer about half a cm thick.
    b. The frosting in this model represents the Earth's **mantle**. The plates in this model are represented by fruit roll up (oceanic crust which is thin and dense) and graham crackers (continental crust which is thick but less dense).
2. Divergent plate boundary
    a. Place the two squares of fruit roll up (oceanic plates) onto the frosting right next to each other.
    b. Press down slowly on the fruit roll ups (because they are dense and will sink a bit into the mantle) as you slowly push them apart about half a cm.
    c. Notice how the frosting is exposed and pushed up where the plates are separated? This is analogous to how magma comes to the surface where real plates are moving apart at **divergent plate boundaries**. Most divergent plate boundaries are located within oceanic crust. When plates begin to pull apart at continents, rift valleys are made, which can become the bottom of the sea floor if the plates continue to pull apart.
3. Continental-oceanic collision
    a. Remove one of the fruit roll ups from the frosting. (You can eat it if you wish!)
    b. Place one of the graham cracker halves **lightly** onto the frosting mantle next to the remaining fruit roll up piece. The graham cracker represents **continental crust**, which is thicker and less dense than oceanic crust (fruit roll up). It floats high on the asthenosphere so don't push it down.
    c. Gently push the continent (graham cracker) towards the ocean plate (fruit roll up) until the two overlap and the graham cracker is on top. The oceanic plate is **subducted** below the continental one.
4. Continent-continent collision

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a. Next, you will model what happens when two continents collide. Remove both the cracker and fruit roll up from the frosting mantle. (You can eat or discard the fruit roll up.)
b. Place one edge of both crackers into a glass of water for just a few seconds.
c. Place the crackers onto the frosting with wet edges next to each other.
d. Slowly push the graham crackers towards each other.
e. Notice how the wet edges crumple? This is how mountains are made at **convergent plate boundaries**! When continents move towards each other there is nowhere for the rock to go but up!

5. Transform plate boundaries
    a. Pick the two crackers up off the frosting and turn them around so that two dry edges are next to each other.
    b. Push one cracker past the other to simulate a **transform plate boundary** like the San Andreas fault!
6. Final step: eat all remaining model materials (except, of course, wax paper and plastic utensils!)

Part I Observations: Draw and describe what happens in steps 2, 3, 4 and 5.

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Part B: Milky Way Model

DIVERGENT BOUNDARY:

1. Unwrap the candy bar and hold the bar with two hands. Gently push up in middle of bar with thumbs to 'bend' bar. DO NOT separate bar into two halves. Sketch what you observe

CONVERGENT BOUNDARY

2. Holding the Milky Way in both hands, return to as close to original bar as possible. (Flat, straight). Push in from the ends of the bar to force plates together. It might work best to put fingers on edges of bar, not on top & bottom. Try to keep bar in a straight line. The top layer should do one of two things:
   1) form mountains
   2) one chocolate layer will subduct under the other one

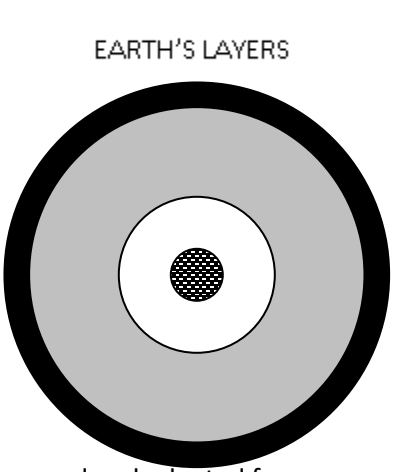
   Sketch your observations

TRANSFORM BOUNDARY

3. Again, return Milky Way to 'original position'- as best as possible. With fingers & thumbs on long edges of bar, slide your right hand forward, pull your left hand back. Sketch your observations.

MODEL OF THE EARTH

4. When finished, pull the candy bar completely apart, but don't eat it yet! Look at the exposed interior and think about the candy bar as a model of the Earth's layers. The chocolate is the lithosphere, the caramel is asthenosphere and the nougat is the remaining mantle material. Draw arrows to relate each description below to the structure of the earth and the layers of the chocolate bar.



CRUST or LITHOSPHERE

thin', brittle, hard, cold,

MANTLE

OUTER CORE

Hot, liquid (very high pressure, more heavy

INNER CORE

This layer is solid.

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Part II Observations:

Analysis:

1. Give an example of one North American land structure formed by each of the processes modeled in this activity.

2. Why did we use icing to represent the Earth's mantle in this activity?

3. Would the icing still serve as a useful model if it had hardened completely? Why or why not?

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4. What might be a better alternative to icing for this model?

5. Were the graham crackers and fruit roll-ups useful models for the structures in the earth's crust? Why or why not?

6. Why did we wet the sides if the graham crackers?

7. What were the strengths and weaknesses of the two models (graham cracker and candy bar) in illustrating plate tectonics? Which model did you prefer? Why?

Conclusion: Draw and label a diagram illustrating each of the processes you investigated in this activity.

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Extension:

Choose two adjacent plates from a map of the world. Research the geological characteristics of the areas where the edges of those two plates meet to determine how the plates likely move relative to one another. Report your findings using a detailed, labeled diagram or a 3 dimensional model of the plate boundaries and the geological features.

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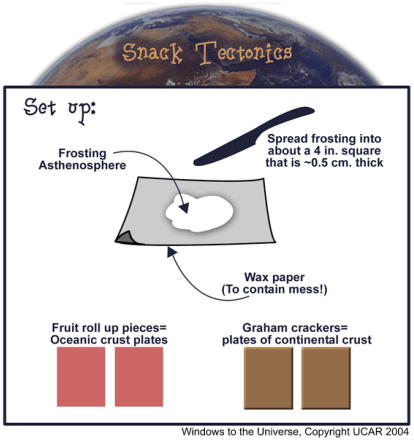
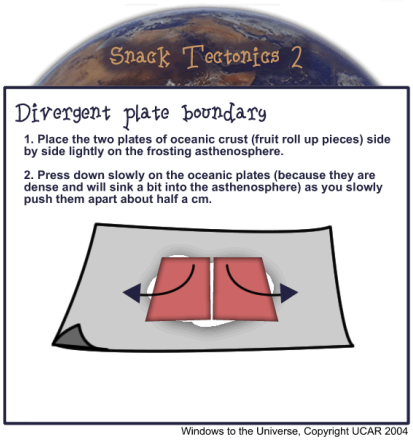
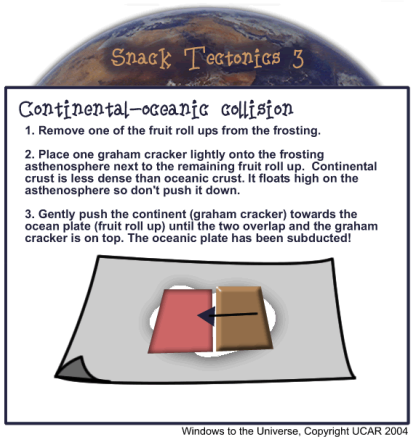
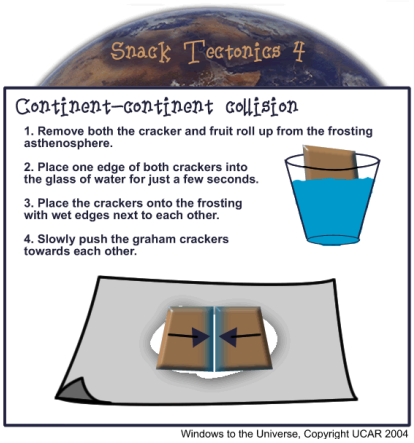
Snack Tectonics Student Instruction Overheads

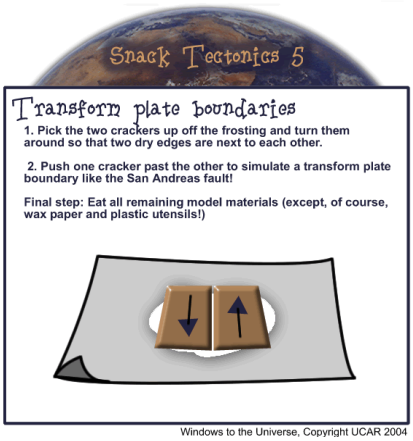
The graphics below accompany the Snack Tectonics activity from Windows to the Universe. Click on each for the larger version and print it onto overhead transparency. Then show the overheads in sequence to provide students with directions for developing their tasty models of plate tectonics!











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