PLAY-DOH TECTONICS

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Developed by Maureen Leshendok
Mackay School of Mines

Grades 4-5 NMA Activities, Nevada State Science Education Standard Correlation. Referencing Science Standards 2005 http://www.doe.nv.gov/standards/standscience.html				
	N.5.A.2	N.5.A.6	N.5.B.3	E.5.C.3
Playdoh Tectonics 01-10	X	X	X	X

PLAY-DOH TECTONICS

By Maureen Leshendok

OBJECTIVE: To introduce concepts of earthquakes, faults, and folds, and to relate those concepts to the geology around us.

PROCEDURE and MATERIALS: A series of activities follow, described individually.

WHAT ARE TECTONICS? A branch of Geology dealing with the broad architecture of the outer part of the Earth, that is, the regional assembling of structural or deformational features, a study of their mutual relations, origin, and historical evolution.

--Glossary of Geology, 3rd edition

PLAY-DOH TECTONICS
Activity 1 Map of the Dynamic Earth

OBJECTIVE: To relate some of the big forces acting on the surface of the Earth to the geography and geology of the Earth.

MATERIALS: Map of the Dynamic Earth, suspended where all can see it.

PROCEDURE: Read the map and discuss.

Question 1: Where are the earthquakes, generally?
Question 2: Can you find a broad pattern?
Question 3: Can you find evidence or a suggestion of changes over time?
Question 4: What is the big, overall term that might apply to these patterns and changes?

PLAY-DOH TECTONICS
Activity 2 Plate Tectonics Puzzle

OBJECTIVE: To see how the plates interact with each other.

MATERIALS: Copy of Plate Tectonics Puzzle
Scissors

PROCEDURE: Cut along the dark lines, spread out on the table in front of you, and try to reassemble.
Try to label some of the pieces; i.e., "AFRICA".
Refer to the Map of the Dynamic Earth to answer questions.

OPTIONAL DISPLAY MODEL: Enlarge the Plate Tectonics Puzzle on photocopier, cut out pieces, mount on cardboard cut to same shape, glue to magnets, move around on cookie sheet.

Question 1: In what direction is South America moving relative to Africa?
Question 2: In what direction is Africa moving relative to Europe?
Question 3: What is happening between Europe and Asia?
Question 4: Look at the boundaries of the North American Plate. Where are the boundaries relative to the edge of the continent?
Question 5: Are there any plates that are mostly ocean floor?
Question 6: What happens to the ocean floor when it reaches Japan?
Question 7: Is India moving? If so, which way? How can you tell?
Question 8: Look at the Red Sea. Look at Africa. Can you see a relationship?
Question 9: Look at California, at the San Andreas fault. Which way(s) are the plates moving?
Question 10: Now, what are the 3 ways that plates move relative to each other at their borders?

PLAY-DOH TECTONICS
Activity 3 Place Mats and Plate Tectonics?

OBJECTIVE: To see what happens to a flexible object being pushed against something else ("compression").

MATERIALS: Place mats or hand towels (some piece of relatively heavy fabric, about the size of a place mat)
slippery table top
Map of the Dynamic Earth

PROCEDURE: Place hands on either end of the place mat. Gently push hands toward each other.

Question 1: What happens?
Question 2: Is the place mat covering as much of the table top as before?
Question 3: Refer to the Map of the Dynamic Earth. Are there any places that look similar to the wrinkled place mat?
Question 4: How? Why?
Question 5: Refer to the Map of the Dynamic Earth, and the Plate Tectonics Puzzle. Locate the Appalachian Mountains. Can you make a guess about the origin of the Appalachians?

PLAY-DOH TECTONICS

Activity 4 A Deck of Cards and Plate Tectonics—Local Plate Tectonics are Structural Geology

OBJECTIVE: To experiment again with Compression.

MATERIALS: Pack of 3x5 cards or deck of playing cards.

PROCEDURE: Slightly stagger the deck so that the tops and bottoms of the cards are not in perfect alignment. Tidy up the deck by flexing (bending) it, i.e., pushing it together.

Question 1: What happened?
Question 2: Does that have any relationship to the Place Mat experiment in Activity 3?
Question 3: Can you relate the deck of card experiment to the Map of the Dynamic Earth?

HINT: The cards moving over each other are just like FAULTS in the Earth, with rocks moving against other rocks.

PLAY-DOH TECTONICS
Activity 5 Silly Putty

OBJECTIVE: To discover under what conditions the putty breaks, and under what conditions it bends.

MATERIALS: Silly Putty

PROCEDURE 1: Grasp putty firmly with both hands, one hand at either end. Jerk hands (and putty) sharply in opposite directions.

Question 1: What happened?

PROCEDURE 2: Put putty back together, smooth and warm it with your hands. Grasp again with both hands, pull apart gently.

Question 2: What happened?
Question 3: Why?
Question 4: Can you relate the broken and the bent Silly Putty to the wrinkled place mats and to the pushed together deck of cards?
Question 5: Was the stress you applied (pulling or pushing) to the place mats, cards and putty the same or different? Remember, pushing together is "Compression". Pulling apart is "Extension."

PLAY-DOH TECTONICS
Activity 6 Faults and Folds

OBJECTIVE: To relate the concepts learned in Activities 1-5 to Earth Science

MATERIALS: Ward's Geology Demonstration Kit
Flexible Styrofoam
Fault Blocks Model (assembled)

PROCEDURE 1: Place 3 layers of flexible Styrofoam so that contrasting colors are adjacent to each other.
Grasp on both ends of 3-layer model and push together.

Question 1: What happened?
Question 2: Why?
Question 3: How was it alike, and how was it different from the Silly Putty? Place Mats?
Question 4: How would this look on the Plate Tectonic Puzzle?
Question 5: Where might this be found on the Map of the Dynamic Earth?

PROCEDURE 2: Place the 3 pieces of the Fault Block Model together so that the outside ends are vertical, and the inner piece's two sides are tapered toward each other (looking like the keystone of an arch). Grasp the outer ends of the model, raise above the table top, and very gently pull apart until the keystone piece slides downward slightly.

Question 1: What happened?
Question 2: What kind of force (stress) was applied?
Question 3: Try to relate this result to the place mats, the deck of cards, the silly putty experiments, and the flexible Styrofoam.
Question 4: How would it work on the Plate Tectonic Puzzle?
Question 5: Where might it be found on the Map of the Dynamic Earth?

PROCEDURE 3: Take 2 of the Fault Block Model pieces. Position so that the green side with the drawing of the road is facing up, with the road extending continuously across the 2 pieces. Move the two pieces sideways about 1 inch.

Question 1: Was the force applied compression (push together)?
Question 2: Was the force applied (stress) extension (pull apart)?
Question 3: What kind of force was it? (Hint: the name is SHEAR stress).
Question 4: How would it work on the Plate Tectonic Puzzle?
Question 5: Can you find a place like that on the Map of the Dynamic Earth?

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Activity 7 How Faults are Like Popsicle Sticks

OBJECTIVE: To see what happens when brittle objects are bent too far.

MATERIALS: Popsicle stick

PROCEDURE: Using a hand on both ends, grasp the Popsicle stick.
Bend the Popsicle stick until it breaks.

Question 1: Draw the popsicle stick before it was bent.
Question 2: Draw the popsicle stick just before it broke.
Question 3: Draw the popsicle stick pieces after it broke.
Question 4: Describe what happened.

HINT: This process is called “Elastic Rebound.”

PLAY-DOH TECTONICS

Activity 8 How Earthquake Energy is Transmitted to the Surrounding Crust

OBJECTIVE: To discover how the energy earthquakes make when the fault down deep in the Earth's crust breaks or moves suddenly affects the surface of the Earth.

MATERIALS: Popsicle sticks
Basin of Water
Paper towels

PROCEDURE: Weaken the popsicle stick slightly in the middle.
Place the end of the popsicle stick on the bottom of the basin.
Push the top end until the popsicle stick snaps.

Question 1: What happened to the popsicle stick?
Question 2: What happened to the water?
Question 3: If the breaking Popsicle stick was like a sudden break in a Fault in the Earth, what would people on the Earth's surface feel?

PLAY-DOH TECTONICS
Activity 9 Earthquakes and Slinkies

OBJECTIVE: To discover the sorts of waves of energy made by earthquakes.

MATERIALS: Slinkies

PROCEDURE: Stretch a Slinky across the table, with a person holding each end.

P Waves: 1 person should pull loops of the Sliny together until he or she holds 10 loops tightly together. Let go all but the end loop suddenly.

Question 1: What happened?

Repeat, from the other end.

Question 2: Was there any difference?

S Waves: 1 person, keeping the Slinky flat on the table, should move the Slinky sideways, sort of like throwing a rope, so that the Slinky makes a sort of ripple moving across the table.

Question 1: Was this rippling motion like the P Wave?

Repeat from the other end.

PLAY-DOH TECTONICS
Activity 10 Slinky Races!

OBJECTIVE: To compare P Waves and S Waves.

MATERIALS: 2 Metal Slinkies

PROCEDURE: Using a very large, smooth table or the floor, stretch the slinkies as far as they will go without permanently stretching them. Someone holds each end.
One person stands between them at one end. This is the Judge.
Someone stands between them at the other end. This is the Starter.
Or the Judge, with a Stop Watch, can stand at the end.

Version 1: No Stop Watch.

One Slinky will be the P Wave Slinky. The person holding the starting end gathers up at 10 loops of Slinky.
The other Slinky is the S Wave Slinky.
The Starter says: "Ready. Set. Go!"
Each Slinky's wave is started.
The Judge determines which wave arrived first at the other end.

Version 2: Stop Watch.

Repeat Version 1, except the times on the Stop Watches will be compared.

Question 1: Which is faster, the P Wave or the S Wave?
Question 2: If you felt an earthquake, which wave would you feel first?

Draw a P vs. S travel time graph on the board.

Question 3: If you were 5 miles from the earthquake and you felt the the P Wave 1 second before the S Wave, and your best friend was 10 miles from the earthquake, would your best friend feel a 1-second difference too? Would the difference be bigger? Smaller?