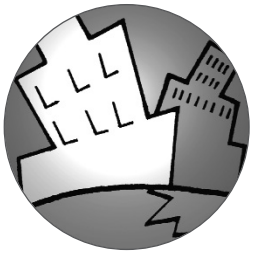

Earthquakes
K–2

Earthquake Science

LESSON PLAN 1

Plate Tectonics

Young children can better understand earthquakes, volcanoes and tsunamis when they learn that we live on the surface of a constantly changing earth.

Key Terms and Concepts

convection currents
core
crust
earth
earthquake
magma
mantle
tectonic plate

Purpose

To have the students illustrate that the earth is composed of different, constantly moving layers, including the surface, or outer layer, where we live.

Objectives

The students will—

- Identify the three layers of the earth using a demonstration.
- Use *The Apple and the Earth* to compare and label the layers.
- Experiment to illustrate convection currents and how they move objects that float on them.
- Write formatted poems (diamantes) to describe the earth's mantle. (Linking Across the Curriculum)
- Model the layers of the earth and how they move to change the shape of the earth.
- Illustrate an understanding of the sequence of changes occurring on the surface of the earth due to plate tectonics with the activity sheet *Earth Changes*.
- Use *Changes* with their families to illustrate changes they have witnessed in their lives. (Home Connection)
- Sequence the changes of the earth as tectonic plates push together, using *Earth Changes* as a guide. (Linking Across the Curriculum)
- Experiment to find whether or not different items change with time and with certain elements added. (Linking Across the Curriculum)

Activities

"The Apple and the Earth"

"Convection Currents"

"Building Mountains"

American Red Cross

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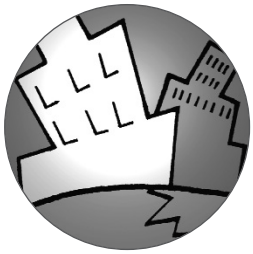


Earthquakes K–2

LESSON PLAN 1

Plate Tectonics

Materials

- Apples, one half for each small group of students
- Knife (for teacher use only)
- Globe
- Crayons
- *The Apple and the Earth*, 1 copy per student
- Chalkboard and chalk or chart paper and markers

American Red Cross

Visit the American Red Cross Web site at *www.redcross.org/disaster/masters*

"The Apple and the Earth"

SET UP 15 minutes **CONDUCT** 20 minutes

Language Arts: Vocabulary; Science: Earth Science

Form small student groups for this activity. Cut the apples into halves vertically, preparing enough apples so that each group will have half an apple.

1. Show the students an apple and a globe. Make sure the students recognize that the globe is a model of the earth. Ask the students to find ways that an apple is like the globe (earth). Note their responses on the chalkboard.

2. Explain to the students that the apple and the earth have a hidden similarity: Both the apple and the earth have three layers.

3. Distribute the apple halves to the students in their small groups.

4. Draw a picture of the apple half on one side of the chalkboard and a picture of the earth cut in half on the other side. (See the drawings on *The Apple and the Earth*.) Write the word "apple" above the picture of the apple and write the word "earth" above the picture of the earth.

5. Invite the students to help you label the layers of the apple from their observations of the apple halves they are examining.

   The outside layer is the skin.

   The middle layer is the flesh.

   The innermost layer is the core.

6. Now, identify the layers of the earth on your picture, specifically comparing the earth's layers to those of the apple.

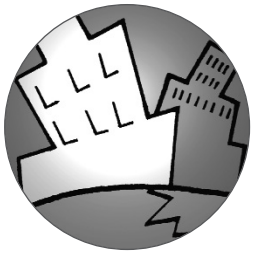
   The outside layer of the earth is called the crust. On an apple this layer is the skin.

   The middle layer of the earth is called the mantle. On an apple this layer is the flesh.

   The innermost layer of the earth is called the core. On the apple this layer is also called the core.

Wrap-Up

Ask the students on which of the three layers we live. (The core, the mantle or the crust?) Make sure the students understand that we live on the crust.



Earthquakes K–2

LESSON PLAN 1

Plate Tectonics

TEACHING NOTE Explain that the skin of the apple is thin but the crust of the earth is very thick. The earth is so large that actually the skin of an apple is proportionately thicker than the earth's crust. To make this point, ask the students if they have ever dug a deep hole in the ground. Compare the deepest holes described by students. Ask them if they know about other deep holes in the ground, such as water or oil wells. Explain that the earth's crust is so thick that no one has ever been able to dig through it.

Distribute *The Apple and the Earth*.

For younger students: Read the directions on the activity sheet to the class. Explain that they may look at the board to help them identify the different layers. Then have the students color the layers and label the layers according to the directions.

For older students: Erase the labels from the chalkboard and then have them work in groups to read the directions and identify and label the different layers.

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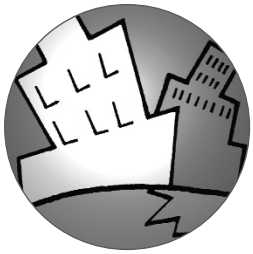


Earthquakes K–2

LESSON PLAN 1

Plate Tectonics

Materials

- Ice cubes, frozen ahead of time with one drop food coloring in each, 1 per pair of students
- Food coloring (blue, green or red)
- Tall, clear, plastic drinking cups, 9-oz. or larger, 1 per pair of students
- Water at room temperature to almost fill the cups
- Paper circles from a hole punch (the round pieces that have been cut)

American Red Cross

Visit the American Red Cross Web site at *www.redcross.org/disaster/masters*

"Convection Currents"

SET UP 20 minutes **CONDUCT** 35 minutes

Science: Physical Science and Earth Science

TEACHING NOTE An alternative is to put a drop of food coloring in each cup and use clear ice cubes. This is not quite as effective, but it works.

1. Discuss the concept of boiling and ask the students to describe what happens to water as it heats. (Water starts to bubble, and the bubbles begin to rise to the surface.) Ask the students for other examples to illustrate the concept that heat rises. (A flame reaches upward, smoke rises, etc.)

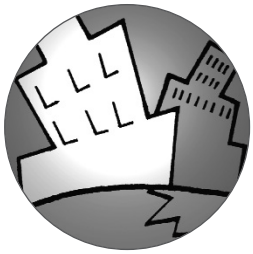
2. Arrange the students in pairs and give each pair a cup of water. Let the water sit still for a while.

TEACHING NOTE The activity will be more effective if the light source (window, if available) is behind the water, so the students should be looking through the water to the light. If the only light is from overhead, a blank piece of white paper held behind the cup may make the convection currents more visible.

3. Ask the students what they think will happen to an ice cube when it is placed in the water. (Since the water is warmer than the ice, the ice will begin to melt.) Ask the students what would happen to bits of paper dropped onto the water. (The paper will float. If the water is still, the paper pieces will float in place.)

4. Carefully place an ice cube in each cup and drop a few paper circles on the surface of the water in each cup. Try to avoid disturbing the water. Tell the students to observe what happens as the ice begins to melt and then draw or write their observations. (As the ice melts, the water gets very cold. That cold, tinted water sinks to the bottom of the cup. The tinted water will warm and rise again. More cold water forms as the ice cube continues to melt. There are vertical currents streaming down from the ice cube and then moving upward. Soon all the water will be tinted one color.)

5. Explain that cooling the water causes a vertical, circular motion that is called a convection current. Have the students discuss what happened to the paper circles within the convection currents. (The circles are pushed by the currents and may bump into and push each other.)



Earthquakes K–2

LESSON PLAN 1

Plate Tectonics

Wrap-Up

Gather the students together to discuss their observations.

Explain to the students that the mantle of the earth is composed of rock that is so hot that it has melted, and this very thick liquid is called magma. Some parts of the crust are moving apart, and the mantle rises to fill in the gaps. Other parts collide, with one piece sinking and melting into the mantle again.

Challenge the students to identify the layers of the earth represented in their experiments. (The water represents the mantle, or magma, and the ice cube and paper circles represent the earth's crust.)

TEACHING NOTE With older students, introduce the concept that the ice cube represents a tectonic plate made of oceanic crust, and this plate is being pulled downward under the continental crust and melting into the mantle.

Ask—

What happened to the ice cube? (The melting water sank to the bottom of the cup.)

What happened to the cold water after it sank to the bottom of the cup? (It rose upward as it warmed.)

What happened to the paper circles? (They were pushed and moved by the currents and bumped into each other and the ice cube.)

If large pieces of the earth floating on the mantle ran into each other as they moved on the currents of the mantle, pressure would build up. What would happen to houses, rocks and people sitting on the floating pieces of the earth's crust? (When the pressure is great enough, energy is released and the earth shakes; the houses, rocks and people on the surface experience an earthquake.)

TEACHING NOTE Remind students that the earth is so big that the movement of pieces of the crust is very small compared with the movement of the ice cube and paper circles in the plastic cup. Imagine replacing the water in the cup with peanut butter or hot cereal. Would the circles move as much? Why not?

Linking Across the Curriculum

Language Arts: Vocabulary and Writing

Invite the students to help you compose a class "diamante" poem to describe the earth's mantle.

- First, ask the students to name things (nouns) that come to mind when they think of the mantle. If they need help with this, "prime their mind pumps" with "fire," "rocks," "river," "ocean," etc.

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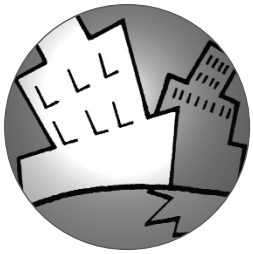

Earthquakes K–2

LESSON PLAN 1

Plate Tectonics

- Then, ask them to think of action words (verbs) that describe what the earth's mantle is doing. If they need help with this, suggest "boiling," "moving," "burning," "bumping," etc.
- Finally, ask them to name descriptive words (adjectives) for the mantle. If they need help with this, suggest "fiery," "red," "yellow," "hot," etc. Now you have the words to compose a diamante verse.

Diamante format:

- *First and fifth lines of the poem:* Have the students choose their two favorite nouns they associate with the earth's mantle. One noun goes in the first line and one in the fifth.
- *Second and fourth lines of the poem:* The students will choose their four favorite verbs that describe what is happening in the mantle or through the mantle's action. Two verbs go in the second line and two in the fourth line.
- *Third line of the poem:* Have the students choose three adjectives they believe best describe the earth's mantle. These adjectives compose the third line of the poem.

TEACHING NOTE Younger students can copy the class diamante and illustrate it. Older students can write and illustrate their own diamantes to describe the mantle, crust or core of earth.

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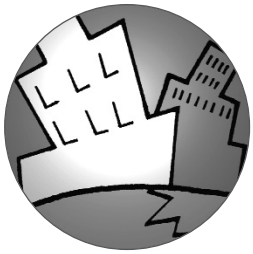

Earthquakes K–2

LESSON PLAN 1

Plate Tectonics

"Building Mountains"

SET UP 20 minutes **CONDUCT** 30 minutes

Science: Earth Science and Physical Science

TEACHING NOTE You can adapt this lesson to a class demonstration rather than a small-group activity depending on the ability of your students to complete an independent, small-group activity.

Materials

For each group:

- Soft, plastic clay (at least three colors)
- 2 wooden blocks
- A smooth, nonstick surface
- Rolling pin, wooden dowel or tin can
- Waxed paper
- *Earth Changes*, 1 copy per student
- Chalkboard and chalk or chart paper and markers
- *Changes*, 1 copy per student (Home Connection)

1. Create a list on the chalkboard, entitled "Earth Changes." Explain to the students that just as babies grow or bikes can rust if left out in the rain, the earth changes, too. Ask the children to identify changes in nature, such as weather changes (rain to sun), seasonal changes and the growth of trees or other plants. List these on the chalkboard.

2. Next, have students name the layers of the earth: crust, magma and core. Remind them that the crust is not a single sheet, but rather a series of giant pieces called tectonic plates that float on the magma. Explain to the students that the movement of the earth's crust can result in dramatic changes. In this activity they will model one kind of natural change that occurs to rock layers at the top of a plate when it collides with another plate.

3. Talk about mountains and hills. How do they look compared with lower or flatter areas of the earth? Explain that mountains and hills often represent a change to the earth's surface that results from the collision of tectonic plates. Tell the students that they are going to model this change.

4. Divide the class into several groups. Have the groups prepare three layers of modeling clay, using the rolling pins (dowels or tin cans) and a smooth surface.
   - Each of the three layers is made from clay of a different color.
   - Each clay layer is at least 2 inches wide and 6 to 8 inches long (5 centimeters wide and 15 to 20 centimeters long).

TEACHING NOTE Remind students to work the clay as little as possible so that it won't stick to the surface.

5. Explain to the students that the earth's crust is often composed of more than one layer of rock and that each layer of clay represents a different kind of rock. Have the students make a sandwich of the clay layers by placing them one atop the other.

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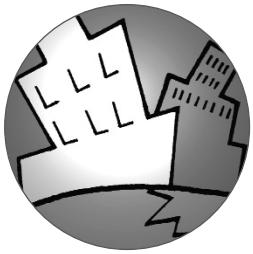


Earthquakes K–2

LESSON PLAN 1

Plate Tectonics

6. The students will now lay the clay sandwich on waxed paper and put the two wooden blocks on opposite ends of the sandwich. The clay layers represent the crust of the earth; the wooden blocks represent the forces created by two tectonic plates colliding with each other.

7. Instruct the students to slowly push the two blocks together at the same time and ask them to describe what happens to the clay. (The clay between the blocks pushes up, forming a mountain.)

8. Using a little more clay, have the groups create a new clay sandwich that is 12 to 18 inches (30 to 45 centimeters) in length. What happens when the blocks slowly push together against this sandwich? Have the students keep pushing until there is more than one fold. (Several mountains form and fold in on each other, continually changing as the students push.)

Wrap-Up

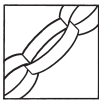
Tell the students to imagine that their clay is actually the ground resting on a tectonic plate.

Listen for understanding of how plate tectonics affect the surface of the earth as students discuss this question: How would the ground look after it has been pushed up by colliding plates over a long period of time? Explain that when the plates push into each other they move in tiny jerks; each jerk is an earthquake. Slowly the surface changes from flat ground to hills and then mountains. Tell the students that this process takes a long time and many, many earthquakes to build a mountain.

Distribute *Earth Changes* to check student understanding of the slow changes caused by colliding plates over the course of time. Have the students put the pictures in order.
Answers to *Earth Changes:* 4 (mountains); 1 (flat ground); 3 (big hills); 2 (little hills).

Home Connection

Change is an important scientific and social concept for young students. Have the students talk with their families to make drawings to illustrate changes they have witnessed in their lives—growing taller or stronger, starting to read, flowers growing around their homes, trees losing leaves, the colors of the sky at sunset, etc. The students should bring back their drawings and discuss the causes of each change and how long the changes took.



Linking Across the Curriculum

Science: Earth Science

Review *Earth Changes* and the movement of the plates of the earth, which causes the crust to buckle and push up, building mountains. Talk with the class about weather and water and what it does to change the earth's surface. (Heavy rains wash away some of the earth's surface; winds can move loose dirt and rocks; and rivers can cut deep holes in the earth.)

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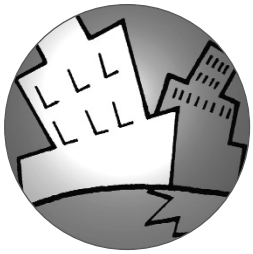

Earthquakes K–2

LESSON PLAN 1

Plate Tectonics

Now, have the students renumber the pictures on *Earth Changes* to illustrate what weathering might do to the surface of the Earth.
Revised Answers to *Earth Changes* based on weathering: 1 (mountains); 4 (flat ground); 2 (big hills); 3 (little hills).

Science: Earth Science and Physical Science; Mathematics: Measurement
For this exercise, you will need clear plastic containers (1 for each small group) and index cards (several for each student or small group).

Invite the students to compile three lists:

- Things they know will change (Leaves fall and turn brown; nails rust; tomatoes rot; and newspapers turn yellow.)
- Things they know will not change (plastic toys, CDs and plastic bags)
- Things they think might change (a paper bag when it gets wet; a tree twig that falls in the dirt; and a penny dropped in water)

For each item on the list of changeable things, ask students what is needed for a change to occur. For example, some children may recognize that nails can rust. If they put a nail on the list of changeable things, make sure they understand that water is required to make the change. For leaves to dry out, the change requires a lack of water.

Divide the class into small groups. If possible, have the students from each group bring in items from each list to school. Have them place each item in a clear plastic container along with any needed elements to cause the change.

Help the students label the containers and list the contents on index cards. Tape the cards to the containers and put them where the students can observe them over a period of weeks.

Assign an observation day and allow time for observations. Each day, meet with a group of students and help them write reports on their observations.

At the end of the period of observation, you can wrap up the experiment with a discussion of what the students learned and how they would refine their original list of changes. With older students, you can continue the experiment by changing the elements in the containers to try to effect change or stop change.

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The Apple and the Earth

Name _____

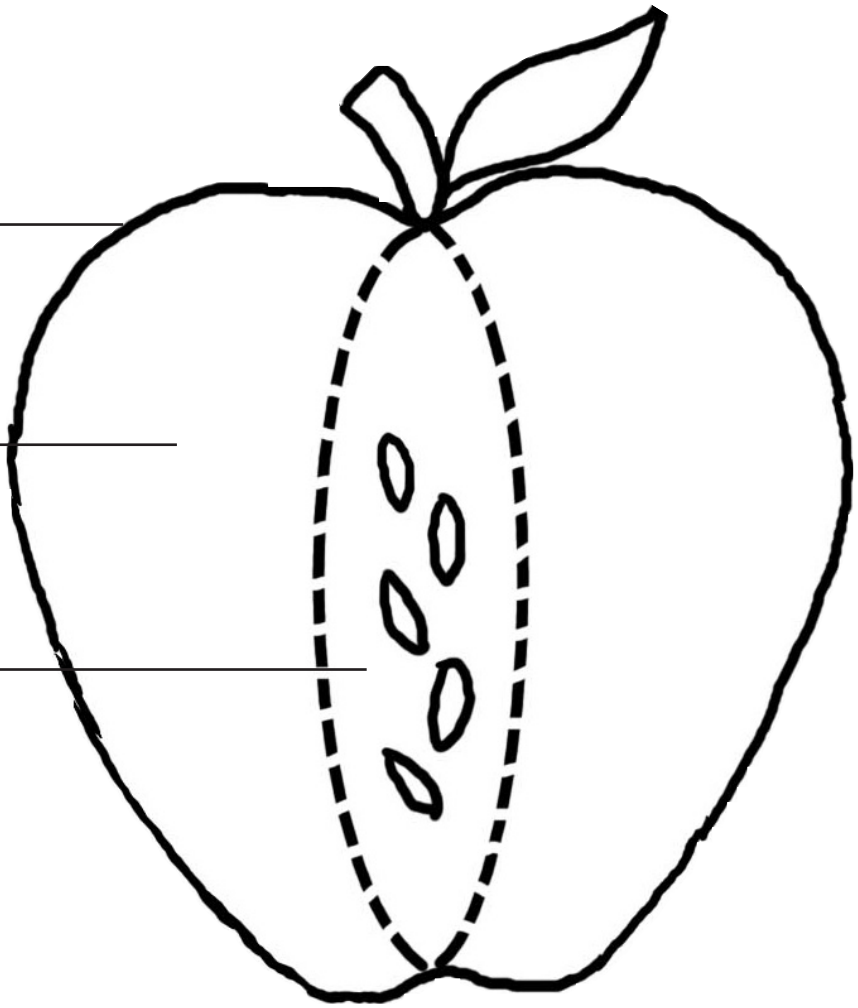
Just as an apple has layers, or parts, so does the earth.

Directions: Look at the three layers of the apple. Color the **skin** red. Color the **flesh** yellow. Color the **core** brown. Now color the **seeds** in the core black. Write the names of the three layers on the lines.

1. _____

2. _____

3. _____



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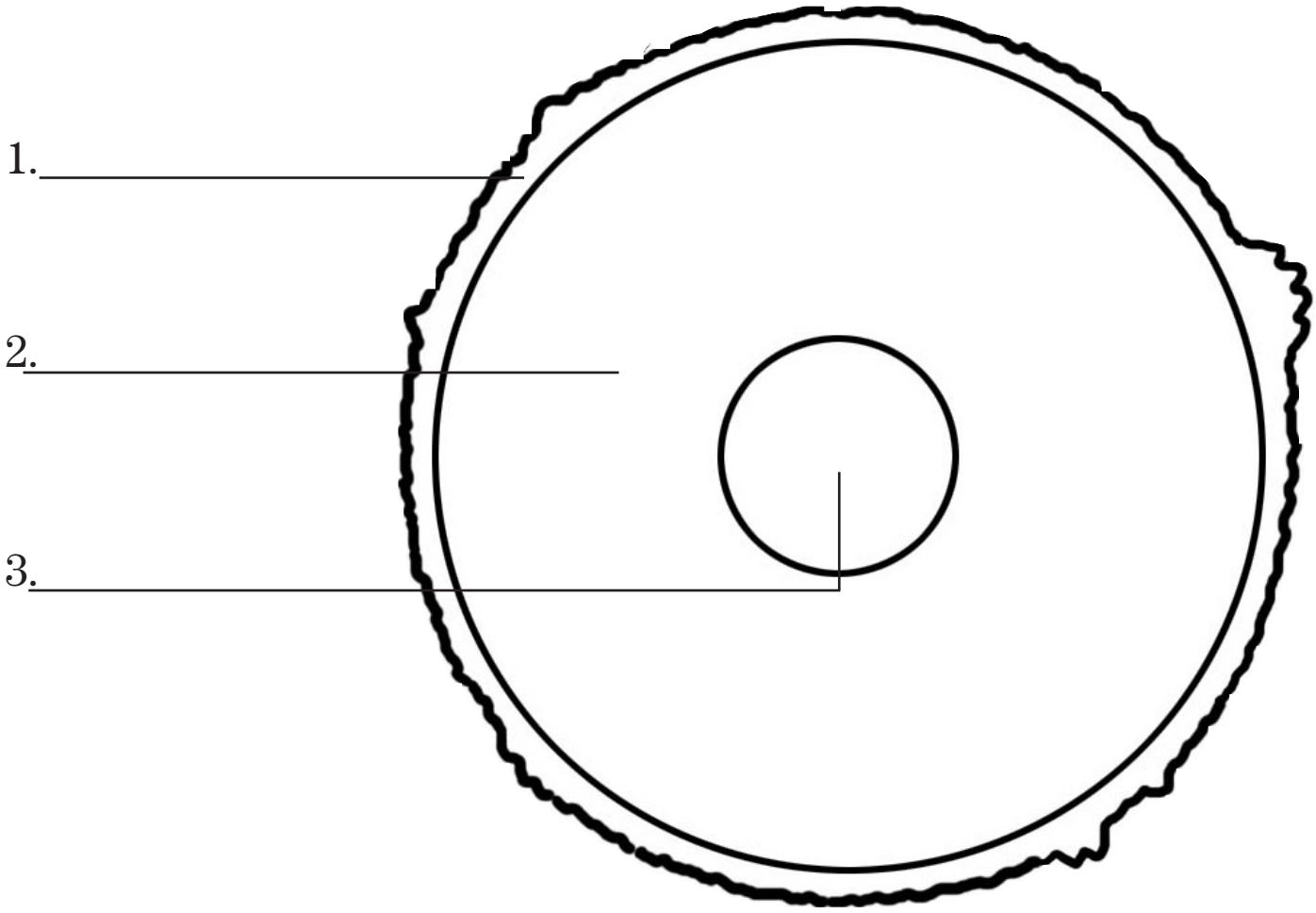
The Apple and the Earth

Directions: Look at the three layers of the earth. Color the **crust** blue. Color the **mantle** yellow. Color the **core** red. Write the names of the three layers on the lines.



How are the parts of the apple like the parts of the earth? How are they different?

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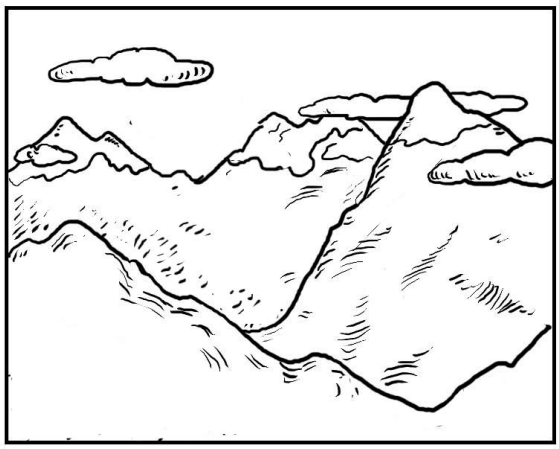
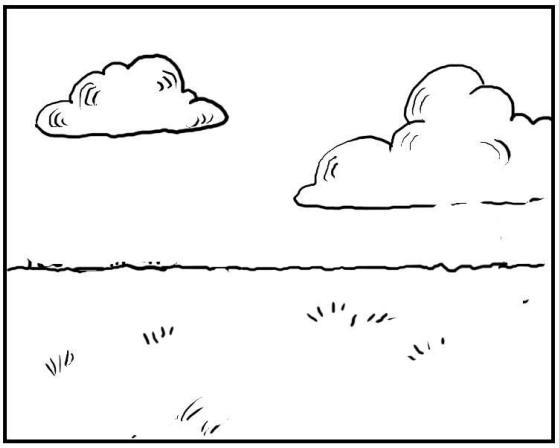
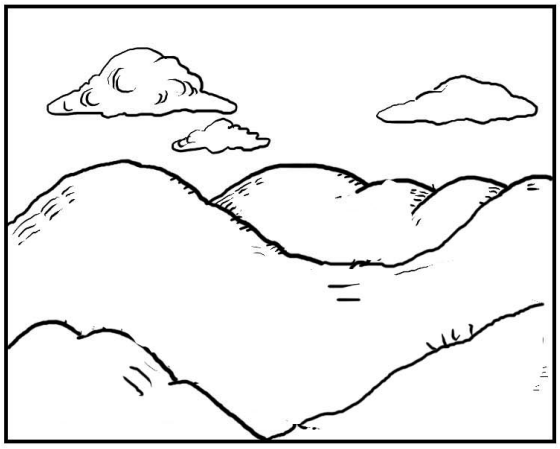
Earth Changes

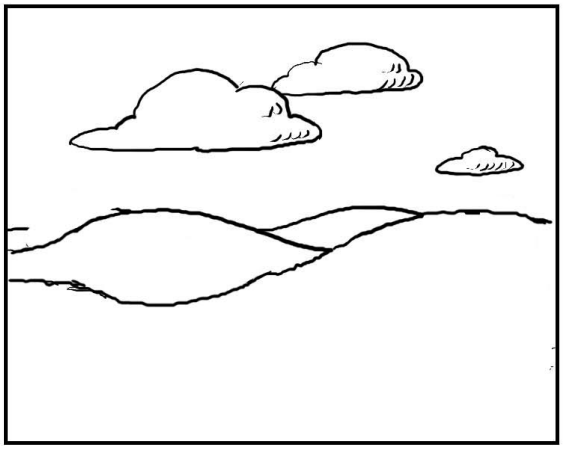
Name _____

Directions: Some of the earth's mountains were built when the earth's plates pushed together. This happened slowly over time. Look at the pictures below. Number the pictures to show the correct order of the changes.









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Changes

Name _____

Directions: Many changes happen slowly, like building mountains as the earth's plates push together. However, there are many changes we can see around us. Draw a picture or describe changes you see in your world.

1. Before	After

2. Before	After

3. Before	After

4. Before	After

5. Before	After

6. Before	After

Talk about it: What helped make each change happen?

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