(MS)2TC Life Science 7 Summer Project #2: Beneath the Earth's Surface

Procedures:

1. Read and follow the directions to complete Activity 38.

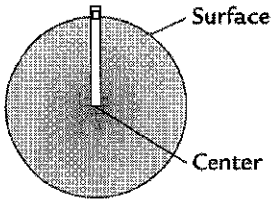
2. Complete this work packet before the start of the 2017 - 2018 school year to be turned in to Mrs. Duddles on the second day of school at Butcher.

38 Beneath the Earth's Surface

READING

When volcanoes erupt, magma is released. Where does this magma come from? To answer this question, it helps to know more about the earth.

Imagine taking a glass elevator to the center of the earth. What would you see?



Earth

CHALLENGE **What is beneath the earth's surface?**

MATERIALS

For each pair of students

- 1 calculator
- colored pencils (optional)

For each student

- 1 Student Sheet 38.1, "Talking Drawing 1: Beneath the Earth's Surface"
- 1 Student Sheet 38.2, "Talking Drawing 2: Beneath the Earth's Surface"
- 1 metric ruler
- 1 compass (optional)

READING

Use Student Sheet 38.1, "Talking Drawing 1: Beneath the Earth's Surface," to help prepare you for the following reading.

On the Earth's Surface

A **volcano** is an opening in the earth from which magma and gas erupt. Gases within the magma build up enough pressure to force it upwards and eventually through gaps in the earth's surface, causing an eruption. Once magma has erupted onto the earth's surface, it is called **lava** (LAH-vuh). As it cools, the lava forms volcanic rock. Over time, volcanic rock and ash can result in a hill or mountain around the opening. This resulting landform is also called a volcano.

Volcanic eruptions are not all alike. Some eruptions are gentle, with lava slowly seeping from a vent. Other eruptions are violent, with lava, ash, and other materials being hurled hundreds of kilometers into the air. Differences in volcanic eruptions result in different volcanic mountain shapes, such as shield volcanoes, cinder cones, and composite volcanoes. You can see examples of each of these shapes in the photographs on the next page.

There is a lot of evidence of volcanic activity on earth. Many mountains have been formed from volcanoes that are now extinct or dormant. Yucca Mountain was formed from volcanic material exploding from a composite volcano that is now extinct. The Cascade Mountain Range that extends from British Columbia through Washington, Oregon, and Northern California, was mostly formed by volcanoes. Alaska's Aleutian Islands and all of Hawaii are volcanic formations.

Scientists who study volcanoes are known as volcanologists (vul-ka-NOL-o-jists). These volcanologists are measuring the temperature of an active volcano.

COMPARING VOLCANIC MOUNTAINS

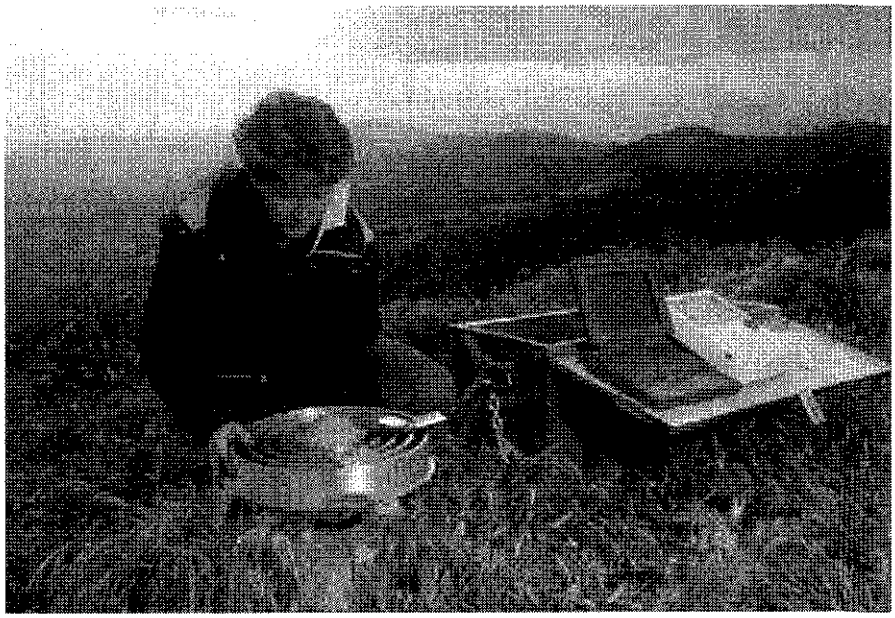
a. ***Shield volcanoes,*** *such as Oregon's Mount Bachelor, shown here, usually form large, broad volcanoes. They release relatively fast-moving, less gassy lava, and tend to have less explosive eruptions than other types of volcanoes. People can often walk fairly close to these erupting volcanoes.*

b. *The smallest and most common volcanoes are called* ***cinder cones.*** *They are formed from explosive eruptions that shoot small pieces of magma and ash into the air. The magma then cools and hardens as it falls back to the earth, forming a cinder cone. In many cases, cinder cones form on the sides of a larger volcano. This photo shows a cinder cone on Mount Etna, in Italy.*

c. ***Composite volcanoes*** *have explosive eruptions as a result of more gassy magma. They are formed from layers of lava and ash. Composite volcanoes are also known as* ***stratovolcanoes.*** *This photo shows Mount St. Helens, Washington, a composite volcano, before its 1980 eruption.*

Inside the Earth

Early evidence about the inside of the earth came from volcanic eruptions. In the last hundred years, scientists have been learning more about the earth using technology and new methods for gathering evidence. For example, scientists have learned a lot from studying earthquakes. Earthquake waves move through different materials in different ways and at different speeds. In general, these waves move faster through more dense solids than they do through less dense solids. The waves move slowest through liquids. Scientists, such as the one shown below, measure the waves from a single earthquake at different places on the earth's surface. By analyzing and comparing the data from many earthquakes, they have been able to determine the state—solid, liquid, or gas—of the material inside the earth.



This geophysicist is using a GPS device to measure how much the land shifted after an earthquake.

Scientists now know that the rocks on the earth's surface are only a tiny fraction of what makes up the planet. Think of the earth as an egg. The thickness of the eggshell would represent the thickness of all the rocks at the surface. Beneath an eggshell there is egg white and yolk. What is beneath the rocks at the surface of the earth? Research indicates that the earth has three layers: a **crust**, a **mantle**, and a **core.** The core is made up of both a solid and a liquid layer, which are usually described separately as the **outer core** and the **inner core.** Information about each of these layers is summarized in the table on the next page.

Layers of the Earth

	Approximate depth below surface (km)	State	Material	Temperature (°C)
Crust	0–40 (average)	solid	many kinds of rocks	0–700
Mantle	40–2,800	upper part is solid, lower part is liquid	iron, magnesium, and silicon compounds	700–2800
Outer core	2,800–5,200	liquid	iron and nickel	2,800–5,200
Inner core	5,200–6,400	solid	iron and nickel	over 6,000

The magma that erupts from volcanoes often comes from the mantle. Magma rising from the mantle can collect in underground chambers in the earth's crust, building up pressure before exploding toward the surface. The mantle is almost 3,000 km thick, which is about the same as the distance from New York City to Denver, Colorado. The land from New York to Colorado is not always the same, and neither are all the parts of the mantle. The uppermost part of the mantle is more solid than the lower part. Because the upper mantle and the crust are both solid, geologists have a name for the combination of these two layers: **lithosphere** (LITH-o-sfeer). *Litho* means "stone" in Greek, and the lithosphere refers to the first 100 km below the earth's surface.

ANALYSIS

1. Which layer(s) of the earth is (or are):
   a. the hottest?
   b. at the earth's center?
   c. completely solid?

2. Copy the five words shown below.

   outer core upper mantle
   lithosphere solid
   crust

   a. Look for a relationship among the words. Cross out the word or phrase that does not belong.
   b. Circle the word or phrase that includes all the other words.
   c. Explain how the word or phrase you circled is related to the other words in the list.

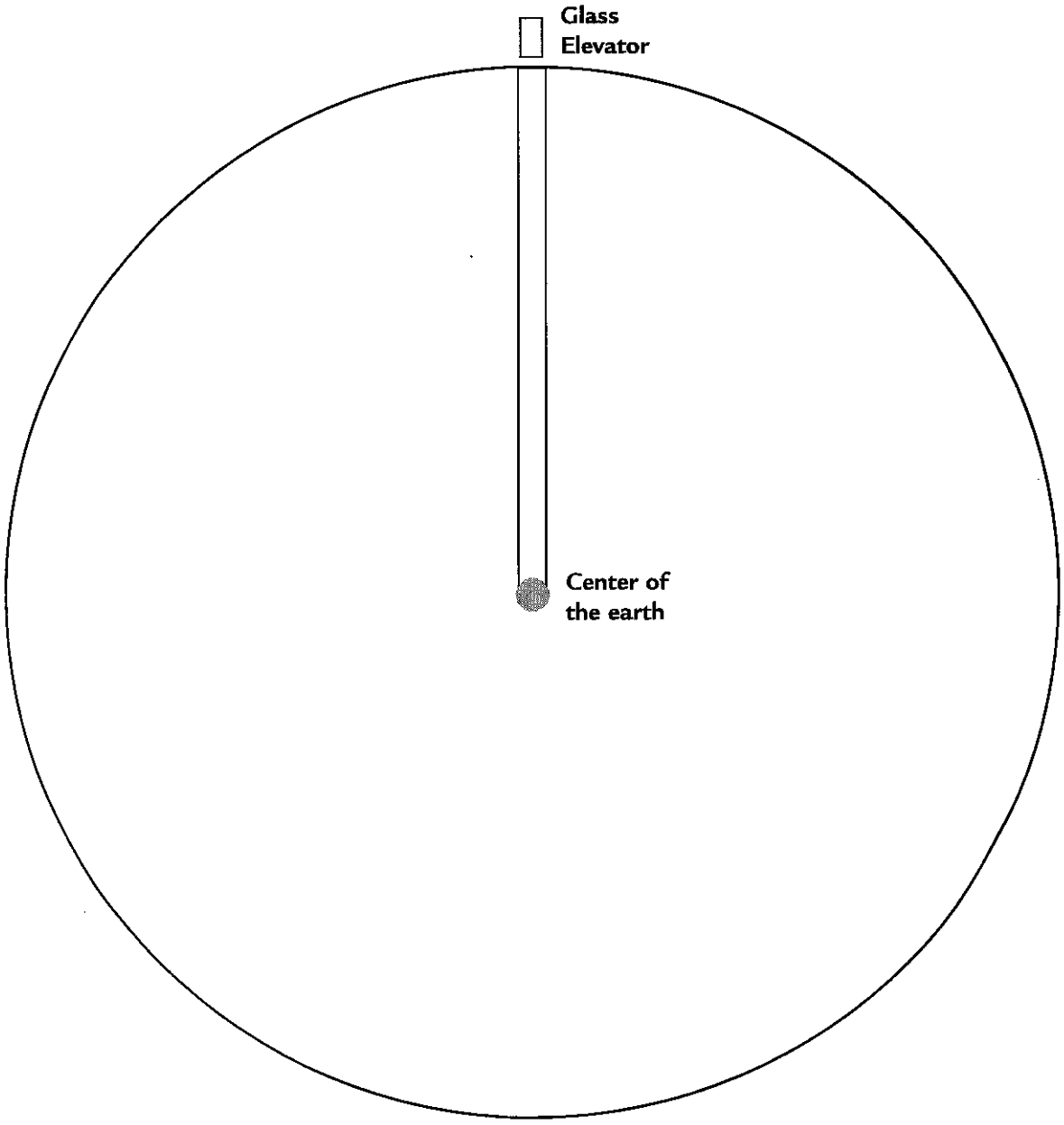
Your teacher will give you Student Sheet 38.2, "Talking Drawing 2: Beneath the Earth's Surface." Use it and the information from the Reading to answer Questions 3 and 4.

3. Answer Parts a–h to create a scaled drawing of the earth's layers on Student Sheet 38.2. If you have time, you may want to color in the different layers.
   a. How far is it to the center of the earth in kilometers (km)? Record this distance on Student Sheet 38.2.
   b. Use a ruler to measure and record the distance from earth's surface to its center in centimeters (cm).
   c. How many kilometers will a single centimeter represent? This is called a **scale.** Calculate and record your scale. Hint: You will need to divide the distance to the center of the earth in kilometers (km) by the scale.
   d. Record the lowest depth of each earth layer in kilometers.
   e Use your scale and a calculator to determine the scaled depth of each earth layer in centimeters.
   f. Use a ruler to measure the depth of each layer, starting from the earth's surface. Draw a circle at each depth. Hint: After drawing the other layers, sketch the approximate location of the crust.
   g. Label each layer with its name, state, and temperature.
   h. Label the lithosphere. Be sure to record its actual depth in km.
4. At Yucca Mountain, nuclear waste will be stored at a depth of about 0.3 km (300 meters, or 1,000 feet).
   a. In which layer of the earth will the waste be stored?
   b. Place an "X" on that layer of your drawing on Student Sheet 38.2.
5. Compare your drawing on Student Sheet 38.1, "Talking Drawing 1: Beneath the Earth's Surface," with your drawing on Student Sheet 38.2. Describe the earth's interior and explain how your understanding of it has changed.

Name _____ Date _____

Talking Drawing 1: Beneath the Earth's Surface

1. Imagine taking a glass elevator to the center of the earth. Draw what you see. Be sure to label your drawing.
2. I think the distance to the center of the earth is: _____ kilometers (km).
3. Place an "X" at the depth you think nuclear waste should be stored. Label the depth in kilometers (km).



Name _____ **Date** _____

Talking Drawing 2: Beneath the Earth's Surface

Distance to the earth's center (actual):

_____ kilometers (km)

Distance to the earth's center (measured):

_____ centimeters (cm)

Scale: 1 cm = _____ km

Earth Layer	Depth below the Earth's Surface (km)	Scaled Depth below the Surface (cm)
Crust		
Mantle		
Outer Core		
Inner Core