

## Scale Drawing of Earth

**Overview:**

Students learn about Earth’s layers by making scale drawings. Students develop an understanding of the relative thickness and location of Earth’s layers.

**Objectives:**

The student will:

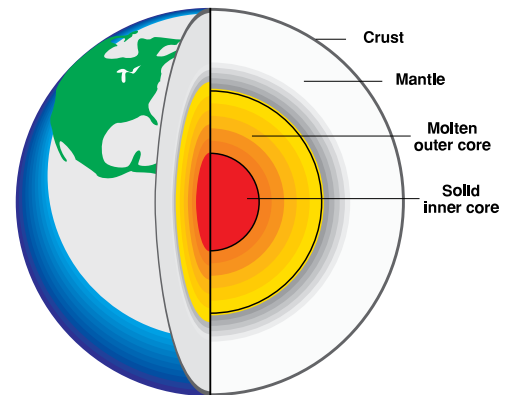
- identify Earth’s layers, including the inner core, outer core, mantle, and crust;
- apply knowledge of scale to calculate the relative size and thickness of Earth’s layers; and
- use a drawing compass and ruler to create a scale drawing of Earth’s layers.

**Materials:**

- Drawing compasses
- Metric rulers
- Calculator (one per student)
- VISUAL AID: “Earth’s Layers”
- TEACHER INFORMATION SHEET: “The Thickness and State of Earth’s Layers”
- STUDENT WORKSHEET: “Scale Drawing of Earth”

**Answers to Student Worksheet:**

1. 0.01 millimeters/kilometers
2. *Scale Drawing Thicknesses*  
*Outer Core= 22.5 millimeters*  
*Mantle= 29 millimeters*  
*Crust= 0.3 millimeters*
3. *Should be drawn proportionally to diagram at right, with layers labeled as shown.*



## Scale Drawing of Earth

### *Activity Procedure:*

1. Show VISUAL AID: “Earth’s Layers.” Use TEACHER INFORMATION SHEET: “The Thickness and State of Earth’s Layers” to describe Earth’s inner core, outer core, mantle, and crust. Emphasize the thickness of layers, and describe each layer as solid or liquid. The temperature and composition of each layer is discussed in another lesson.
2. Distribute a ruler, compass, calculator and STUDENT WORKSHEET: “Scale Drawings of Earth” to each student. Ask students to make a scale drawing of Earth’s layers around the inner core, which already is sketched on their worksheets. The diameter of the inner core is 2600 kilometers. The diameter of the circle representing the inner core is 26 millimeters.
3. Ask students to complete their worksheets. Show students how to use the first equation on the STUDENT WORKSHEET: “Scale Drawings of Earth” to calculate the scale factor between the radius of the Inner Core and the circle (0.01 mm/km).
4. Explain that the outer core is about 2250 kilometers thick. Using the scale factor calculated previously, ask students to calculate the thickness, in millimeters, of the outer core layer on their drawing (22.5 millimeters) and enter their result in the chart of Question 2 on their worksheets.
5. Ask students to use rulers to measure 22.5 millimeters from the edge of the inner core of their drawing and to mark that spot. Next, students should adjust their drawing compass so that it stretches from the center of the circle (marked with an x) to the mark they made, and draw a circle. This new circle represents Earth’s outer core.
6. Ask students to repeat steps 4 and 5 for the mantle and crust, always measuring from the edge of the outermost layer and centering each circle on the x.
7. When students have completed their worksheets, discuss the relative thicknesses of Earth’s layers and ask students to compare drawings.

## The Thickness and State of Earth's Layers

### INNER CORE

Earth's inner core is incredibly dense because it is under intense pressure. The inner core begins at a depth of about 5150 kilometers below Earth's surface.

*Thickness:* Diameter is about 2600 kilometers

*State:* Solid

### OUTER CORE

Most of the rock in Earth's outer core is molten, which means that it acts like a hot liquid. The outer core begins about 2900 kilometers below Earth's surface.

*Thickness:* About 2250 kilometers thick

*State:* Molten Liquid

### MANTLE

The mantle is Earth's thickest layer. About 80% of the volume of Earth is contained in Earth's mantle, which extends from the base of the crust to the liquid outer core. The mantle is generally considered to exist in a solid state, although high temperatures and pressure can cause some of this solid rock to flow like an extremely thick liquid.

*Thickness:* About 2900 kilometers

*State:* Considered solid, but has the quality of plasticity, which means the solid rock in this layer can flow like a thick liquid.

### CRUST

The crust is the outermost layer of Earth. This layer, on which life exists, is covered with soil, rock and water. Relative to the thickness of Earth's other layers, Earth's crust can be compared in thickness to the shell of an egg or the skin of an apple. The crust is thickest under the continents and thinnest under the oceans.

*Thickness:* 5 to 64 kilometers (varies depending on which type of crust)

*State:* Solid

## Scale Drawing of Earth

**Directions:** The circle near the bottom of this page represents Earth's inner core. Perform the calculations in questions 1 and 2, then finish the scale drawing of Earth's layers.

1. Earth's inner core is 2600 kilometers in diameter. The inner core drawn below is 26 millimeters in diameter. Use the following equation to calculate the scale factor for this drawing:

$$26 \text{ mm} \div 2600 \text{ kilometers} = \underline{\hspace{2cm}} \text{ millimeters/kilometers}$$

2. Write the scale factor just calculated in the appropriate boxes on the chart. Then complete the chart equations to learn how thick each layer should be on the scale drawing.

Layer	Actual Thickness		Scale Factor		Scale Drawing Thickness
Inner Core	2600 km	x	<u>        </u> mm/km	=	26 mm
Outer Core	2250 km	x	<u>        </u> mm/km	=	<u>        </u> mm
Mantle	2900 km	x	<u>        </u> mm/km	=	<u>        </u> mm
Crust	30 km	x	<u>        </u> mm/km	=	<u>        </u> mm

3. Use a ruler and a compass to finish the scale drawing of the remaining layers of Earth. Label each layer.

