Activity: Modeling Earth's Dimensions

NGSS Science and Engineering Practices:	Developing and Using Models
NGSS Crosscutting Concepts:	Scale, Proportion, and Quantity
NGSS Disciplinary Core Ideas:	ESS2.A: Earth Materials and Systems

Materials

- Notebook paper
- Graphing paper
- Drawing compass
- Metric ruler
- Calculator
- Table 7.1
- Fig. 7.3
- Fig. 7.6

ACTIVITY SHEET

Table 7.1. Worksheet for Modeling Earth's Dimensions Activity

Procedure

1. Table 7.1 lists the average thickness of each of the earth's layers in kilometers. Refer to Fig. 7.3 for a diagram of these layers.

   a. Calculate the actual radius from the center of the earth to the top of each of the layers in kilometers.

   b. Record in Table 7.1 C.

2. Prepare the paper (Fig. 7.6).

a. Fold the paper in half lengthwise, then open the paper and lay it sideways.

b. Make an "X" on the crease at the bottom edge of the paper to represent the center of the earth.

c. Fold the paper crosswise, and open the paper. Make a dot along in the center of the page where the creases intersect. This dot will represent the surface of the earth.

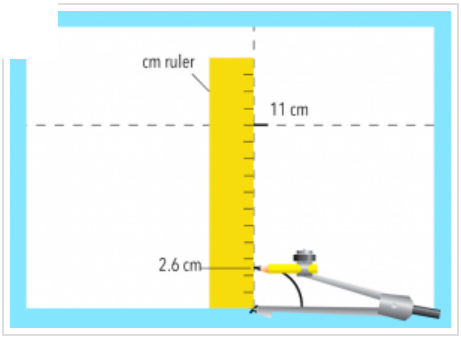

Fig. 7.6. Making diagrams of layers of the earth
Image by Byron Inouye

3. Determine an appropriate diagram distance scale.

a. Determine how many millimeters there are between the "X" representing the center of the inner core and the dot representing the surface of the earth.

b. The average radius of the earth is 6371 km.

c. Divide the average radius of the earth (6371 km) by the distance measured in step 3a. Record the number. Note the units are kilometers per millimeter.

d. Complete the following sentence and record: *Every 1 millimeter on my diagram represents _____ kilometers of depth*.

e. Label your diagram with a scale legend.

4. Draw the inner core of the earth.

a. The inner core is 1220 km thick (Table 7.1 C). Use your legend to calculate the number of millimeters that distance would represent on your diagram. This number is the radius of earth from the center to the top of that layer. Record it in Table 7.1 D.

b. Lay a centimeter ruler along the crease with the zero at the "X". Make a "tick" for the measurement you calculated.

c. Draw a semicircle (Fig. 7.6).

i. Place the point of a drawing compass on the "X".

ii. Place the pencil of the drawing compass at your "tick".

5. Repeat steps 4a–4c for the outer core, mantle, and crust using the measurements from Table 7.1.

6. Create a graph of layer depth on the x axis (Table 7.1 C) and layer density on the y axis (Table 7.1 A) to examine the relationship between density and depth.

Activity Questions:

1. How did you calculate the radii for Step 3?

2. If you had used a larger piece of paper, how would your distance scale have changed?

3. How does scale affect your interpretation of the data?

4. What happens to the density of the materials in the earth as depth increases? How does the density of each layer affect its location with respect to other layers?

5. The mantle has layers. The density of the upper mantle is 3.3 g/cm^3. The density of the deeper mantle is 3.5 g/cm^3. In Table 7.1 the average density of the mantle is 4.5 g/cm^3. Why do you think these numbers are different?

6. What are the limitations of your model of the earth? How could you improve it?

7. What would you need to do to incorporate the depth of the ocean in your model?