Name: _____

Planet Earth in Cross Section

Objective: Devise a model of the layers of the Earth to scale.

Background

Planet Earth is organized into layers of varying thickness. This solid, rocky planet becomes denser as one travels into its interior. Gravity has caused the planet to differentiate, meaning that denser materials have been pulled towards Earth's center. Relatively less dense materials migrate to the surface. What follows is a brief description of each layer beginning at the center of the Earth and working out towards the surface.

Inner Core – The solid innermost sphere of the Earth, about 1271 kilometers in radius. Examination of meteorites has led geologists to infer that the inner core is composed of iron and nickel.

Outer Core – A layer surrounding the inner core that is about 2270 km thick and which has properties of a liquid and is composed of iron and nickel.

Mantle – A solid, 2285 km thick layer composed of ultra-mafic igneous rock (igneous rock with very low silica content) in the mantle located below the crust. This is the thickest layer of the earth.

Asthenosphere – A partially melted layer of ultra-mafic rock in the mantle situated below the lithosphere. The asthenosphere is ductile and can be pushed and deformed like silly putty in response to the warmth of the Earth. These rocks actually flow, moving in response to the stresses placed upon them by the churning motions of the deep interior of the Earth. The flowing asthenosphere carries the lithosphere of the Earth, including the continents, on its back

Lithosphere – The solid outer portion of the Earth that is capable of movement. The lithosphere is a rock layer composed of the crust, composed of granite and basalt (continental and oceanic) and the portion of the mafic (rock rich in iron and magnesium) upper mantle situated above the asthenosphere.

In this lab, a model of the layers of the earth will be constructed to scale using cash register tape. The tape will represent a "column" of the Earth from its center to the surface. This cross-section model will be constructed to a scale of 1 centimeter equals 100 kilometers.

Procedure

1. Calculate the scale distances for the layers of the Earth and note it in the table below. To do this, divide the average thickness of a layer by 100 and round to the nearest tenth. Here is an example: The radius of the inner core is 1276 km. Thus 1276/100 = a 12.7 cm thick layer drawn on the register tape. Note the scale distances for all layers on the data table below.

Layer	Ave Thickness (km)	Scale (cm)
Inner Core	1271	12.7
Outer Core	2270	
Mantle	2885	
Asthenosphere	200	
Lithosphere	100	

2. Cut a 90 cm piece of register tape. You may wish to secure each end of the paper to a table top with a piece of tape.
3. Use a ruler and neatly draw a line perpendicular to the length of the tape roughly 10 cm from one end. This will be the starting line for all the layers.

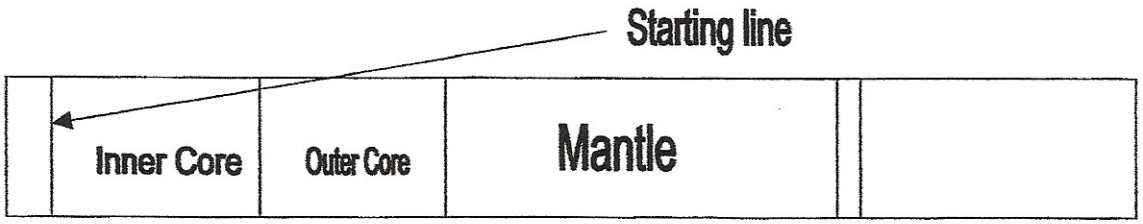

Diagram 1. Example of cross section model with solid layers.

4. Using a pencil mark the layers of the Earth onto the register tape based on your calculations. Begin from the center of the earth and add each **successive** layer in order. Label each layer.

5. Using your ESRT and the vocabulary on page 3 of the lab, put the composition of each layer on the model.

6. Refer to the reference table page. Put the density (densities) of each layer on the model.

7. Color the layers as follows**:**
Inner core - yellow
Outer core – orange
Mantle – red
Asthenosphere - light brown
Lithosphere - lightly pencil shade

Questions (each worth .3)

1. List the layers of the Earth from least dense to most dense.

2. As you go deeper into the Earth, what does the temperature do? _____

3. As you go deeper into the Earth, what does the pressure do? _____

4. What is the rock inferred to be at a depth of 4500 km? _____

5. What is the temperature range of the asthenosphere? _____ Is the temperature ever above the melting point? _____ What can you infer about the state of matter in the asthenosphere?

6. What is the other layer that has a temperature above the melting points and therefore is a liquid layer?

7. What is the pressure **and** temperature of the earth at a depth of 6000 km?

8. The pressure is 1.1 million of atmospheres, at what depth is that **and** what layer of the earth is inferred?

9. What is the density of the oceanic crust? _____

10. In which layer of the earth would you find a density of 4.2 g/cm^3? _____

11. What is the continental crust made of? _____

12. The average depth of the ocean is 4 km. Describe where this would fit on the model and how thick would it be as a layer drawn to scale.

Conclusion: Describe the changes in Pressure, Temperature and Density as you go from the surface to the center of the Earth.