

Layers of the Earth (Density) – Teacher Notes

This activity uses secondary data (data/information collected by another reputable scientist). Students will be using the following secondary data to create a reasonably accurate model of the Earth from clay, plasticine or play dough.

When rock becomes stressed it releases unwanted energy as an earthquake. This energy travels through the Earth as seismic waves. (Seismic = shaking (Greek)). When seismic waves pass through rock, particles are moved to release stress. Shock waves travel in all directions away from the source and are slowed and deflected by the materials they travel through. Denser rocks, such as are found in the mantle, slow and deflect the waves more than less dense rocks of the crust. Surface waves travel along the crust whilst body waves can travel through the planet. Some body waves cannot travel through liquids and that is how we know the outer core of our planet is fluid.



Earth statistics

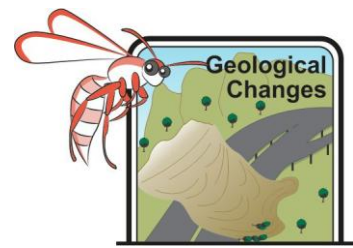
Average radius from crust to core at the equator	6,370km
Average depth to bottom of crust	100km
Average depth to bottom of mantle	2,900km
Average depth to bottom of outer core	5,100km

Why do you think you were given **average readings**? The readings vary from place to place. The Earth's circumference is greater at the equator than at the poles. The surface of the Earth varies due to high mountain ranges and deep oceanic trenches. Also we do not have accurate readings from all around the world.

If you drew a straight line from the surface to the centre, what percentage of this line would each layer take?

Layer	Thickness (km)	Calculation	Percentage (%)
Crust	100	$\frac{100 \times 100}{6,370}$	1.6
Mantle	2,800 (2,900 – 100)	$\frac{2,800 \times 100}{6,370}$	44.0
Outer Core	2,200 (5,100 – 2,900)	$\frac{2,200 \times 100}{6,370}$	34.5
Inner Core	1,270 (6,370 – 5,100)	$\frac{1,270 \times 100}{6,370}$	19.9

HINT Sneaky students know a quick way to check at the end if they have the correct percentages. What is this? All the percentages added together should make 100% because “per cent” means part of 100 i.e. 10% means 10 parts of one hundred or one tenth.



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This activity demonstrates how thin the crust of the Earth really is. If the Earth is represented by an apple cut in half. The skin of the apple is thicker than the crust!

Scientists often construct models to explain important ideas. Using the plasticine or play dough create a model of the layers inside our planet. The model will be small enough to fit into the palm of your hand. *Students will need to work out a scale so that the model will be small enough. A direct scale using the percentage will mean the model would be 39.8cm in diameter!* *Students may work in pairs and have half of the model each. These models make a good display when mounted on cardboard or polystyrene.*

Most teachers have their own recipe for play dough but I find this one works well, however it does not last as long as recipes using borax. Borax should not be ingested/eaten.

Materials for making uncooked play dough

- 1 cup of plain flour.
- 1 tablespoonful of vegetable oil.
- $\frac{1}{4}$ cup of salt.
- $\frac{1}{2}$ cup of water.
- food colouring.

Method

1. Mix together flour and salt.
2. Pour in the oil.
3. Add the colouring to the water and mix in.
4. Knead the dough until plastic. (Some flours require more water).

Colour for crust 1 part in 50

Colour for mantle 20 parts in 50

Colour for core 19 parts in 50

Materials for creating the model

- Play dough or plasticine in four colours
- A sharp knife retained by the teacher to cut the models in half

Method

1. Determine how many colours you will need **4**
2. Which layer should you start from? **Start with the inner core and add outer layers**
3. If we are making this to scale we will need:
 - A ball for the inner core with a radius of **0.2cm** or a diameter of **0.4cm**
 - A layer **0.35cm** deep round the inner core to represent the outer core
 - A layer **0.44cm** deep round the core to represent the mantle
 - A layer **0.02cm** round the mantle to represent the crust.
 - Slice the model in half to expose the layers of the Earth.
 - Label each layer where possible
 - Measure the diameter of your model Earth

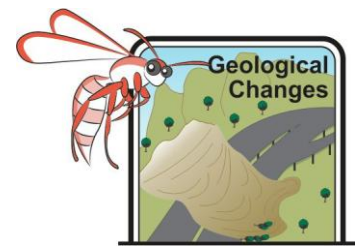
Results

Stick a photograph or draw a sketch of your model here
Scale



Will vary

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What have we learned today?

(Use your best scientific words or a diagram)

1. The Earth is made of **three (four)** layers. **Core (inner and outer), mantle and crust.**
2. Seismic waves are energy released by an **earthquake**
3. We can use seismic data to **estimate the thickness of each layer of the Earth**

Vocabulary Core, crust, earthquake, mantle, seismic, wave.