Geology 12
Unit 2 – Earth: Core to Surface
Day 1 – Earths Interior

Name: _____

Date: _____

Block: _____

Earths Interior Preview: Studying the Earth's interior poses a significant challenge due to the lack of ~~direct access. Many processes observed at the Earth's surface are driven~~ by the heat generated within the Earth, however, making an understanding of the interior ~~essential. Volcanism, earthquakes, and many of the Earth's surface features~~ are a result of processes happening within the Earth.

The science behind studying Earths interior:

The study of seismic waves and how they travel through the Earth has been ~~very useful in helping to determine the changes in density and composition within~~ the Earth and in locating the boundaries between ~~the inner core, outer core, mantle, and crust.~~

Seismic Waves:

energy waves generated during earthquakes; two types known as P and S waves propagate through ~~the Earth as wave fronts from their place of origin~~

surface waves are only located on the surface so not of interest here

The three types of Seismic Waves:

- **P-Waves:** P-waves are compressional waves that move back and forth like an accordion

  able to travel through liquids but will slow due to density

- **S-Waves:** S-waves are shear waves that move material in a direction perpendicular to the direction of travel, much like moving a rope up and down

  not able to travel through liquids

- **Surface Waves:** Surface waves travel more slowly through Earth material at the planet's surface and are predominantly lower frequency

The details of waves travelling through Earths interior:

The velocity of both of these waves increases as the density of the materials they are traveling through increases.
most liquids are less dense than solids so the waves slow down in liquids

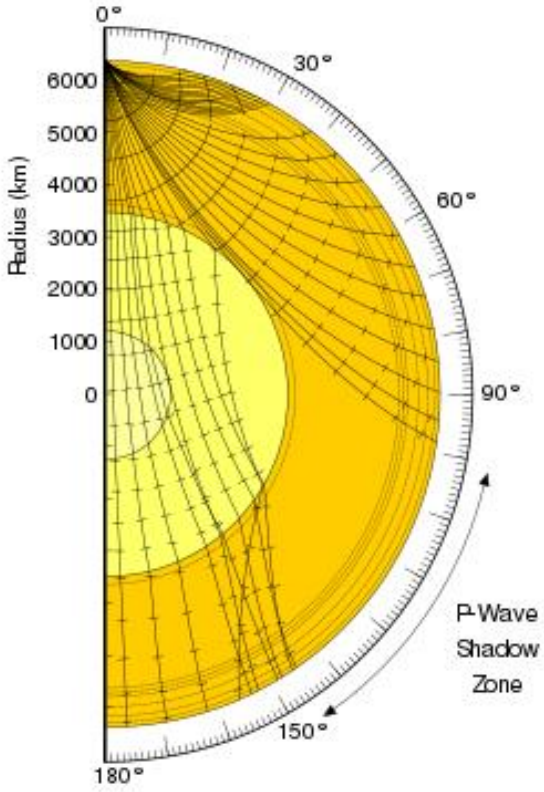
How we know Earth isn't Homogenous:

If the Earth was completely homogeneous, the P and S waves would flow in ~~straight lines. They don't behave this way.~~
As the waves travel through materials of different densities, they are refracted (bent,),as their direction and ~~velocity alter. Sometimes these refractions can result in shadow zones.~~

Shadow zones are how we know that the outer core is liquid.

Seismic Shadow Zones:

A seismic shadow zone is an area of the Earth's surface where ~~seismographs cannot detect direct P waves and/or S waves from~~ an earthquake. This is due to liquid layers or structures within the ~~Earth's surface. The most recognized shadow zone is due to the~~ core-mantle boundary where P waves are refracted and S waves ~~are stopped at the liquid outer core~~



The density of Earth:

Based on the way that the Earth travels through space, we know that the average density of the Earth is 5.52 g/cm3

most crustal rocks have densities in the range of 2.5-3 g/cm3

This means that there must be denser material inside the Earth

the core of Earth is estimated to have a density of 9-13 g/cm3

Composition of Earths Layers: The bulk Earth composition is mostly made up of iron (~32%), ~~oxygen (~30%), silicon (~16%), and magnesium (15%).~~

Earth's surface: oxygen (~47%), followed by silicon (~28%) and aluminum (~8%)

lesser amounts of iron, calcium, sodium, potassium, and magnesium

Much of the Iron can be found in the core of the Earth, which accounts for the major increase in density there