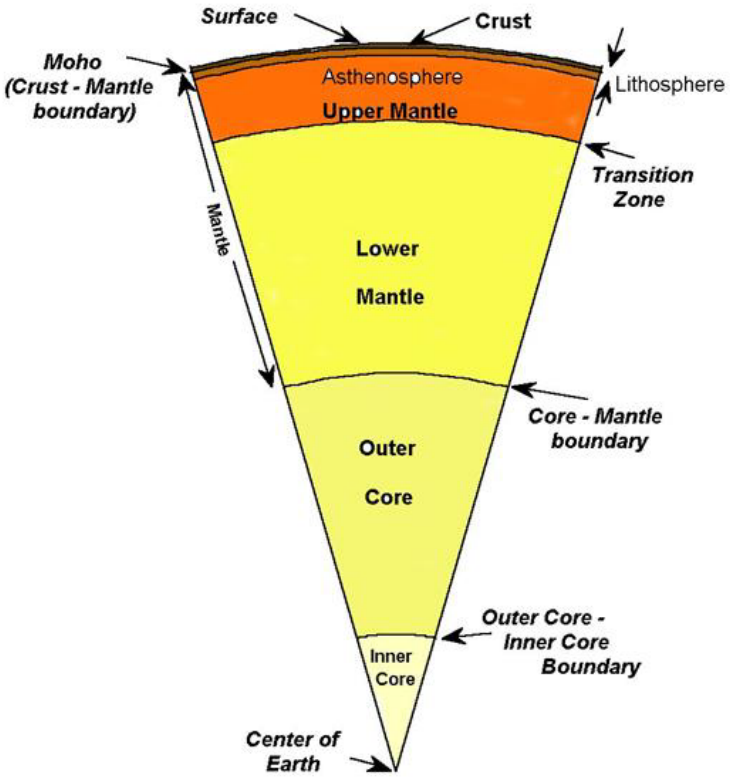
Name: _____

Study Guide

Topic 6: Plate Tectonics

Earth's Interior is layered



- **Gravity** caused layering according to **density differences** in early Earth materials.
  - These layers differ in *composition* and *states of matter*.
    - Lithosphere (crust and rigid mantle)
    - Asthenosphere – solid
    - Mantle – solid
    - Outer Core – liquid
    - Inner Core – solid

- The characteristics of the Earth's interior are inferred through the study of the behavior of **earthquake waves** passing through it, and also by analyzing meteorites.

  - Meteorites suggest that the inner core is made up of **iron and nickel**

  - And the approx. age of the earth is **4.5 billion years**

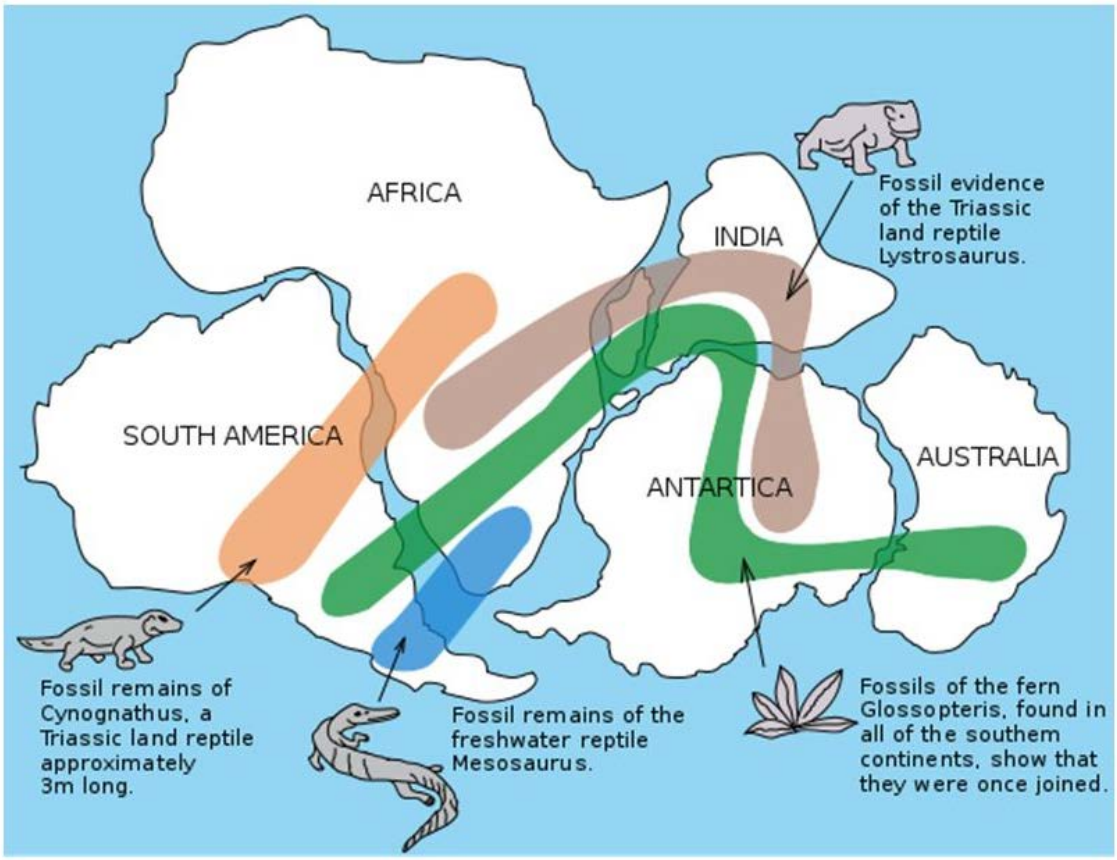
Earth's Crust

- Continent Crust: **thicker, less dense, older, and felsic (granite rock)**

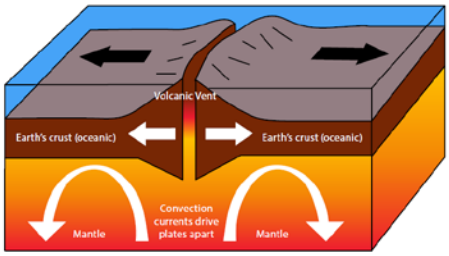
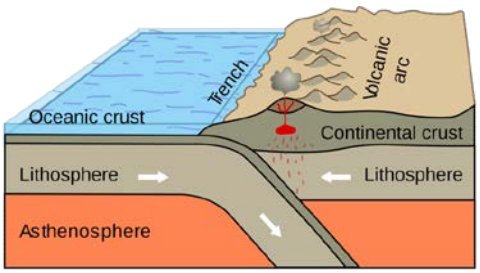
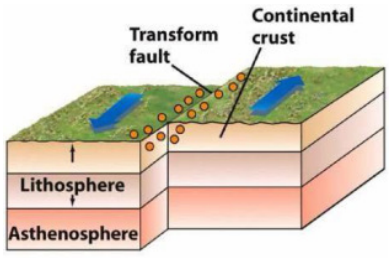
- Ocean Crust: **thinner, more dense, younger, and mafic, (basalt rock)**

Theory of Plate Tectonics

- The lithosphere consists of separate plates that are moving.
- These plates ride on the fluid-like asthenosphere and are moved by **convection currents.**
- Evidence:
  - Continents appear to "fit like puzzle pieces" like South America and Africa
  - **Similar Fossils:** appear in different parts of the world
    - For example: Scientist found that fossils on Australia were similar to the fossils in South America.
  - **Similar Rocks** appear in different parts of the world
    - For example: The West Coast of Africa has very similar rocks formations to those on the East Coast of South America

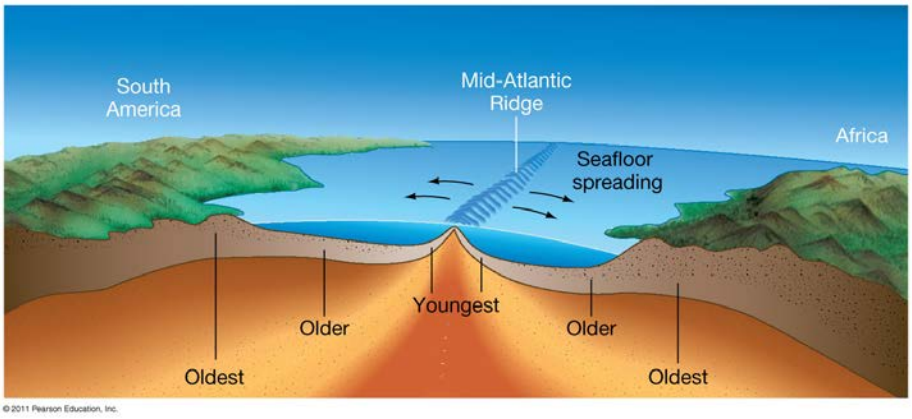


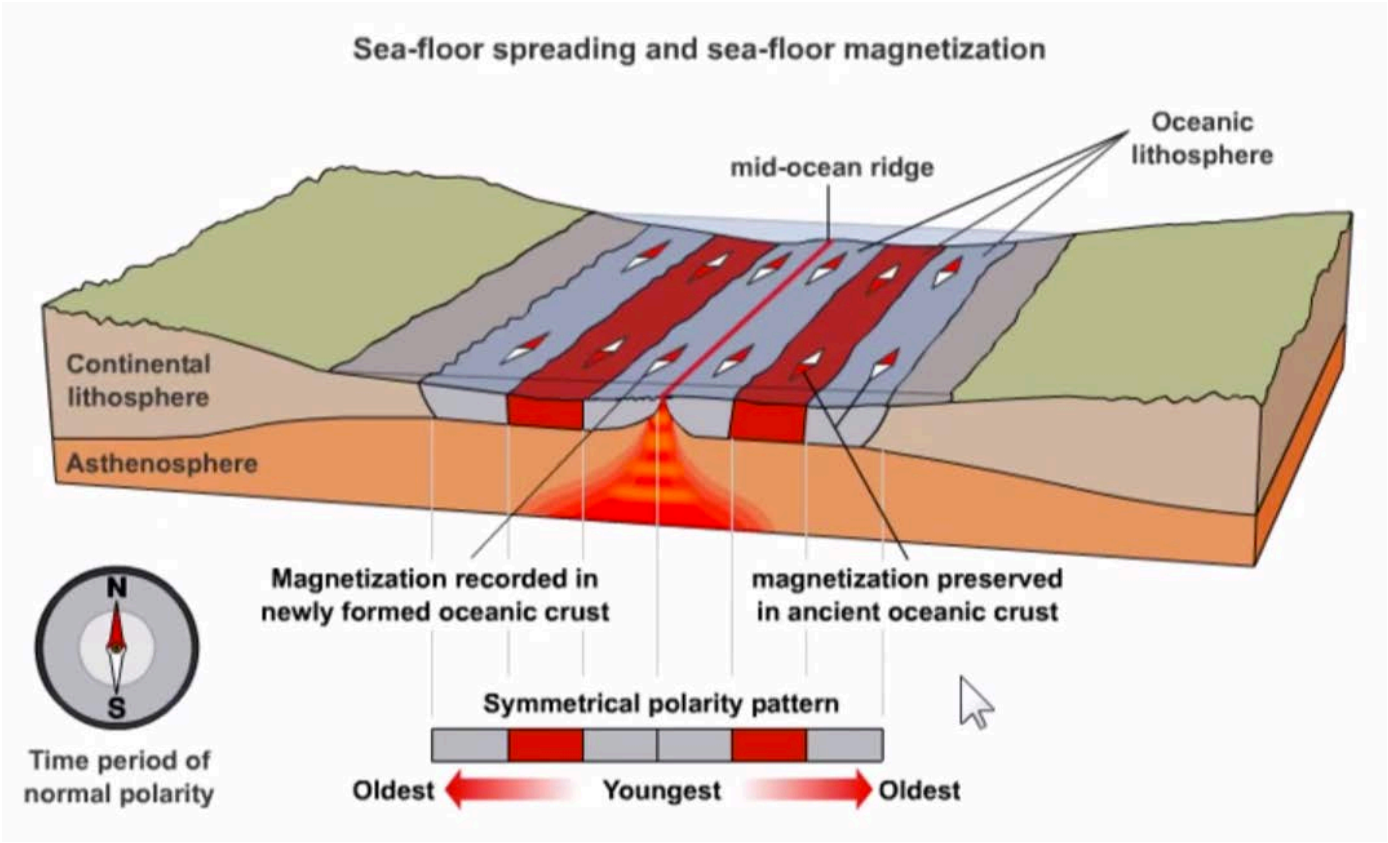
Types of plate boundaries

Type of Boundary	Type of Crust	Resulting Features	Examples
Divergent *Definition:* Boundary between two plates that are spreading apart 	Oceanic & Oceanic	• Mid-ocean ridges • New crust forming	Mid-Atlantic Ridge
	Continental & Continental	• Continental Rift Valley	East African Rift
Convergent *Definition:* Boundary between two plates colliding 	Oceanic & Continental	• Ocean Trench • Earth Quakes • Volcanic Arc	Peru-Chile Trench
	Continental & Continental	• Mountains • Earthquakes	Himalaya Mountains (Boundary between Eurasian and Indian-Australian Plate)
Transform/ Strike Slip *Definition: B*oundary at which plates slide by each other. 	Continental & Continental	• Faults • Earthquakes	The San Andreas Fault in California

Earth's Features Resulting from Plate Tectonics

- Mid-ocean ridges: new basaltic rock forms as oceanic plates diverge
  - Youngest rock is closest to the ridge
  - Magnetic field reversals are recorded and match on either side of the ridge



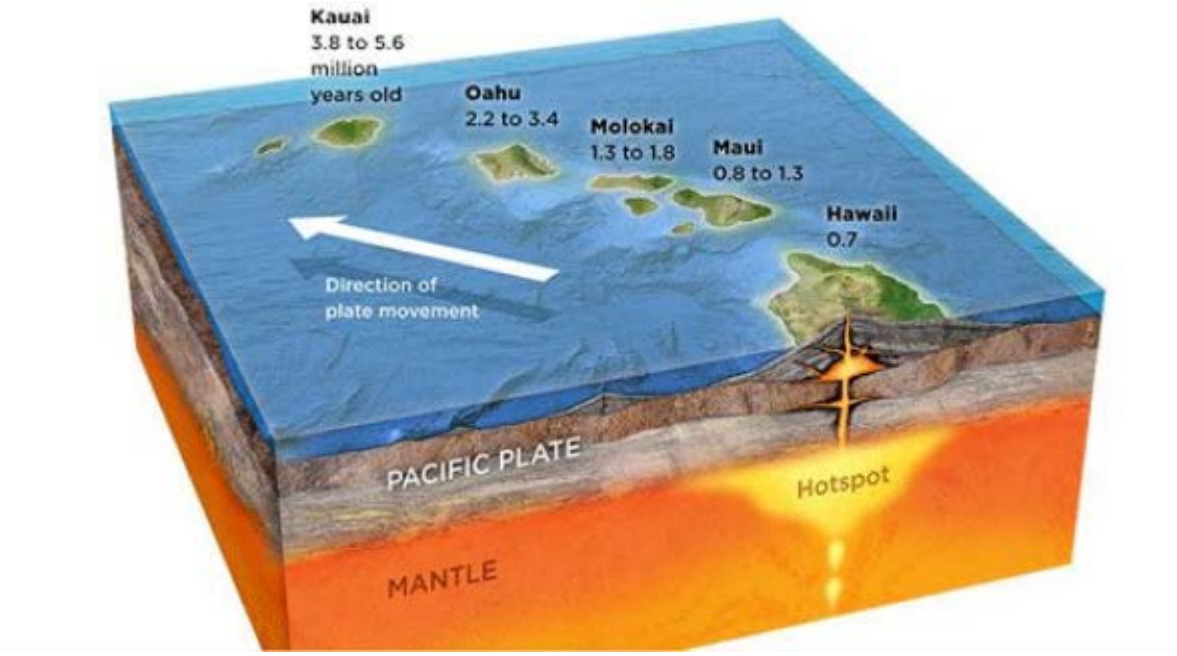


- Earth's magnetic field flip flops over time.

- This creates **symmetrical pattern** of magnetic stripes of alternating polarity on either side of the mid-ocean ridges.

How the islands of Hawaii formed…

- **Volcanic Island Chain:** forms as an ocean plate moves over a hot spot volcano
  - Ex: Hawaiian Islands
  - Hot spot does not move
  - Oldest island in direction of plate movement



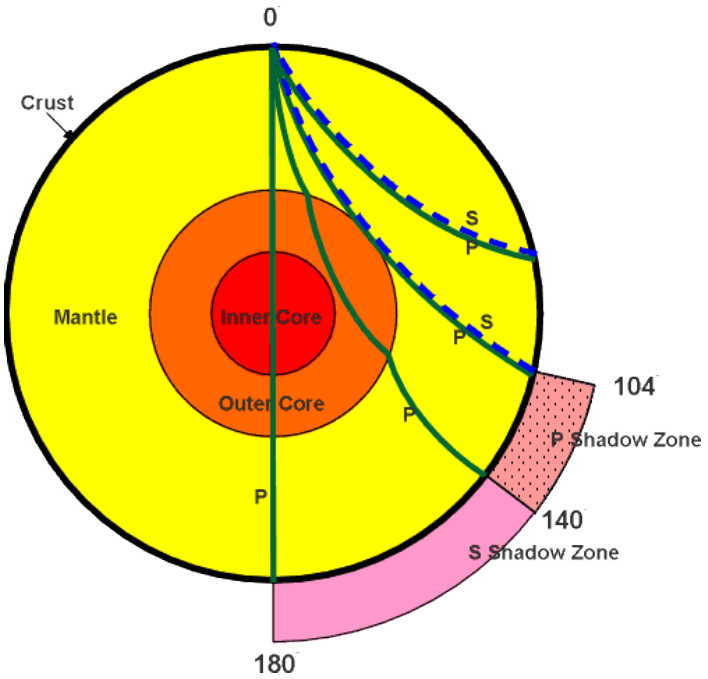
Earthquakes

- Most occur at **plate boundaries.**
- The breaking of Earth's crust produces a **fault.**
- Shaking of Earth's crust produces seismic waves (earthquakes waves) that are measured with a seismogram.
  - **Focus:** underground source of seismic waves

    Epicenter: point on earth's surface directly above the focus

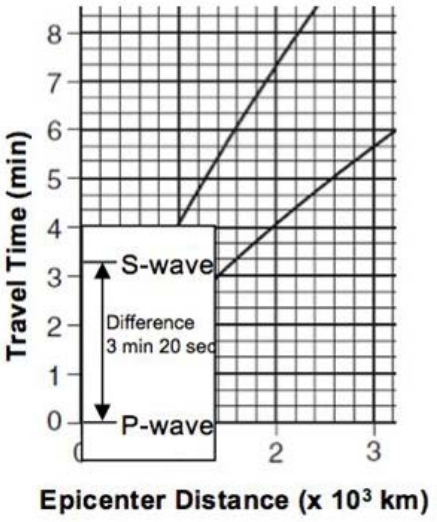
The denser the medium through which waves travel, the faster these waves will move!

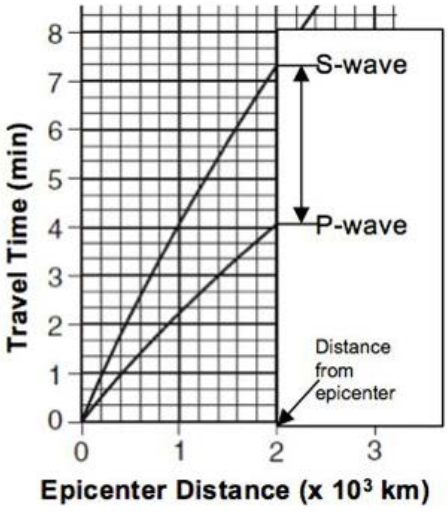
- Two basic types of earthquake (seismic) waves:
  - **P-waves: Primary waves (arrive first)**
    - compression waves
    - faster
    - Travel though anything (solid, liquid, gas)
  - **S-waves: Secondary waves (arrive second)**
    - shear waves
    - slower
    - Only travel through solid.
- **Shadow zones:** caused by these seismic waves being bent or absorbed as they pass through layers of Earth's interior.
  - **P-waves are refracted** when they enter the Earth's outer core.
  - **S-waves are absorbed** when they enter the Earth's outer core.



Using the P-wave and S-wave chart

1. Determine the arrival time of the S-wave and P-wave.
2. Subtract the two arrival times (S-P) to determine the difference in arrival times.
3. On a scrap piece of paper, mark the difference in arrival times using the vertical axis of the Earthquake P-wave and S-wave Travel Time graph in your ESRT.
4. Keeping the scrap paper vertical, slide paper up along the P-wave line until the second mark on the scrap paper matches up with the S-wave line.
5. Follow the edge of scrap paper down to the horizontal (distance) scale to determine the distance to the epicenter.





Locating an epicenter

- Once an earthquake occurs you can determine its location
  - **Three seismograph** stations must record the waves
  - Using the difference in arrival times, the station can say that the earthquake occurred within a certain radius. (distance)
  - Once 3 stations have been drawn, the **epicenter is where the 3 circles intersect each other.**

How to measure the strength of an Earthquake

- **Magnitude:** strength of the earthquake as determined by a seismograph
- Richter scale: open-ended logarithmic scale of earthquake strength
  - The earthquake magnitude scale used to report the strength of an earthquake.
  - The higher the amplitude of the wave, the stronger the earthquake.
- Mercalli intensity scale: based upon observable damage caused by an earthquake

Modified Mercalli Scale		Richter Magnitude Scale
I	Detected only by sensitive instruments	1.5
II	Felt by few persons at rest, especially on upper floors; delicately suspended objects may swing	2
III	Felt noticeably indoors, but not always recognized as earthquake; standing autos rock slightly, vibration like passing truck	2.5
IV	Felt indoors by many, outdoors by few, at night some may awaken; dishes, windows, doors disturbed; autos rock noticeably	3
V	Felt by most people; some breakage of dishes, windows, and plaster; disturbance of tall objects	3.5
VI	Felt by all, many frightened and run outdoors; falling plaster and chimneys, damage small	4
VII	Everybody runs outdoors; damage to buildings varies depending on quality of construction; noticed by drivers of autos	4.5
VIII	Panel walls thrown out of frames; fall of walls, monuments, chimneys; sand and mud ejected; drivers of autos disturbed	5
IX	Buildings shifted off foundations, cracked, thrown out of plumb; ground cracked; underground pipes broken	5.5
X	Most masonry and frame structures destroyed; ground cracked, rails bent, landslides	6
XI	Few structures remain standing; bridges destroyed, fissures in ground, pipes broken, landslides, rails bent	6.5
XII	Damage total; waves seen on ground surface, lines of sight and level distorted, objects thrown up in air	7
		7.5
		8