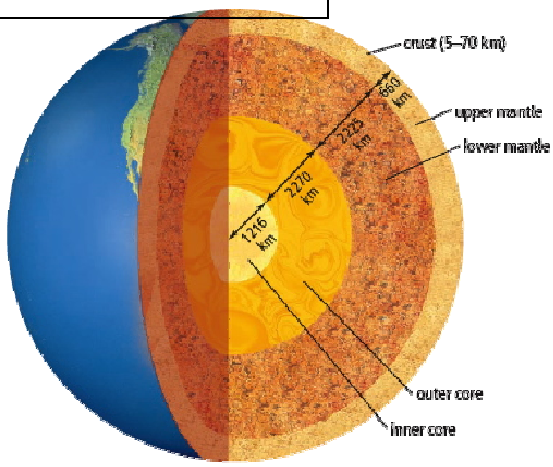
Section 12.2 Notes: Features of Plate Tectonics

Layers of the Earth



1. Crust (Outermost; 0-100km thick)

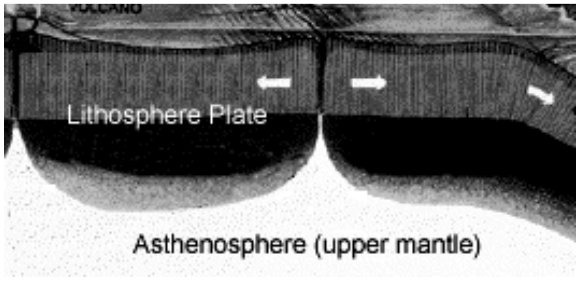
- Consists of a series of **interlocking plates**
- **Thinnest layers** found under **oceans**, **thickest layers** found under **continents** (land)
- Continental crust tends to be made of **granite**, oceanic crust tends to be made of **basalt** (slightly denser than granite)
- Makes up ~ **1% of Earth's mass**

2. Mantle (~ 2900km thick)

- Part **solid**, part **liquid**, Denser than the **crust layer**
- Most of the mantle is under **high pressure** and is **very hot**
- Accounts for ~ **70% of the Earth's mass**
- Behaves like a **thick liquid** (similar consistency to **tar**)
- **Convection currents** cause plates to move

Inner (~1250km thick) and Outer Core (~2200km thick)

- Thought to be mainly composed of **iron and nickel** with extremely **high temperature and pressure**
- Outer core → **Liquid** (molten = melted)
- Inner Core → **Solid**



- ***Lithosphere*** → lower part of the **crust**; upper part of the **mantle**
- ***Asthenosphere*** → upper part of the **mantle**; has a **tar-like** consistency
  - *Lithosphere plates move around in the mantle by* ***floating on top of the asthenosphere***
  - *This causes* ***earthquakes and volcanoes***

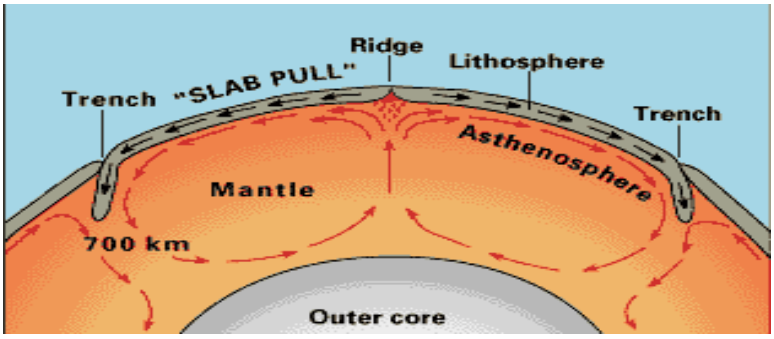
Theory of Plate Tectonics

- The Earth's lithosphere is divided into a number of moving (~2cm/year) rigid pieces called **plates**. The study of **formation and movement** of these plates is known as **Plate Tectonics**

- The ***Theory of Plate Tectonics*** states that **lithospheric plates move around slowly** on the **fluid asthenosphere**, with the **plates interacting** when they **collide**
- If the plate is in an ocean, it is called an **Oceanic Plate**
- If the plate carries a continent, it is called a **Continental Plate**

Plate Movement

- The lithospheric plates are believed to move due to **convection currents** in the **asthenosphere** (***Convection*** *is the movement of heat*)
- The asthenosphere has a similar composition to the lithosphere, however, **it is partially melted and therefore has the ability to flow**



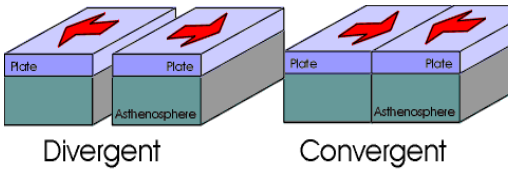
- As the **heated asthenosphere rises** to the **Earth's surface**, it pushes lithospheric plates **apart and begins to cool and solidify**, creating **new lithosphere** at areas called **RIDGES** (**spreading centres**)
- As the asthenosphere **cools**, the material becomes **denser and sinks back into the mantle**. Here, the lithospheric plates **move together** and form a **valley called a TRENCH**
- The latest tectonic theory states that a subducting plate is actually **pulling the rest of the plate into the asthenosphere** along with it. This process is referred to as a "**SLAB PULL**"

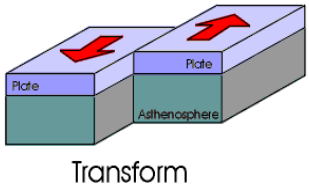
Types of Plate Boundaries

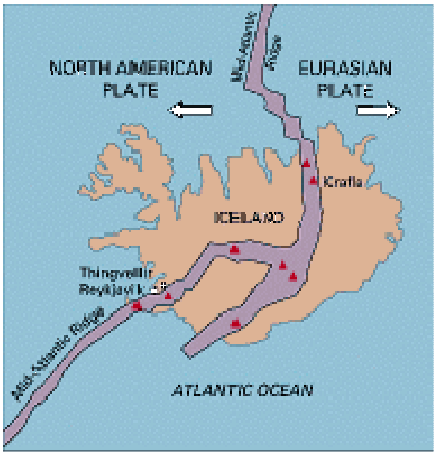
The **areas in which plates meet** are known as **Plate Boundaries.**

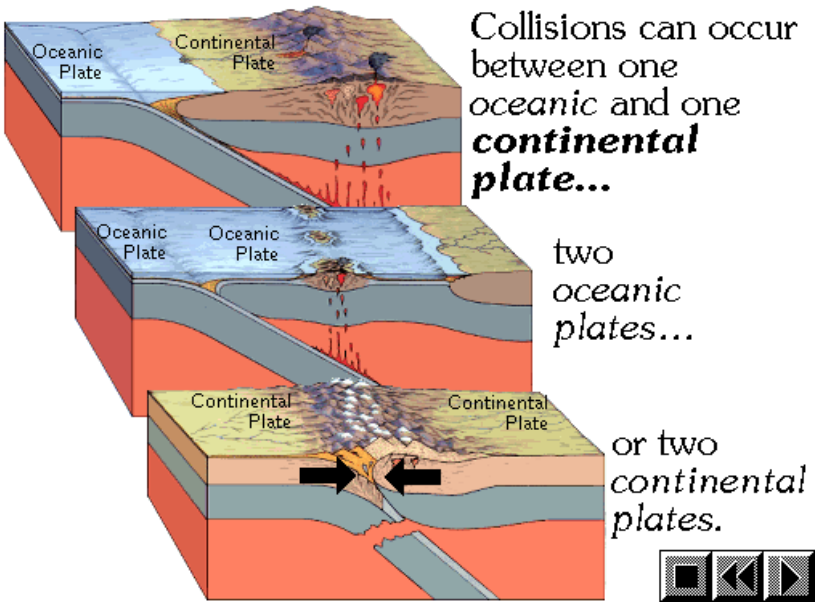
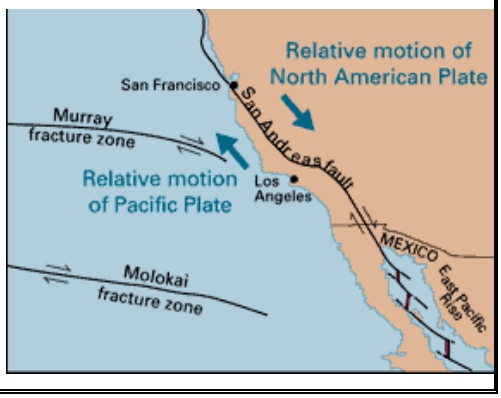
There are three types of plate boundaries:

1) **Diverging**
2) **Converging**
3) **Transform**





Type of Plate Boundary	**Description**	**Image**
DIVERGING	• Where **two plates are moving apart** from one another • **Volcanoes** can occur here • a.k.a. **spreading centres** **Example: MidAtlantic Ridge**	
CONVERGING	• When two plates **come together (collide)** • Often form **subduction zones**, where a **denser plate** (typically oceanic) is **forced underneath a less dense plate (trench formed)** • **Or…..Formation of mountains** are found at these zones two plates move upwards	

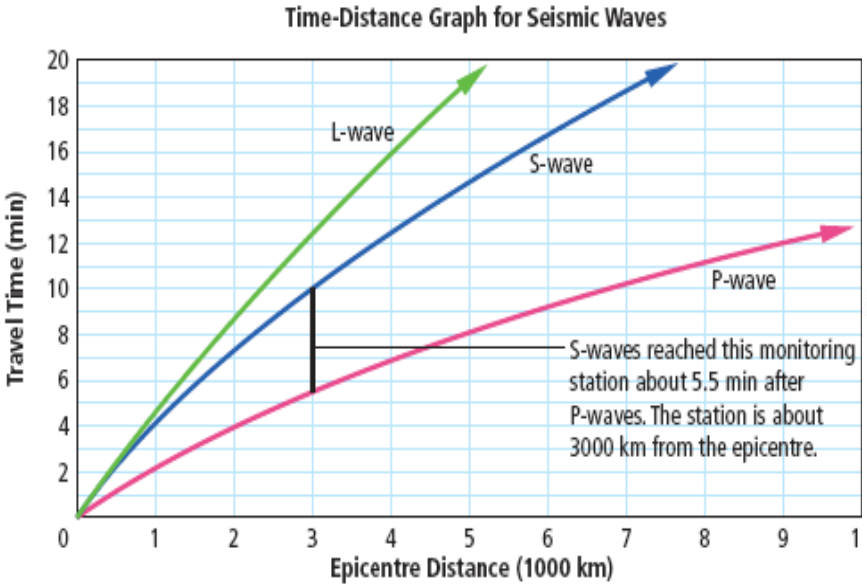
Three Types of Convergent Plate Boundaries *1 & 2 – Volcanoes* • **One plate is pushed down under the other** *3 – Mountains* • *Both plates are forced upward*		
TRANSFORM Fault	• Where two plates are **sliding past one another** • a.k.a. **Sliding Boundaries** • Where **earthquakes** occur	

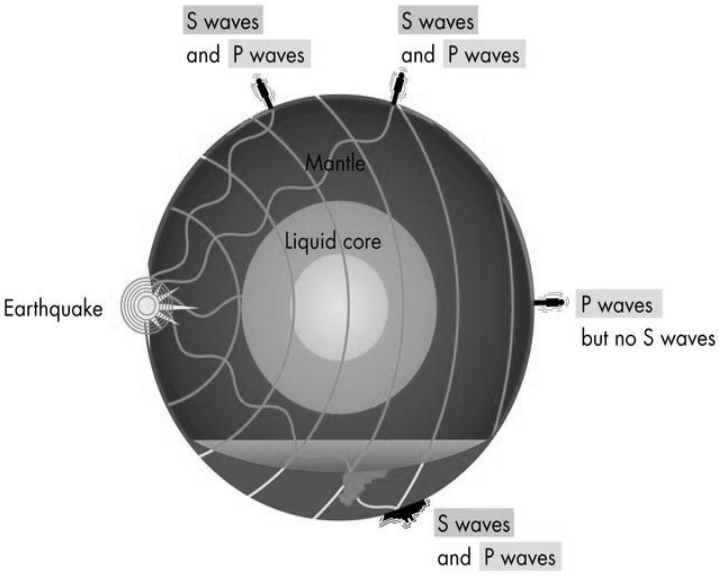
- Your ***Data Booklet*** provides information about where the various types of plate boundaries are located throughout the World

Earthquakes

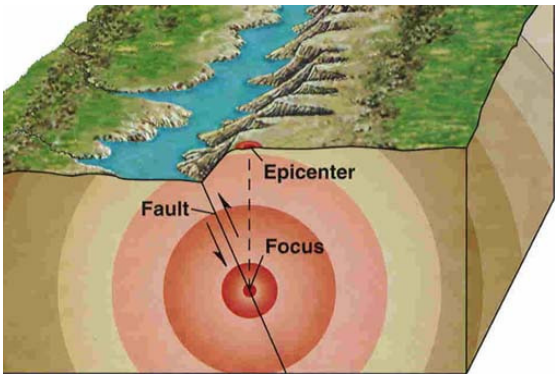
- Earthquakes and volcanoes generally occur **along plate boundaries**
- Earthquakes detected by **Seismographs**
- Occur when plates move suddenly along faults
- Occur in waves called **SEISMIC WAVES** (P, S, & L). Can be BODY WAVES (TRAVEL UNDERGROUND) or a SURFACE WAVE (roll of earth's surface like ripples on a pond)
- Part of the fault where there is the most movement is the FOCUS

Type of Seismic Wave	Description
P Wave **(Primary Wave)**	❑ **BODY WAVE (GOES THROUGH ALL LAYERS OF EARTH INCLUDING CORE)** ❑ **First to arrive and FASTEST** ❑ **Travels through solids, liquids and gases** ❑ **Travel through earth's crust at a rate of 6km/s**
S Wave **(Secondary Wave)**	❑ **BODY WAVE (CRUST AND MANTLE ONLY)** ❑ **Second to arrive (slower than P waves, travel at about 3.5 km/s)** ❑ **Waves are "larger" so greater damage to structures during earthquake** ❑ **Travels through solids but not liquids**
L Wave **(Surface waves)**	❑ **SURFACE WAVE (CRUST ONLY)** ❑ **Travels along Earth's surface ONLY** ❑ **Last to arrive (slowest)** ❑ **Roll along earth's surface like ripples in a pond**





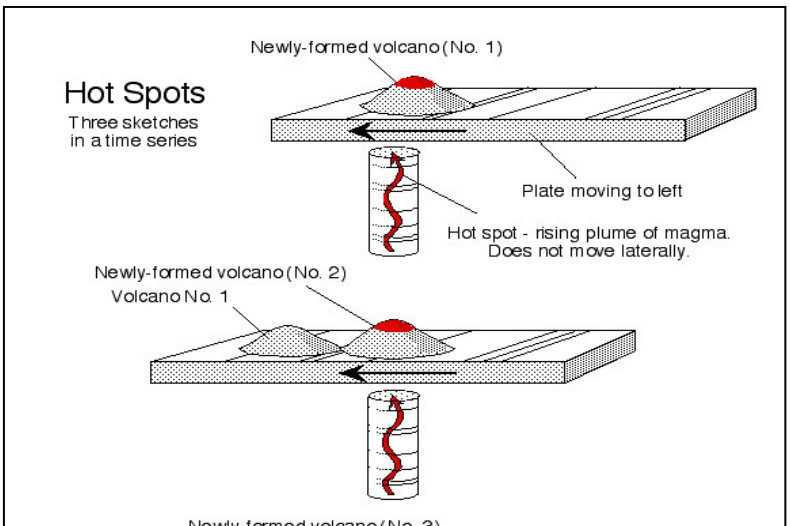
- Point on the surface of the crust directly above the focus is called the **Epicenter** (it is the location where the earthquake feels the strongest)



- Earthquakes result when **stress begins to build up** between two plates.
- This initial stress **does not usually cause any movement** of the plate, because **friction** between the plates **hold them together at the plate boundary**
- Eventually, this stress can cause **deformation of the plates**
- If the stress gets large enough it **overcomes the force of friction**, resulting in the **sudden movement** of the plates
- Once this occurs, the plates **snap back into shape**, **but in new locations relative to one another**
- *This particular explanation for the occurrence of earthquakes is known as the **Elastic-Rebound Theory***
- Anytime an earthquake occurs under the ocean, a tsunami (giant wave) may occur, travelling at speeds up to 800km/hour.

Volcanoes

- When a volcano erupts, an **earthquake always occurs**
- There are 3 types of volcanoes: **composite, shield, and rift eruptions**
- Most of the Earth's earthquakes and volcanoes **occur along the boundaries between lithospheric plates**
- Some volcanoes, however, occur in the **center of lithospheric plates**
- These areas are called **Hot Spots**. The **Hawaiian Islands** formed due to one such hot spot
- A hot spot is believed to occur due to **concentrations of heat from radioactive sources in the asthenosphere**



Homework:

Study guide with multiple choice

Text Review pages 538 #1-21