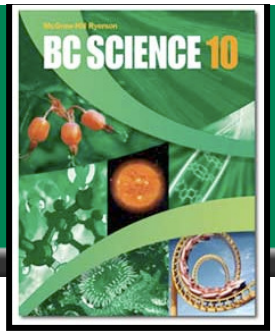
These notes are posted on my site for the following reasons:

- for students to copy in their own hand-writing
  - in order to complete their class notes
  - if student did not have enough time in class
  - if student was away and missed this section
- for assistants and tutors to follow progress of the concepts taught

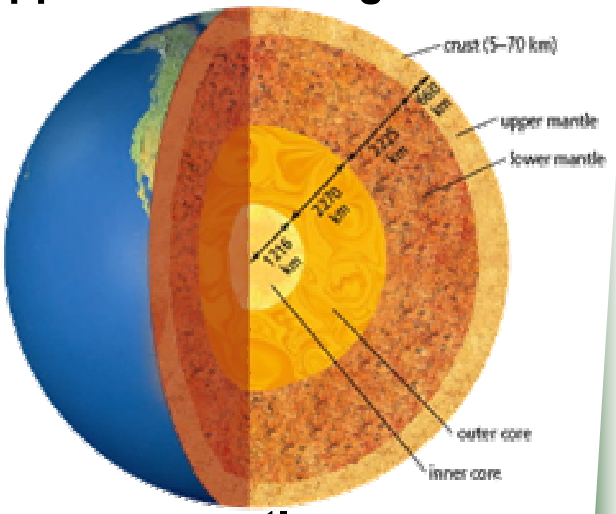
Photocopied/printed notes can not be used during the Unit Notebook Check in class.

ndupuis@sd61.bc.ca dupuis.shawbiz.ca

12.2 Features of Plate Tectonics



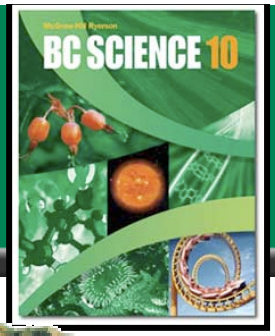
- **Earth is over 1200 km thick, and has four distinct layers.**
  - These layers are the crust, mantle (upper and lower), outer core, and inner core.
    - Crust - outer solid rock layer (granite on land, basalt in oceans)
    - Mantle - thickest layer, mostly solid except for upper mantle being able to flow like "thick toothpaste"
    - Outer core - composed of liquid iron and nickel
    - Inner core - mostly solid iron, at tremendous temperature and pressure



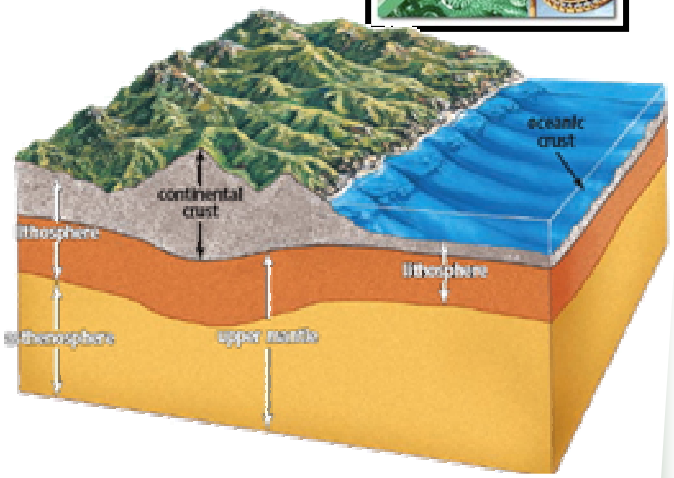
- **Tectonic plates make up the lithosphere, which floats on the asthenosphere.**
  - The lithosphere is the crust and upper portion of the upper mantle.
  - The asthenosphere is the molten layer of the upper mantle.
    - Heat to keep asthenosphere molten comes from radioactive elements.
    - A convection current forms as hot, low density rock rises

See pages 518 - 521

Plate Motion (continued)



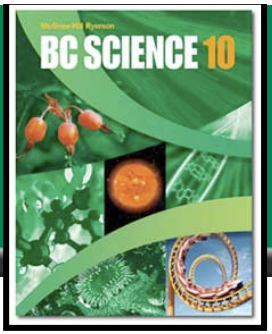
- **Continents, attached to the tectonic plates, float in the magma of the asthenosphere.**
  - **As magma is heated in the asthenosphere, convection currents form.**
  - **Rising magma can reach the surface at ridges (in the oceans) or rifts (on land).**
    - **The magma cools when it reaches the surface, solidifies, and is pushed aside as new magma pushes from below. This is called ridge push.**



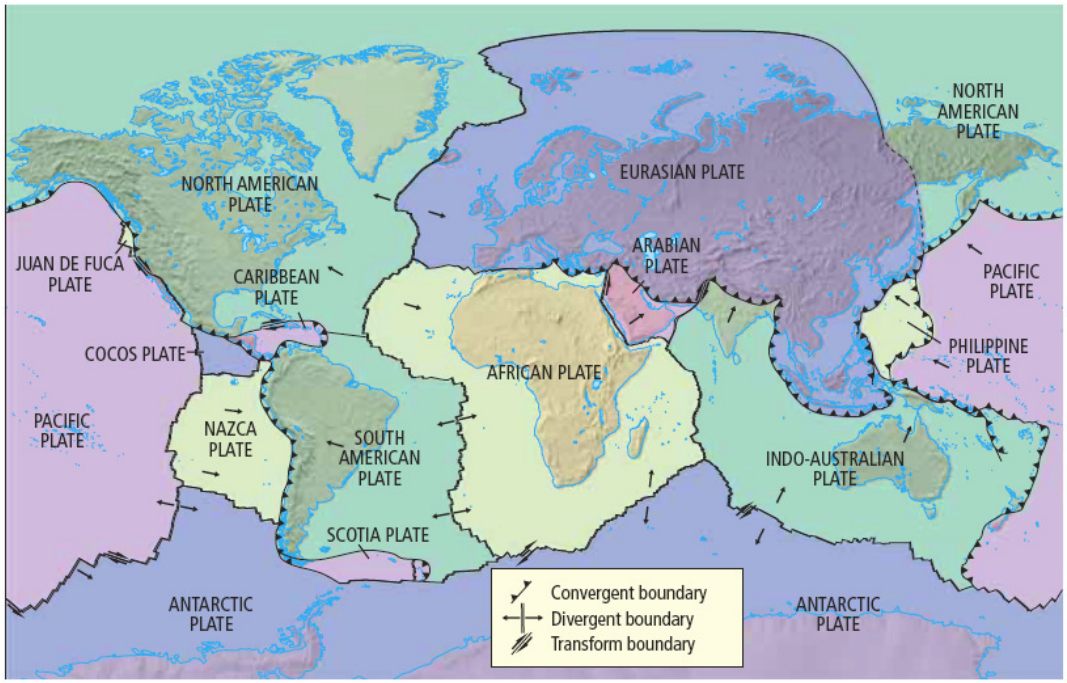
- **Tectonic plates are all moving at the same time.**
  - **There are 12 large tectonic plates, and many smaller ones.**
  - **Where continental and oceanic plates meet, subduction occurs.**
    - **More dense oceanic plate subducts under the lighter continental plate.**
      - **By "slab pull", the rest of the plate follows.**
  - **Large earthquakes and volcanoes are found in subduction zones.**

See pages 520 - 522

Plate Interactions



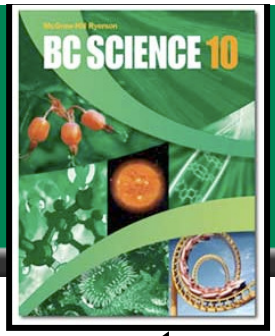
- **A plate boundary is where two plates are in contact.**
  - **The way the plates interact is based on the type of plate, and the direction the plates are moving relative to each other.**
  - **Divergent plate boundaries - where plates are spreading apart**
  - **Convergent Plate boundaries - where plates meet**
  - **Transform plate boundaries - where plates move past each other**



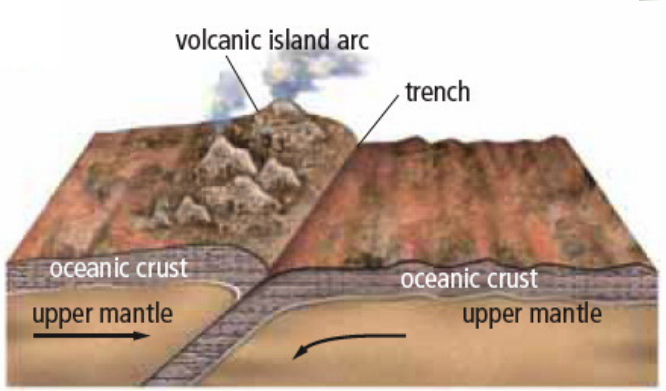
Tectonic plate boundaries, and their relative movement to each other.

See page 523

Plate Interactions (continued)



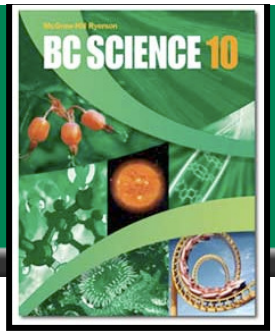
1. **Divergent plate boundaries are where plates are spreading apart.**
   - Ocean ridges and continental rifts are examples
   - The Mid Atlantic Ridge is the longest mountain range on Earth.
2. **Convergent plate boundaries are where plates collide.**
   - A. **Oceanic-Continental plate convergence**
     - The oceanic plate subducts under the continental plate, forming a trench.
     - Cone-shaped volcanoes can form from magma seeping to the surface.
       - This is how the volcanic belt of the Pacific Northwest has formed.
     - Mountain ranges like the Coast Mountain range also form from the collision.
     - Earthquakes can occur when subduction, ridge push and slab pull stall.



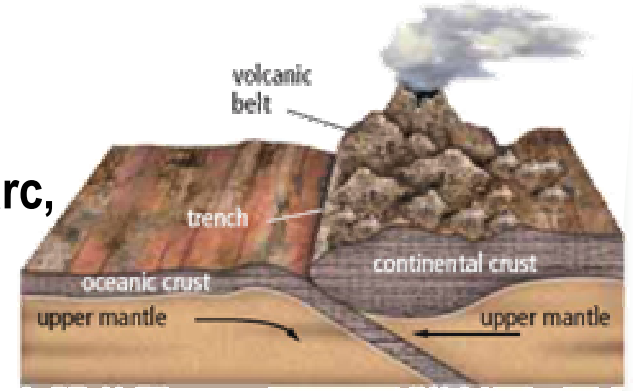
See pages 523 - 525

The convergence of an oceanic and a continental plate.

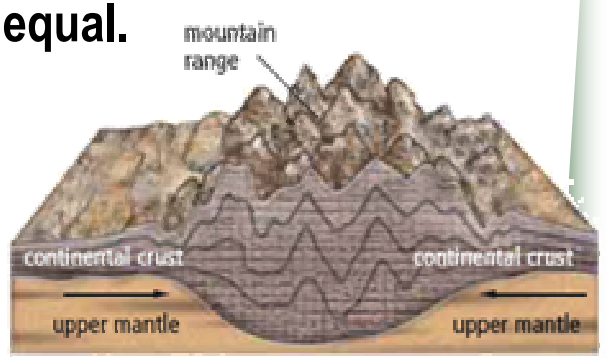
Plate Interactions (continued)



B. Oceanic-Oceanic plate convergence
   - The cooler, more dense plate will subduct under the other.
   - Convergence may produce a volcanic island arc, such as those found in Japan, Indonesia and Alaska's Aleutian islands.

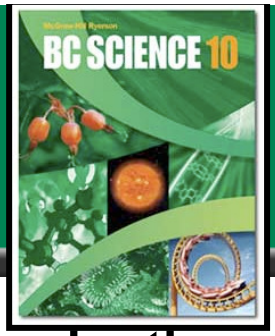


C. Continental-Continental plate convergence
   - Since both are continental plates, densities are equal.
   - As they collide, edges fold and crumple, forming mountain ranges.
     - The Himalayas are the world's youngest (and tallest) mountain range.
       - They formed as Asia and Africa plates collided 40 million years ago.
       - They are still growing taller today.

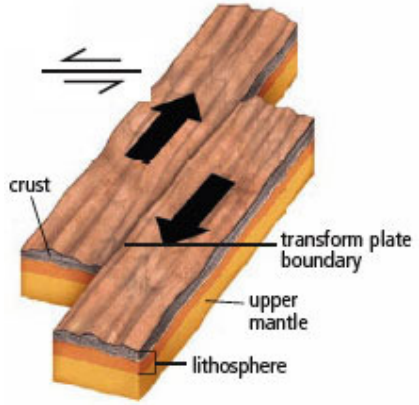


See pages 523 - 525

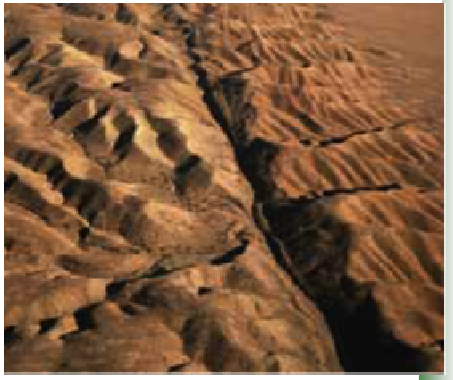
Plate Interactions (continued)



3. **Transform plate boundaries are where plates move past each other.**
   - Usually are found near ocean ridges.
   - Since rock slides past rock, no mountains or volcanoes form.
   - Earthquakes and faults are very common, though.

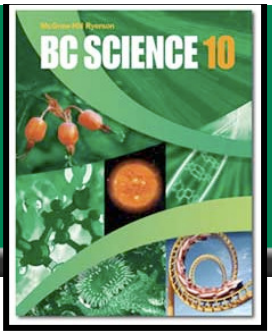


- **Earthquakes often form from the friction between moving tectonic plates.**
  - This accounts for 95% of all earthquakes.
  - The Juan de Fuca convergent plate boundary west of Vancouver Island has many earthquakes.
    - Large earthquakes hit this region every 200 - 800 years.



See pages 526 - 527

Describing Earthquakes



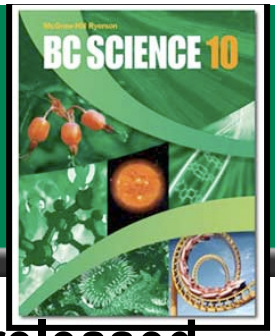
- **Earthquakes are very difficult to predict.**
  - Scientists understand why they happen, but it is very difficult to predict their timing, exact location and strength.
    - Their build-up happens underground, over very long periods of time.
    - What we do understand has helped prepare structures to survive them.
  - The focus of the earthquake is where the pressure is finally released.
    - The epicenter is the point on the surface directly above the focus.
  - Earthquakes occur at various depths, depending on the plates involved.
    - **Table 12.2** Depth of Origin of Earthquakes

Classification	Depth of Focus
Shallow focus	0 to 70 km
Intermediate focus	70 to 300 km
Deep focus	greater than 300 km

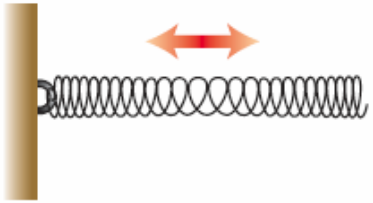
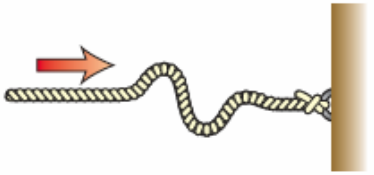
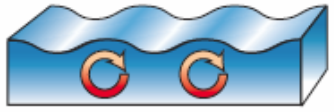
    - Earthquakes at the surface tend to cause more damage.

See page 528

Describing Earthquakes (continued)

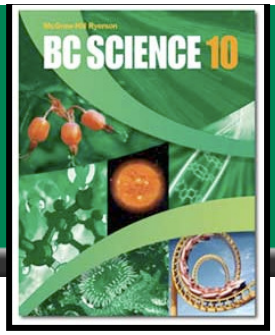


- **Seismic waves form when the energy of an earthquake is released.**
  - **Seismology is the study of these waves.**
  - **These waves reveal the source and strength of an earthquake.**
    - **They also help us learn about the composition and distances of the Earth's interior.**
  - **Table 12.3 Types of Seismic Waves**

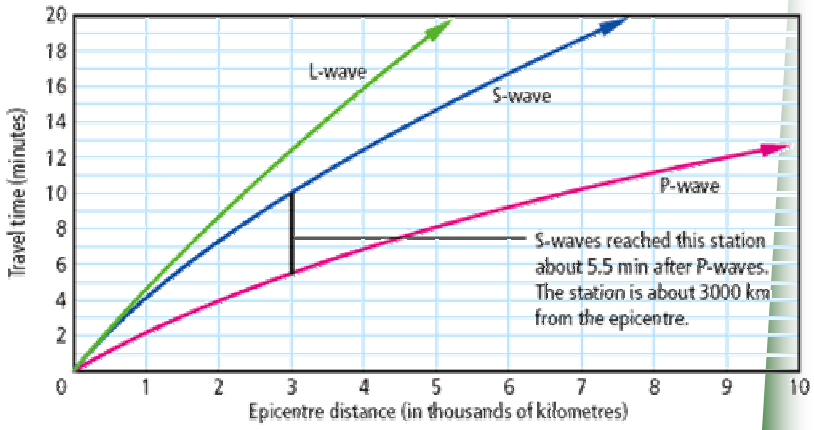
Seismic Wave	Abbreviation	Description	Ground Motion Sketch
Primary wave	P	• type of body wave • first to arrive (fast) • ground squeezes and stretches in direction of wave travel • travels through solids, liquids, and gases	
Secondary wave	S	• type of body wave • second to arrive (slower) • ground motion is perpendicular to direction of wave travel • travels through solids but not liquids	
Surface	L	• travels along Earth's surface • last to arrive (slow) • ground motion is a rolling action, like ripples on a pond	

See page 529

Describing Earthquakes (continued)

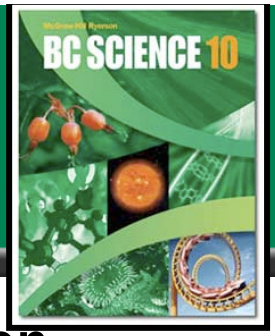


- **Seismic waves behave differently in different Earth layers.**
  - Knowing this, scientists can learn much about both earthquakes and the interior of Earth.
- **Seismometers are used to measure seismic wave energy.**
  - Early seismometers just measured if the ground shook or not.
  - Some seismometers measure horizontal movement, others vertical movement.
    - A seismogram is produced, showing when an earthquake started, how long it lasted, and the magnitude.
    - 1 in magnitude = 10X stronger
      - A magnitude 6 earthquake is 100X more powerful than a 4.
    - Since seismic waves travel at different speeds, a distance-time graph, revealing the focus.



See pages 530 - 531

Volcanoes

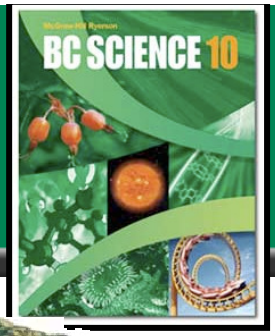


- **The movement of tectonic plates causes volcano formation.**
  1. **Composite volcanoes - this is the stereotypical volcano, erupting and belching smoke and ask everywhere, found along plate boundaries**
     - **Layers of ash and thick lava (magma outside Earth) form a tall cone.**
     - **As magma reaches the surface, it cools, hardens and traps gases below.**
     - **Pressure builds, eventually there is an eruption.**
  2. **Shield volcanoes - these are not found at plate boundaries, but instead form over hot spots (a weak spot in the normal lithosphere).**
     - **Thin magma/lava flows out from a hot spot and forms a low, wide cone.**
     - **The Hawaiian Islands are an example of a chain of shield volcanoes.**
  3. **Rift eruptions - these occur along long cracks in the lithosphere**
     - **These are not explosive, but release massive amounts of lava.**

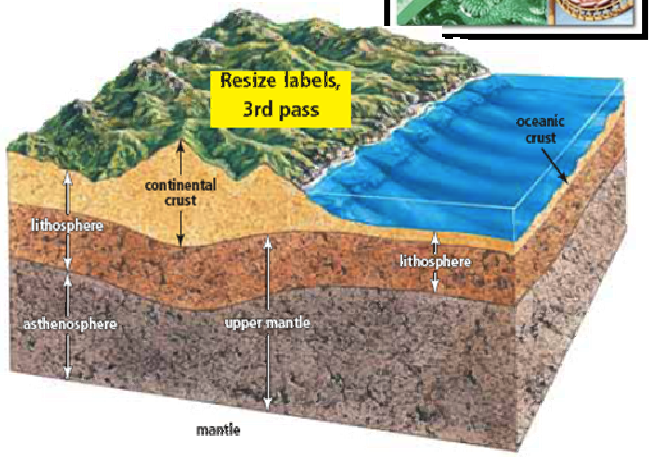
See pages 532 - 534

Take the Section 12.2 Quiz

Plate Motion (continued)



- **Continents, attached to the tectonic plates, float in the magma of the asthenosphere.**
  - **As magma is heated in the asthenosphere, convection currents form.**
  - **Rising magma can reach the surface at ridges (in the oceans) or rifts (on land).**
    - **The magma cools when it reaches the surface, solidifies, and is pushed aside as new magma pushes from below. This is called ridge push.**



- **Tectonic plates are all moving at the same time.**
  - **There are 12 large tectonic plates, and many smaller ones.**
  - **Where continental and oceanic plates meet, subduction occurs.**
    - **More dense oceanic plate subducts under the lighter continental plate.**
    - **Large earthquakes and volcanoes are found in subduction zones.**

See pages 19 - 20

Take the Section 12.1 Quiz