Objectives
This assignment is designed to give you some experience dealing with this very important topic. Because much of what happens on the Earth is affected by plate tectonics, it’s important that you can get a handle on it. This early in the semester, we are only introducing the concept and its importance. More details will follow later in the semester.

Guidelines
This activity will require a computer with an Internet connection. All websites and instructions are given below. Please see me right away if you are having difficulties accessing the website. Do not wait until the day the assignment is due (or after) to tell me you’re having problems. Since you will have to answer some questions from the website and some from this handout, label each question as “website question 1” or “Handout question A.”

Please type all answers on a separate sheet. There are no guidelines for length of answers. Nevertheless, I do expect answers to be well thought-out and in complete sentences when applicable. Show all calculations. As stated in the syllabus, all answers are to be written in your own words, so there is to be NO copying of other students or resources (such as the textbook or websites). Your grade will be based not only on your answers but also your writing. Some tips:

- Again, answers are to be in your own words.
- Please edit your work. This means reading back over your answers to check for spelling and grammar mistakes and making sure your sentences are readable. Running a spell check is a good idea, but don’t get carried away with it. Your word processing program likely will not recognize words such as “subduction.”
- Make sure you answer all questions and every part of each question.

Instructions
Complete the following activities and answer all questions.

Alfred Wegener’s Continental Drift Hypothesis
The concept of Plate Tectonics was not developed until the 1960s. Prior to this, a German meteorologist named Alfred Wegener proposed the Continental Drift Hypothesis. Wegener suggested that at one time (more than 200 million years ago), all the continents as we know them were connected together as one supercontinent. This supercontinent was given the name Pangea.

- Go to Chapter 12 in your textbook and read pages 306-310 about continental drift and plate tectonics.

- Then, go to the website:
  http://www.classzone.com/books/earth_science/terc/navigation/investigation.cfm

  (I’m sorry that this is such a long address - you can also find this linked on the class website, on the “Earth and Plate Tectonics” page from the class schedule.)

- Once at the website, scroll down to the section labeled “Chapter 8: Plate Tectonics.” There are three links under this heading. Go back to the page that lists the topics (Chapter 8: Plate Tectonics). Select “How Old Is the Atlantic Ocean?”
Activity at plate boundaries

Wegener’s hypothesis was not accepted by other scientists at the time because he could not come up with an adequate mechanism to explain how continents could move. Now we know that it’s not just continents that move. Instead, the Earth’s entire outer layer (the lithosphere) is divided into plates that move very slowly. We’ll get into what causes the movement later in the semester. For now, let’s look at plate boundaries.

The following diagram shows the locations, types, and names of major plate boundaries (divisions in the lithosphere) across the planet. It can also be found on page 311 of your textbook.

Some of the evidence that has led to our understanding of plate tectonics has come in the form of the location of earthquakes and volcanoes.

This map shows major earthquakes between the years 1960 and 2000.

A. How does the distribution of most earthquakes compare with the location of plate boundaries?

B. What does this indicate is happening at plate boundaries?
The map to the left shows volcanoes that have erupted in the last 10,000 years.

C. How does the distribution of most volcanoes compare with the location of plate boundaries?

**Types of plate boundaries**

So we know there is activity at these plate boundaries. Let’s look at this activity in a little more detail by examining exactly what is going on at each boundary. Look again at the first map on the preceding page (the one that shows plate boundaries). The arrows on the diagram indicate the direction the lithosphere is moving at each of the major plate boundaries. There are three relative directions: plates move away from each other (→ divergent), toward each other (←convergent), or slide past one another (transform). Let’s consider each in turn.

**Divergent Plate Boundaries**

At these plate boundaries, plates move apart. When this occurs within oceanic crust, it is known as **sea floor spreading**. When it occurs within continental crust, it is known as **continental rift**. We are going to focus on sea floor spreading for now. The following diagram shows the profile of the Atlantic Ocean sea floor.

The most obvious feature is the large ridge that runs down the center of the Atlantic Ocean basin. This is the **Mid-Atlantic Ridge**. There is volcanic activity all along this ridge, where new oceanic crust is formed.

- Go back to the website from the earlier questions. Now, read through Steps 3, 4, 5, and 6. Answer questions #2 though #11.

Note that Step 5 requires **Macromedia Shockwave Player** to view the images. Some web browsers will ask you automatically if you want to install it. Otherwise, the pages will have a link to download this program (it’s safe) in the upper left-hand corner. **Again, please let me know right away if you are having any problems.**
HINT for questions #7 and #8: You are asked to calculate the rate (i.e., speed) of plate movement. Think about what information you need to find out how fast something is moving. If you need help when making calculations, try the link at the bottom of the page that says “Click here if you need help with the calculations.” The questions ask you to state answers in centimeters per year (cm/yr). To help you: 1 kilometer = 100 centimeters and 1 million years is the same as 1,000,000 years. NOTE: Please do not use the exact same numbers as in the example. You need to use your calculated measurements.

D. Does sea floor spreading provide a mechanism for Wegener’s Continental Drift? How does the relationship of the continents of North America, South America, Africa, and Europe to the Mid-Atlantic Ridge support the existence of Pangea?

Convergent Plate Boundaries
Convergent plate boundaries in oceanic crust coincide with large ridges. Convergent plate boundaries in oceanic crust, on the other hand, coincide with very deep trenches. One runs along the west coast of South America. Observe on the map on the first that plates do indeed move toward each other here: the South American Plate is converging with the Nazca Plate.

The map and graph below show the location and depth of earthquakes at this plate boundary. The top picture is a map of South America and the earthquakes that occur along plate boundaries. The bottom picture is a cross-section below the surface. You will need to look at Figure 12.22 on p. 326 of your textbook to see this in color.

As you should expect, there are a lot of earthquakes along this place where plates meet. Notice, however, the distribution of earthquakes as you look deeper under the surface.

E. What accounts for this particular distribution of earthquakes?

F. Find another map of South America (perhaps in your book or online. What geographical feature can be found running down the western side of the South American continent (i.e., on land)?

G. How might the activity at this plate boundary explain the presence of the feature(s) you observed in question F?
**Transform Plate Boundaries**
At these types of boundaries, plates slides past each other. One of these can be found in California as a system of faults known as the San Andreas Fault.

H. What activity is prevalent at this area?

I. How is this evidence for plate movement?