General Oceanography **Name_____**
Geology 105
Expedition 7 – Commotion Beneath the Ocean
Complete by Thursday at 11:00 PM

Expedition Objectives

- Learn about the formation of the seafloor

- Homework - post one multiple choice question on the evidence that supports the theory of plate tectonics and a second multiple-choice question on seafloor spreading in your Expedition 7 Learning Group Discussion in Canvas,

Many of the figures in this worksheet and the online expedition are derived from *"This Dynamic Earth"* by Jacqueline Kious and Robert Tilling of the U.S. Geological Survey. (http://pubs.usgs.gov/publications/text/dynamic.html)

Plate tectonics was a revolution in the earth sciences, which was launched by oceanographers. In this class we will use tectonics to examine:

- the formation and recycling of the seafloor and oceanic lithosphere,
- formation of trenches, volcanic islands
- motions of the seafloor
- marine hazards, such as the locations of earthquakes and volcanoes

Begin expedition at:

http://oceansjsu.com/105d/exped_commotion/1.html

1. Introduction

Is the Earth a dynamic planet? _____ (yes or no)
Why or why not?

From "This Dynamic Earth" by Jacqueline Kious and Robert Tilling of the U.S. Geological Survey.

2. The Theory of Plate Tectonics

What is continental drift?

What is the name of the supercontinent? _____

When did the continents last form a large, single continent?

The breakup of Pangaea resulted in the formation of the modern ocean basins as continental masses drifted apart, allowing seawater to flow between the landmasses.

3. Formation of the Modern Ocean Basins

As the continents drift apart, new crust is formed beneath the sea to fill the space.

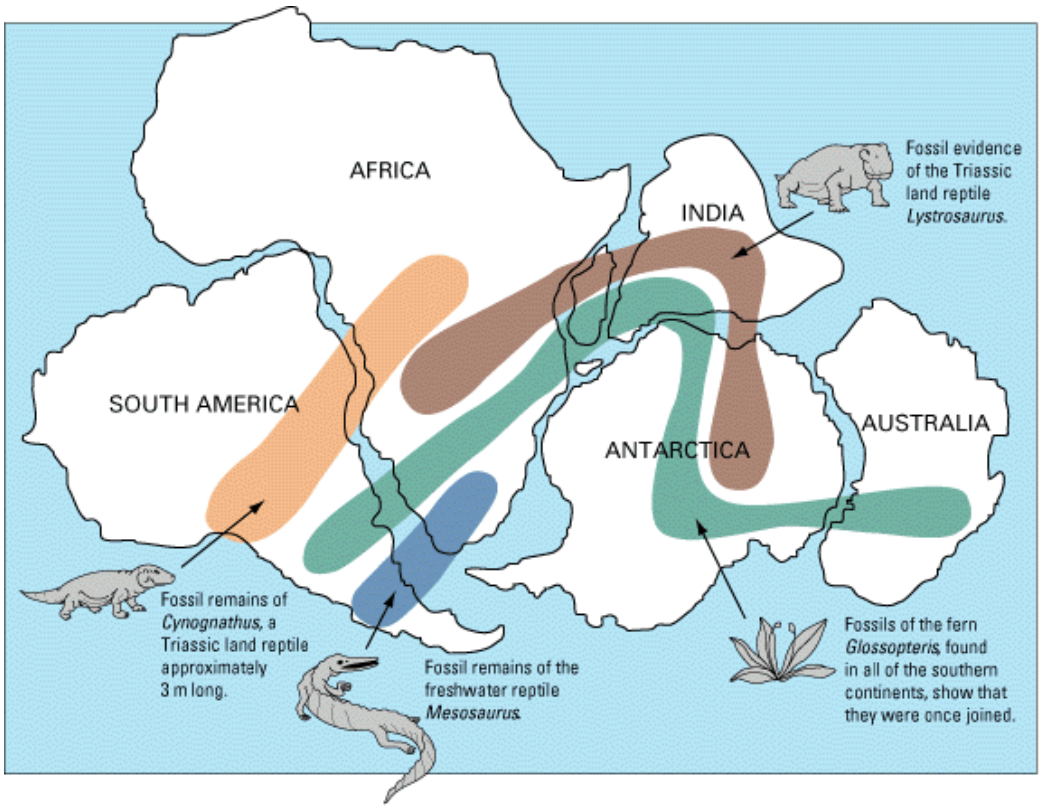
The shorelines of which of the pairs of continents can be easily seen to match up across an ocean?

4. Evidence of Continental Fit

Evidence were used to support the hypothesis of the fit of the continents into Pangea

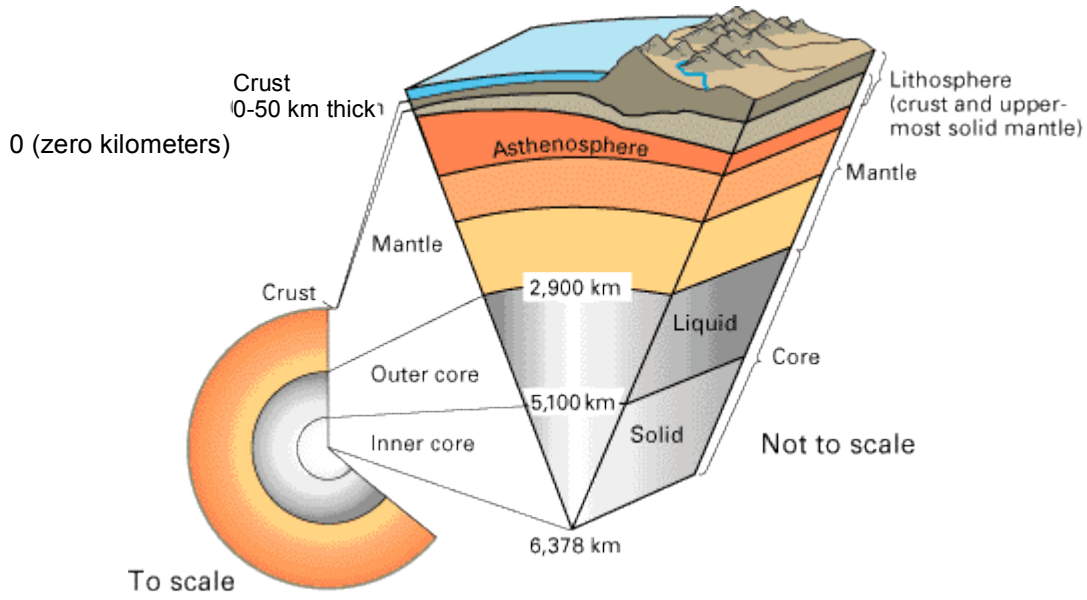
- Some fossils match across oceans when continents are realigned with past positions
- Some rock types match across oceans when continents are realigned with past positions
- The distribution of ancient swamps and sedimentary deposits formed by ancient glaciers align in proper places when continents are realigned into their past positions, just like pieces of a jigsaw puzzle.

See diagram on next page



From "This Dynamic Earth" by Jacqueline Kious and Robert Tilling of the U.S. Geological Survey.

5. Earth's Interior



From "This Dynamic Earth" by Jacqueline Kious and Robert Tilling of the U.S. Geological Survey.

List the layers within the Earth

_____ _____

_____ _____

6. Earth as a Heat Engine

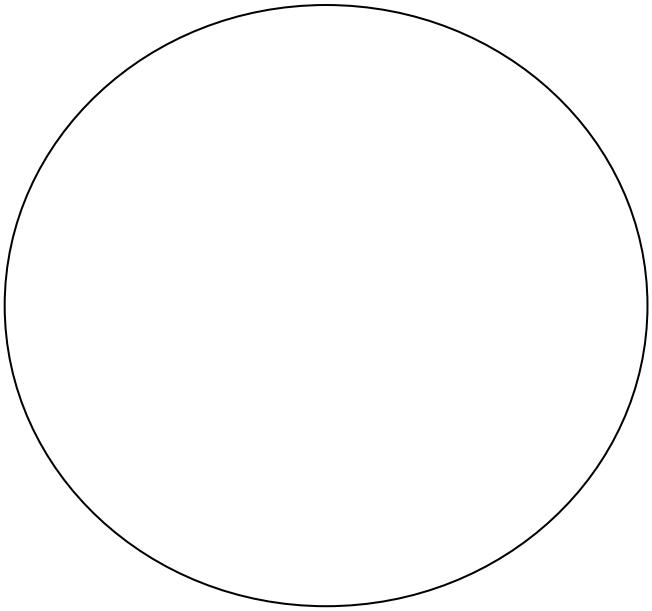
What is convection?

How does convection cause the movement of material within the Earth?

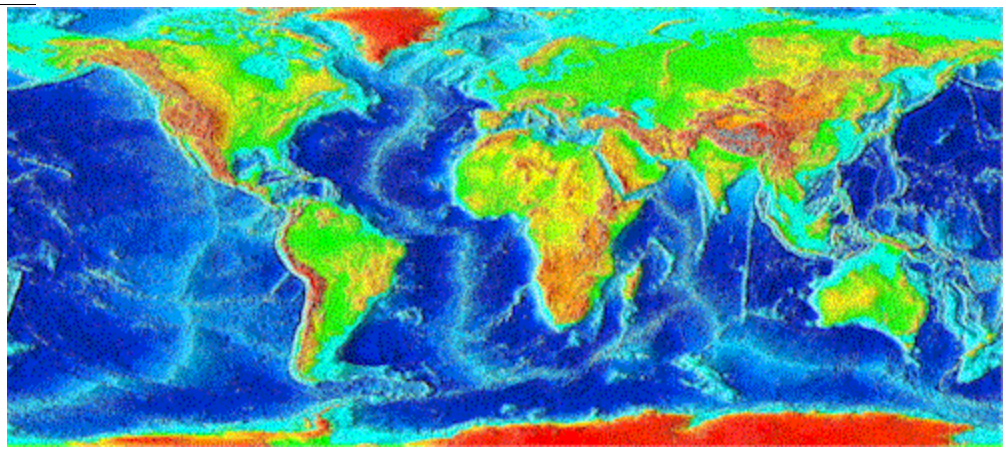
Which layers in the Earth are involved in convection?

_____ _____

Draw a picture of convection within the earth



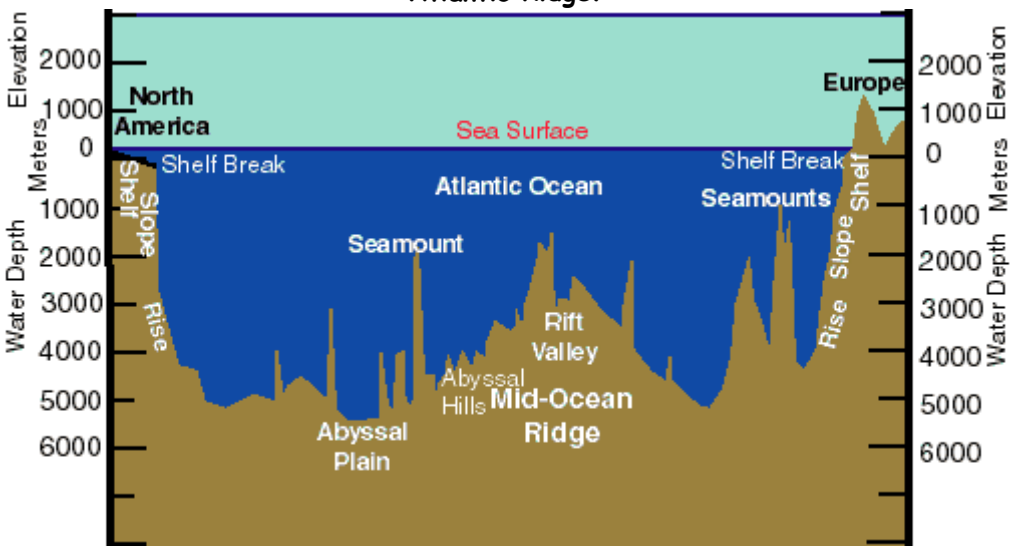
7. **Mapping the Mid-Ocean Ridge System – one of the locations where heat escapes the earth**



From National Geophysical Data Center http://www.ngdc.noaa.gov/mgg/image/2minrelief.html

Trace in the locations of the mid-ocean ridges on the diagram above

Below is a profile of the seafloor across the Atlantic Ocean – where is the Mid-Atlantic Ridge?



8. On a Mid-Ocean Ridge - Know how the mid-ocean ridge system encircles the globe and the locations of mid-Atlantic Ridge and East Pacific Rise

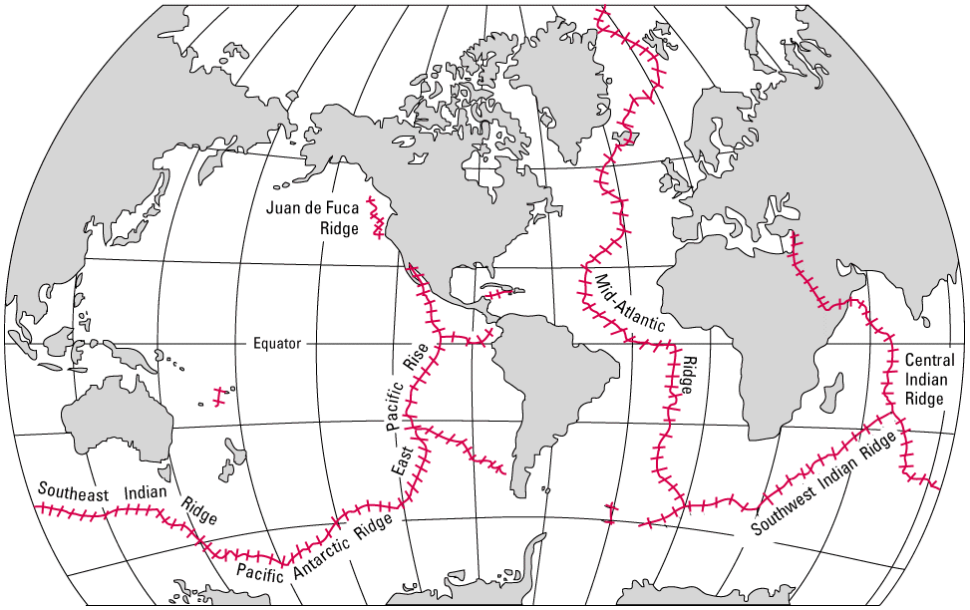
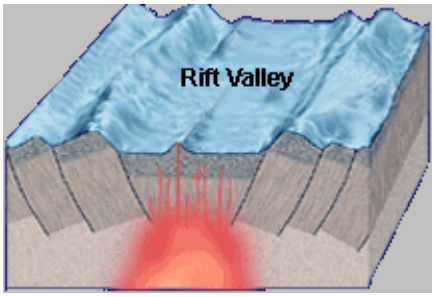


Figure on preceding page from "This Dynamic Earth" by Jacqueline Kious and Robert Tilling of the U.S. Geological Survey.

Know locations of mid-ocean ridges !!!!!!!

What is a mid-ocean ridge?



Rift valley marking divergent plate boundary at mid-ocean ridge

9. Seafloor Spreading - Understand this concept! It will be on quiz!

Make a simple, but very clear diagram illustrating the seafloor spreading hypothesis

Include the motions of mantle convection in the diagram above.

Why is a portion of the earth's mantle in slow, constant motion, called convection?

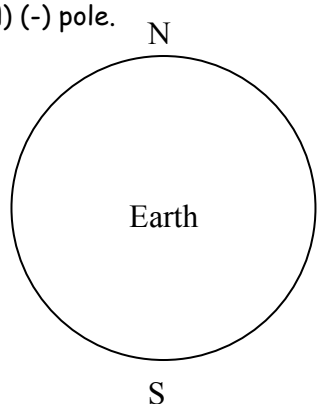
Know about the formation of Earth's crust and its movement away from mid-ocean ridges with time.

What is meant by the term "marine magnetic anomalies" or sometimes called seafloor magnetic stripes?

10. Earth's Magnetic Field

The magnetic field is generated by the electrical currents in the liquid outer core. -- You should know the direction and orientation of the lines of force of the Earth's magnetic field

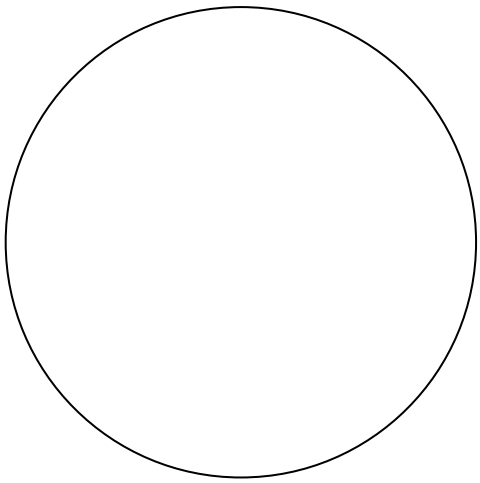
- **Make a sketch of the Earth and surrounding lines of force of the magnetic field** (it is nearly a Dipole Field, similar to that of a bar magnet). These lines of force point outward from the southern pole (S) (+ pole), are nearly parallel to Earth's surface at the equator and point in, towards the interior of the Earth, at the northern (N) (-) pole.



Question -- The lines of force of the earth's magnetic field currently point in which direction?

11. How has the Magnetic Field Changed Over Time

In the previous problem, you drew a picture of the lines of force of the Earth's magnetic field as it is today (so-called normal polarity), now draw one showing the Earth's reversed field (or reversed polarity) as it has been at many times in the past



12. Reading the Magnetic Patterns in the Ocean Basin

How are the marine magnetic patterns used as scientific evidence of seafloor spreading?

13. The Plates

List and Know Names of at least 9 of the Major Plates

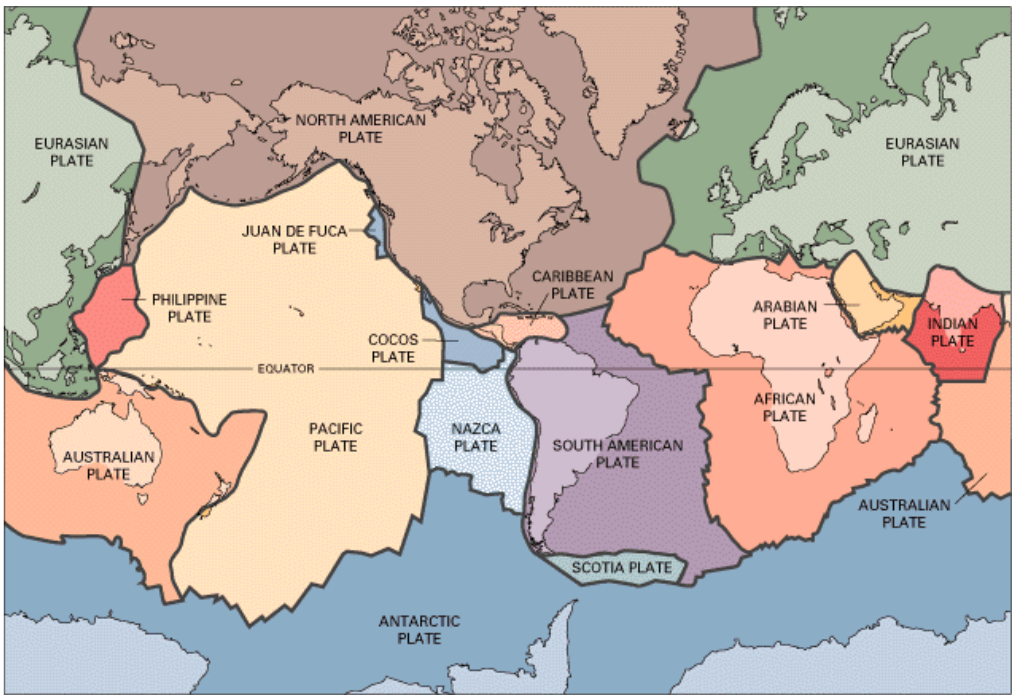
1. _____ 2. _____

3. _____ 4. _____

5. _____ 6. _____

7. _____ 8. _____

9. _____



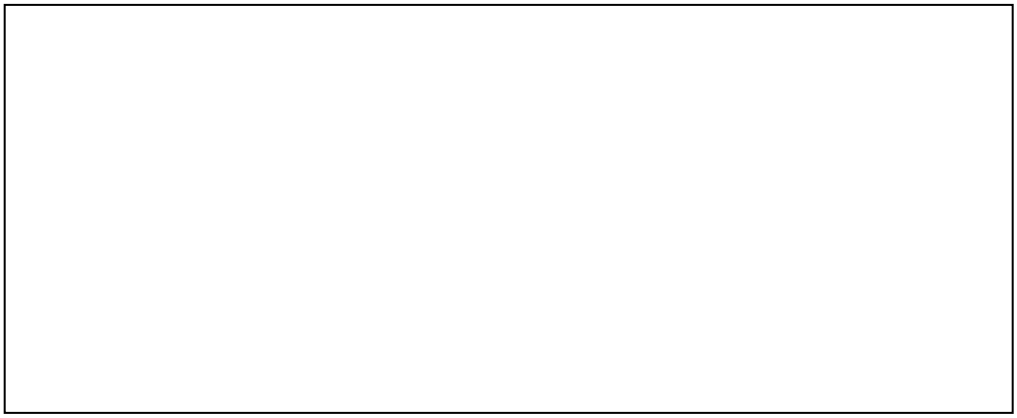
From "This Dynamic Earth" by Jacqueline Kious and Robert Tilling of the U.S. Geological Survey.

14. More on the Plates

What is the lithosphere?

What is the asthenosphere?

Draw a picture showing a plate composed of the ***rigid*** lithosphere floating on the ***hot, mobile*** asthenosphere.



Check Canvas for any required reading assignments for this expedition that are posted online

Homework assignment: - post in your expedition 7 learning group two multiple choice questions with answers (e.g. a, b, c, d, and e); the first multiple choice question should relate to a key piece of evidence that supports plate tectonic theory and the second multiple-choice question focus on seafloor spreading.

You will also be asked to peer review the posted questions of other students in your learning group.