Student Notes- Oceanography **Name _____**
Plate Tectonics And Ocean Basins Date _____

Vocabulary: Please number and define each term below in a complete sentence on a separate sheet of paper. (those that have a *, please illustrate the term)

P-Waves*	S-Waves*	Seismic Waves	Inner Core
Outer Core*	Mantle	Moho*	Granite
Basalt	Crust*	Lithosphere	Asthenospere
Mesosphere	Gondwandaland	Continental Drift	Pangaea*
Ridges	Magma*	Trenches*	Seafloor Spreading
Subduction zones*	Plate Tectonics	Epicenters*	Cores*
Sediments	Dipole	Paleomagnetism	Polar Reversals*
Divergent boundary*	Convergent Boundary *	Transform boundary	Rift Valley*
Pillow Basalts	Wadati-Benioff Zones	Island Arc*	Passive Margin
Active Margin	Spreading Rate	Seamounts	Subsidence
Continental Shelf*	Continental Slope*	Turbidity Currents	Submarine Canyons*
Continental Rise	Abyssal Plain	Abyssal Hill	Fringing Reef
Barrier Reef	Atoll*	Guyots *	Ridge and Rises
Echo Sounder	Neritic	Pelagic	Lithogenous
Biogenous	Hydrogenous	Cosmogenous	

Plate Tectonics

A. The Interior of the Earth

1. What are seismic waves and why are they important to Earth Science?
   -Seismic waves- vibrations in the Earth that can tell us a great deal about the _____ _____-
2. Describe the two types of seismic waves below:
   -P Wave- primary waves or compressional waves, _____, travel through solids, liquids and gases
   S-Wave- secondary waves or shear waves, oscillate at right angles to their direction of motion, _____
3. What determines the velocity of a seismic wave?
   -chemistry, _____, _____ of matter caused by variations in temperature and pressure with depth
4. Describe the different layers of Earth:
   -_____- made up of iron and nickel and a solid state
   -_____ - made up of iron and nickel and a liquid state
   -_____- contains the largest mass of any layer, a state called plastic that flows and made up of magnesium and iron
   -Crust- both solid state
      1) _____- made up of rocks such as granite, average 25 miles thick
      2) _____- made up of rocks such as basalt, average only 4.3 miles thick
   -Moho- a sudden change in _____, boundary between the crust and the mantle

B. The Lithosphere and Asthenosphere

1. What is the lithosphere?
   - the mantle just below the crust which is fused with the crust at the Moho

-up _____

2. Where is the asthenosphere and how is it different than the lithosphere
   -layer below the lithosphere that is _____ (seismic waves slow down here)
   -up to _____

C. History of a Theory

1. What is Gondwanaland, who proposed this idea?
   -Eduard Suess proposed idea in 1909 that _____ and _____ could have been connected
2. Who was Alfred Wegner and what did he propose?
   -Continental Drift- _____ coined the phrase and proposed a single continent existed called _____ existed
3. What evidence supported Wegener's theory which was not accepted until the 1960's?
   -_____,
   -_____,
   -presence of ancient coral reefs at high latitudes,
   -_____

D. Evidence for a New Theory

1. Why could oceanographers begin to survey the deep-ocean floor in the 1950's?
   -armed with new technology from _____ , such as sonar
2. Who was Harry Hess and what did he promote?
   -the concept of _____ of heated material rising up from the core
3. What occurs at upward moving segments of mantle convection?
   - mountain ranges and ridges on the sea floor, _____ is found
4. What is the difference between:
   a. Magma-
   b. Lava-
5. What are trenches?
   -very deep, narrow areas of the ocean where old oceanic crust _____ (see the map on pages 60 and 61 for large trenches)
6. What is seafloor spreading?
   -occurs at _____ where new crust is formed from rising magma
7. What are subduction zones?
   -areas where ocean crust is pushed back into the asthenosphere (_____)

E. Evidence for Crustal Motion

1. Where are most Earthquakes found and why?
   -occur along ridges (spreading centers) or trenches (subduction zones), plate boundaries
2. Why were probes sent to the sea floor?
   -Probes in the sea floor indicate higher temperatures closer to ridges and cooler further away
3. What did the vessel Glomar Challenger find out about the age of the ocean floor?
   -The took _____ of the ocean floor, the youngest found near the ridges and the oldest (_____ million years old) near the continents
4. What does paleomagnetism indicate about sea floor spreading?

-_____ found in the ocean floor are arrange towards the magnetic north pole when they cooled

-The _____ has changed locations many times so the ocean floor rocks have 'stripes' arranged towards past locations of the magnetic North Pole, matching stripes of sea floor are same age on opposite sides of mid-ocean ridges indicates sea floor spreading

F. Plate Tectonics

1.What is Plate Tectonics?

-The concept that combines _____ with _____ , seven major lithospheric plates are recognized along with many smaller plates

2.What are the three types of plate boundaries

-_____, _____ and _____

G. Divergent boundaries

1.What happens at a divergent boundary, what are some examples?

-Spreading zones where the lithosphere splits and new material is lifted to the surface in the oceans and on the continents

-Examples: Mid-Ocean Ridge in the Atlantic Ocean, the _____ and the Red Sea (eventually a rift widens enough where seawater penetrates, such as the Red Sea)

H. Transform Boundaries

1.What occurs at a transform boundary?

-two plates slide past each other, usually creating _____

2.Where are most transform boundaries located?

-found _____ to mid ocean ridges

3. Where are other transform boundaries found and what are some examples?

-found along various plate boundaries

-ex: San Andreas Fault- CA- Pacific and North American Plates sliding past each other _____- off coast of CA and OR, Juan de Fuca Plate and N.A. plate

I. Convergent Boundaries

1.What occurs at a convergent boundary?

-two plates are _____

2.What are the three types of convergent boundaries, what is found at them and list examples:

a. Oceanic Plate collides with continental plate- Oceanic sinks underneath Continental due to _____ causing a trench in the ocean and volcanoes on the continent, also known for powerful earthquakes

1) Examples: Andes Mountains and Peru- Chile trench, _____ of Northwestern U.S.

b. Continental Plate collides with another continental plate- both are the same density so both are thrusted upward creating large mountains

2) Examples: Himalayas of Asia and the _____ in Europe

c. Two Oceanic plates collide- one _____ underneath another and a volcanic island chain is created

3) Example: Volcanic Island Arc Chain- Japan and the Philippines

J. Passive and Active Margins

1. What is the difference between an active and a passive margin?

-_____- areas of past rifting that have moved away from the spreading centers, i.e. much of the U.S. Eastern Coast

-_____- plate boundaries are located along a continental margin

2.What are terranes?

-crustal fragments with distinct histories added to the continents by past collisions

-ex: Delaware Valley- combination of _____-

K. The Motion of the Plates

1.How fast do plate move apart at divergent boundaries?

-At spreading or divergent boundaries, new sea floor is created and moves pushes old sea floor out at rates of _____, about the rate of your fingernail growing, over millions of years plates have moved around dramatically

1. If a plate were moving at 10 cm per year, how many miles would it move in 2 million years? (_____)

L. Hot Spots

1.What are hot spots?

-Areas where volcanic activity occurs in the middle of a plate

-Examples: Hawaiian Islands on the Pacific Plate and _____ on the North American Plate

2. When will the new Hawaiian island, Loihi appear?

-50,000 to 100,000 years from now, it's accumulating layer after layer from the ocean floor at 8,000 feet from the ocean floor

M. The Breakup of Pangaea

1.What has been suggested about a possible cycle based on the knowledge from the breakup of Pangaea?

-A _____occurs where the continents separate and reassemble powered by the radioactive decay of the core

N. Research Projects

1.What does JOIDES stand for and what are its goals?

-Joint Oceanographic Institutions for Deep Earth Sampling

-goals are to drill in all oceans, to seek answers to _____, creation and destruction of ocean basins and underwater earthquakes

2. What was discovered in 1977 at the Galapagos Rift?

-discovered _____, large communities of animals living in superheated water at 8,000 ft in depth

1. Temperature sensors, seismic recorders and magnetic sensors have been left behind to record information at some of these sites

Ocean Basins

A. The Sea Floor

1.Unlike on land where land is eroded by rain, wind and ice how is the ocean floor reshaped?

-by _____ and _____ and accumulates sediments from above

B. The Continental Margin

1.What is a passive continental margin composed of?

-Composed of the continental shelf, continental break, slope and rise

2. Describe the continental shelf:

-extensions of the continent that can stretch into the water from a few meters up to_____ off the coast, they are usually full of sediments carried from rivers, these shelves were above _____ during ice ages but then flooded recently

3. Describe the continental break and slope:

-the break indicates a steep drop off and the continental slope can be shore and steep, continental slopes are usually bare of sediments due to the slope (see figure ____ page ___)

4. What is a submarine canyon?

-resemble canyons on land and are associated with continental rivers, sometimes _____ occur releasing large amounts of sediments (mud, sand, and water) to the deep sea floor due to earthquakes, or overloading of sediments

5.What is a continental rise?

-found at the base of the con. slope where an accumulation of sediments have been deposited due to _____

C. The Ocean Basin Floor

1. What % of Earth is made up of ocean basin floor, what about % of Earth for continents?

-Ocean basin floor: _____ (between 4000-6000 meters), Continents: _____ of the Earth's surface,

2.What is the abyssal plain?

-covered with sediments, ordinary and flat

3. What are abyssal hills?

-less than 1000 meters above the ocean floor,_____ feature on Earth

4. What are Seamounts, how are they related to coral reefs?

-steep sides underwater _____, some rising to the sea surface

-Barrier reefs colonize seamounts near the ocean surface eventually surrounding the island

-If the seamount begins to sink or erode the reefs grow upward creating an _____

5.What is a guyot?

-also called tablemounts, 3300-5600 ft. below ocean surface, flat shaped top indicates they were once above ocean surface

D. The Ridges and Rises

1.What is the difference between a ridge and a rise?

-Are found in every ocean extending across the globe, if the slope is steep= _____, if the slope are more gentle= _____

2.What is a rift valley?

-can be found at the top of these underwater mountain chains and are volcanically active

E. The Trenches

1.What are trenches and where are they found?

-Deepest sections of the ocean usually associated with volcanic mountain chains or island arcs (chain of volcanic islands, such as the Philippines)

-_____, is a portion of the Mariana Trench, recorded a depth of 11,020 meters

F. Measuring the Depths

1.How did early sailors make ocean soundings?

-Depth of oceans used to be measured in _____ (6 feet) by sending a rope to the bottom

2.How were soundings made after 1920?

-In the 1920's, the _____ was invented allowing for many deep sea measurements, sound waves are bounced off the bottom and timed to record depth

3.What has become the most precise way to make an ocean sounding?

-Satellite measurements have become even more precise with each new year

G. Sediments

1. How do oceanographers classify sediments?

-Sediments are deposited throughout the oceans from organisms, rivers, atmosphere etc., oceanographers classify them by their source, _____, place of deposit, particle size, age and color

H. Sediment Location

1.How are neritic and pelagic sediments different?

-_____ sediments- derived from land and sea and found on the continental shelf

-_____ sediments- deep sea sediments derived from land, found on the continental slope and abyssal plain

I. Sediment Sources and Chemistry

1.What are Lithogenous sediments

-derived from rock from the land, nearly half of these sediments come from the tropics due to such high rainfall and erosion, also called _____ or abyssal clay

2.What are Biogenous sediments?

- originated from living organisms, usually shells of _____, much of the deep sea are covered in single celled organisms called calcareous or siliceous depending on elements found (called ooze, if enough), depending on the chemistry of the water much of the biogenous sediments are dissolved before they reach the ocean floor

3.What are Hydrogenous sediments?

-created by seawater _____, such as carbonates, phosphorites and manganese nodules

4.What are Cosmogenouos sediments?

-iron- rich sediments that were originally meteors and meteorites, found in very low concentrations

J. Seabed Resources

1.List at least three important resources found in the ocean?

-Various minerals and other materials have been mined out of the oceans if profitable

-Sand is used for concrete and artificial beaches

-Oil and gas represent the majority of mining in the oceans due to our dependence for transportation and energy