NAME: _____

TECTONICS NOTES

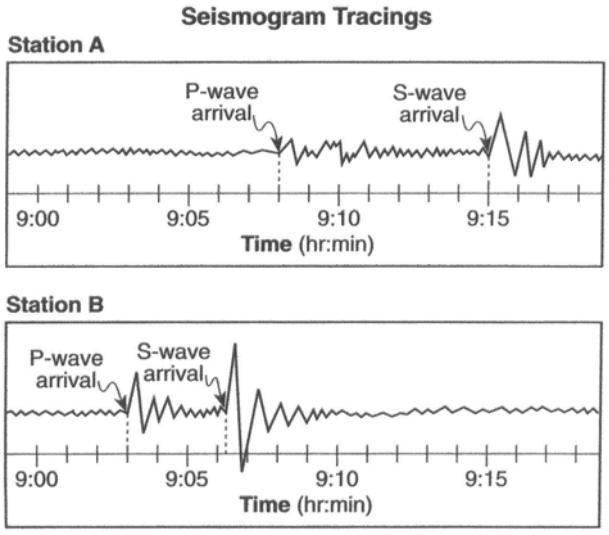
Log onto YouTube and search for **jocrisci** channel.

EARTH'S INTERIOR (Videos 5.1 ESRT 10)

1. What is the density of the continental crust?
2. What is the density of the oceanic crust?
3. What is the upper plastic part of the mantle called?
4. At what depth is the boundary between the mantle and the core?
5. Which zone of the Earth is found at each of the following depths: 6000 km? 4500 km?
6. What is the temperature at each of the following depths: 2000 km? 3000 km?
7. What is the pressure at each of the following depths: 1000 km? 2500 km?

EARTHQUAKES (Videos 5.2 ESRT 11 Study this!!)

1. Explain how the seismic tracings recorded at station A and station B indicates that station A is farther from the earthquake epicenter than station B.
2. Seismic station A is located 5,400 kilometers from the epicenter of the earthquake. How much time would it take for the first S-wave produced by this earthquake to reach seismic station A?
3. Using the difference in time for station A, determine how far away station A is located from the earthquake epicenter.
4. Using the difference in time for station B, determine how far away station B is located from the earthquake epicenter.



5. Using the two seismographs to the right, you would not be able to pinpoint the location of the epicenter. What **additional information** would you need? Once you had it what else would you do with it?

PLATE TECTONICS (Videos 5.3, 5.4, 5.5, 5.6 ESRT 5)

1. Pangaea is the name given to the supercontinent that existed 200 million years ago. What are **four** evidences that prove Pangaea did in fact exist? Be sure to explain your answer not just list them.
2. Be able to read and interpret page 5 ESRT which shows the various types of plate boundaries.
3. What type of plate boundary is shown in the diagram? How can you tell?
4. What part of Earth's mantle are the convection currents located?
5. As you go further from the mid-ocean ridge what happens to rock age?
6. How do the rocks located on either side of the mid-ocean ridge show that Earth's magnetic polarity has reversed?

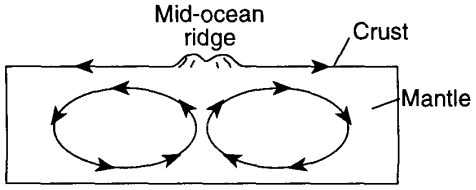


Plate Tectonics Facts

(ESRT pages 5, 10, 11)

Vid 5.1 ESRT 10

1. Ocean crust is / high density, young age, thin, mafic, and made of basalt (ESRT pg. 10)
2. Continental crust is / low density, old age, thick, felsic, & made of granite (think Mt. Everest)
3. Inferences about the Earth's layers and interior come from / studying seismic data
   Example: Mohorovicic found the asthenosphere due speed changes (density differences)

Video 5.2 ESRT 11!!

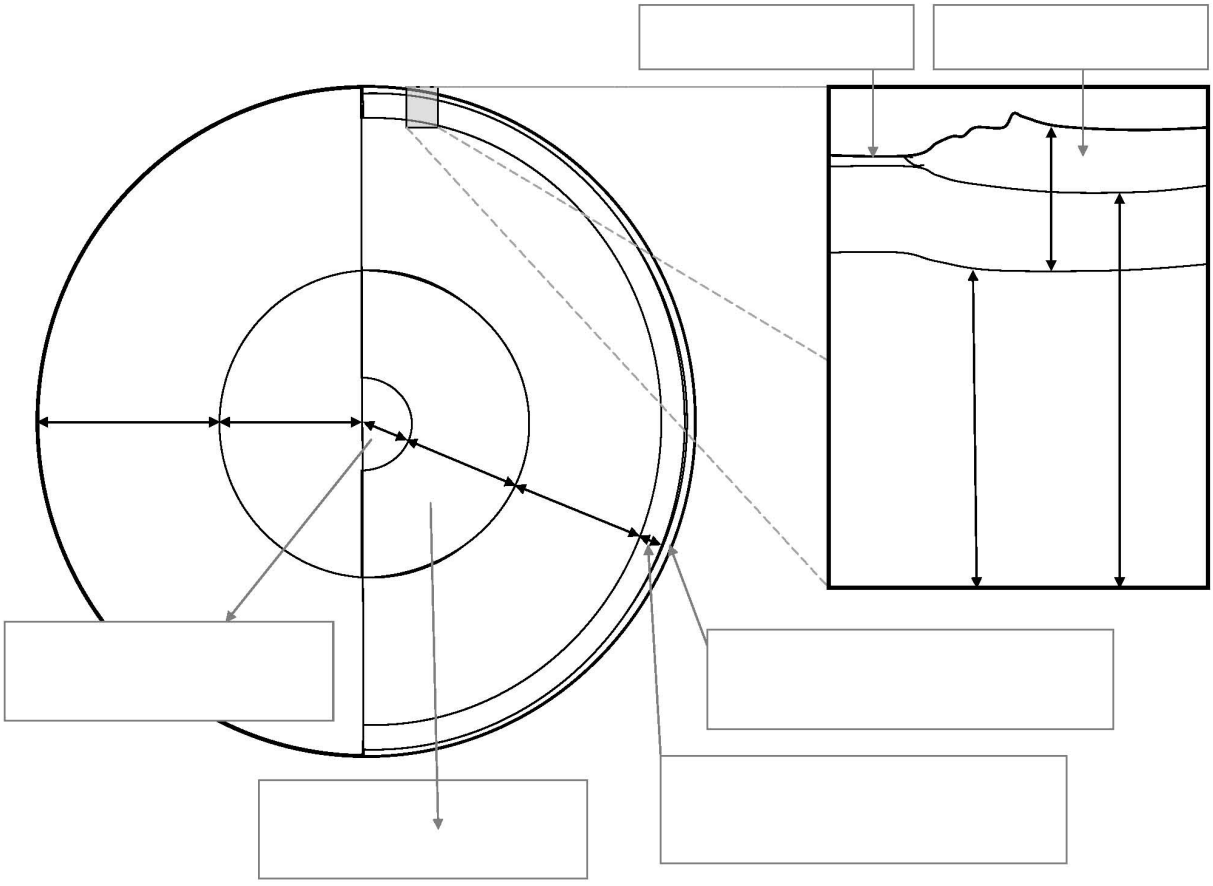
4. Earthquake is / the sudden movement of earth's crust along a fault
5. **Most earthquakes and volcanoes are located / at or near plate tectonic boundaries**
6. Prepare for an earthquake by / creating a plan, learn first aid, make buildings stronger
7. P-waves / faster than S- waves, travels through solids and liquids
8. S-waves / slower, S-motion, solids only (all start with S)
9. We know the outer core is liquid because / S-waves can't go through it
10. Use the difference in time of P and S waves to get / the distance to Epicenter (P-wave slide)
11. One seismograph can give you / epicenter distance (Big circles = Big distance)
12. To get the exact location of an epicenter you need / three seismographs

Video 5.3 – 5.6 ESRT 5

13. Proof of continental drift / continents fit together, fossils/rocks/mts. all match up along coasts, climate evidence (Palm tree fossil and Alfred Wegner)
14. Plate tectonics says / the earth's lithosphere is divided into pieces called plates that move
15. Plate tectonics is caused by / convection currents in the asthenosphere (upper mantle)
16. Divergent boundary / plates move away, forms a mid-ocean ridge or rift valley where magma rises (less dense) forming new rock (basalt)
17. The farther you go from the center of a ridge / the older the rocks get
18. Proof of sea floor spreading / (1) the age of the ocean floor is younger at the mid ocean ridges and gets older as you move away (2) Matching pattern of earth's magnetic polarity on either side of the ridge (Earth's poles have flipped in the past)
19. Convergent boundary / two plates come together forming a trench (volcanoes)
20. Subduction occurs at convergent plates because /ocean crust is more dense than continental
21. Transform boundary / plates slide past each other ex. San Andreas Fault
22. Hot spot / magma burns through middle of plate and forms a series of islands like Hawaii
23. Marine (shell) fossils in mountains prove / crustal uplift occurred (an uplifted sea floor)

Properties of Earth's Interior

EARTH'S LAYERED STRUCTURE



Fact(s) to memorize: 1 - 3

Earth's interior _____

ESRT page _____

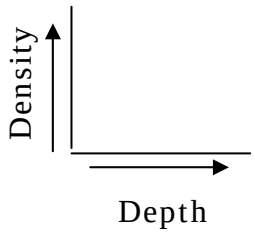
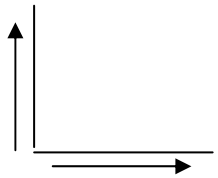
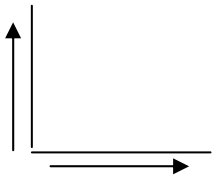
Determine the following:	Density	Composition / Rock Type
Continental Crust	g/cm^3	
Oceanic Crust	g/cm^3	

MOHO - _____

_____

Layer	Density Range (g/cm^3)	Pressure Range (millions of atmospheres)	Temperature Range (˚C)
Mantle	-	-	-
Outer Core	-	-	-
Inner Core	-	-	-

State and **draw** the following relationships:

Depth vs. Density	Depth vs. Pressure	Depth vs. Temperature
As depth increases, density	As	As
		

Determine the following by referring to the Earth Science Reference Tables page 10, "Inferred Properties of Earth's Interior"

1. What two layers make up the lithosphere? _____
2. Name the two elements that compose the inner core. _____
3. Which layer is a liquid? _____ Explain how you can tell by looking at the chart. _____

_____

4. What is the pressure at the stiffer mantle and outer core boundary? _____ mil atm.
5. What is the temperature at a depth of 3000 km? _____ °C
6. What is the temperature at a depth of 500 km? _____ °C

7. What is the pressure at a depth of 5000 km? _____ mil of atm
8. What is the temperature at a depth of 1000 km? _____ °C
9. What is the pressure at a depth of 3500 km? _____ mil of atm
10. What is the temperature at a depth of 5000 km? _____ °C
11. What is the pressure at a depth of 1000 km? _____ mil of atm
12. What is the temperature at a depth of 4500 km? _____ °C
13. Name the layer where the temperature is 4000 ºC _____
14. Name the layer where the temperature is 6000 ºC _____
15. Name the layer where the pressure is 3.5 million atmospheres _____
16. Name the layer where the pressure is 2.4 million atmospheres _____
17. Name of the mountains next to the trench on the diagram _____

Earthquakes

Fact(s) to memorize: 4 - 6

1. What is an earthquake? _____

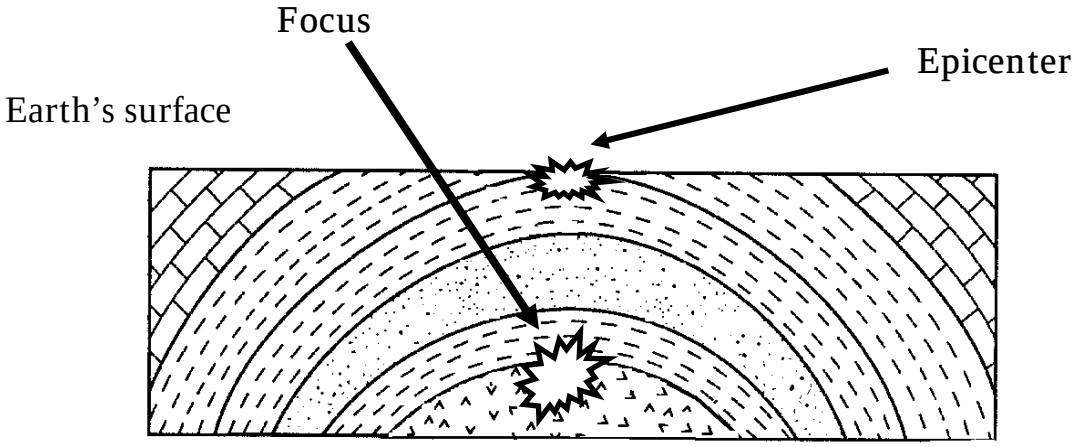
2. Possible causes? _____

3. Damages _____

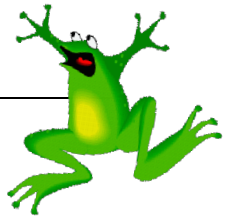
4. Focus _____

5. Epicenter _____

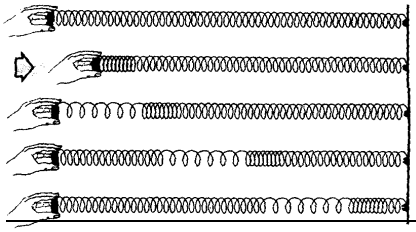
6. Most earthquakes and volcanoes occur at or near _____



Fact(s) to memorize: 7 - 9



Two Main Types of Earthquake Waves

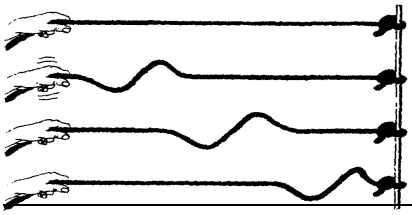


P – waves:

(1)

(2)

(3)



S – waves:

(1)

(2)

(3)

Measuring an Earthquake:

Richter scale - _____

_____

_____

_____

_____

Mercalli Scale - _____

_____

_____

_____

_____

_____

Richter number	Increase in Magnitude
1	1
2	10
3	100
4	1,000
5	10,000
6	100,000
7	1,000,000
8	10,000,000
9	100,000,000

Reading the Earthquake P-wave and S-wave Travel Time Chart, ESRT page 11

1. How long does it take a P-wave to travel 2,000 km? _____ min _____ sec
2. How long does it take an S-wave to travel 2,000 km? _____ min _____ sec
3. How far can an S-wave travel in 11 minutes? _____ km
4. How far can a P-wave travel in 11 minutes? _____ km
5. How long does it take a P-wave to travel 6,000 km? _____ min _____ sec
6. How far can an S-wave travel in 9 minutes 40 sec? _____ km

State how long it takes for the P-wave and the S-wave to travel the distances listed below:

Distance	P – Wave Travel Time		S – Wave Travel Time	
7,000 km	min	sec	min	sec
3,900 km	min	sec	min	sec
2,000 km	min	sec	min	sec
1,600 km	min	sec	min	sec
2,100 km	min	sec	min	sec
8,200 km	min	sec	min	sec
3,500 km	min	sec	min	sec

State how far a P-wave and an S-wave can travel in each given time below:

Given Time		P – Wave Distance	S – Wave Distance
4 min	20 sec	km	km
12 min	00 sec	km	km
6 min	20 sec	km	km
8 min	30 sec	km	km
10 min	20 sec	km	km
5 min	50 sec	km	km
9 min	40 sec	km	km

Determining the arrival time differences between P-waves and S-waves using the chart:

1. _____

2. _____

3. _____

4. _____

Determine the difference in arrival time for each of the following:

8,000 km	min	sec
5,200 km	min	sec
9,600 km	min	sec
400 km	min	sec
6,400 km	min	sec

3,200 km	min	sec
1,800 km	min	sec
4,400 km	min	sec
2,100 km	min	sec
7,200 km	min	sec

Determining distance of an earthquake by using differences in P-wave and S-wave arrival times.

1. _____

2. _____

3. _____

4. _____

How far away is the epicenter if the difference in arrival time is . . .

3	min	20	sec		km	5	min	40	sec		km
6	min	00	sec		km	2	min	30	sec		km
8	min	40	sec		km	10	min	00	sec		km
10	min	20	sec		km	3	min	00	sec		km
5	min	00	sec		km	3	min	40	sec		km
1	min	40	sec		km	6	min	40	sec		km

Questions:

5. A seismic recording station recorded the difference between the arrival times of a P and S-wave to be 6 min 40 sec. How far away is the epicenter from this seismic recording station?

   _____ km

6. A seismic recording station recorded the difference between the arrival times of a P and S-wave to be 9 min 20 sec. How far away is the epicenter from this seismic recording station?

   _____ km

7. A seismic recording station recorded the difference between the arrival times of a P and S-wave to be 2 min 40 sec. How far away is the epicenter from this seismic recording station?

   _____ km

Determining the difference in P-wave and S-wave arrival times.

- Subtract the P-wave arrival time from the S-wave arrival time.

Example 1: A seismic recording station recorded an earthquakes P-wave at 1:00:20. The S-wave arrived shortly after 1:04:40. How far away is the epicenter from this seismic recording station?

S wave arrival time _____

P wave arrival time _____

Difference _____

Using the procedure on page 8 determine the distance to the epicenter _____ km

Example 2: A seismic recording station recorded an earthquake's P-wave at 10:08:00. The S-wave arrived shortly after 10:15:40. How far away is the epicenter from this seismic recording station?

S wave arrival time _____

P wave arrival time _____

Difference _____

Using the procedure on page 8 determine the distance to the epicenter _____ km

- If the S-wave arrival time minutes or seconds are less than the P-waves, you will need to borrow "time".
- REMEMBER: there are 60 seconds in a minute and 60 minutes in an hour.

Example 1: A seismic recording station recorded an earthquakes P-wave at 3:59:40. The S-wave arrived shortly after 4:05:40. How far away is the epicenter from this seismic recording station?

S wave arrival time _____

P wave arrival time _____

Difference _____

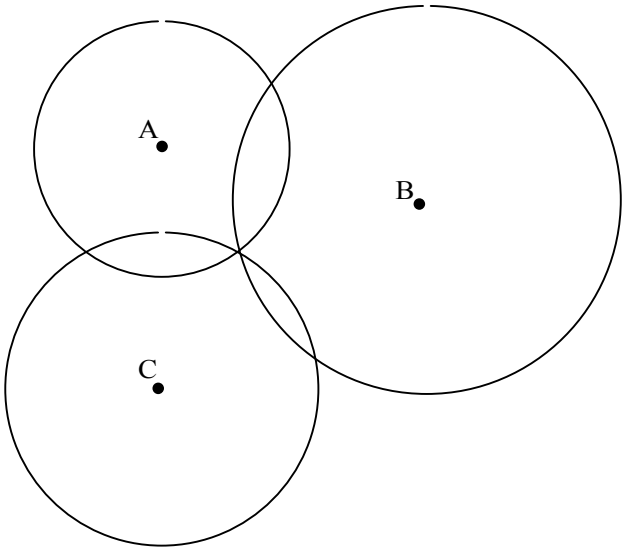
Using the procedure on page 8 determine the distance to the epicenter _____ km

Fact(s) to memorize: 10 - 12

Locating the Epicenter

A minimum of _____ seismic stations are needed to locate an earthquake epicenter.

- One seismic station gives you _____ only, and _____
- Two stations may give you ____ possible locations where the two circles intersect
- When _____ stations are used, the epicenter is where they all _____



a. Which seismic station is closest to the epicenter? _____
How can you tell by the diagram?

_____

b. Which seismic station is farthest away from the epicenter? _____
How can you tell by the diagram?

_____

c. Describe where the epicenter is.

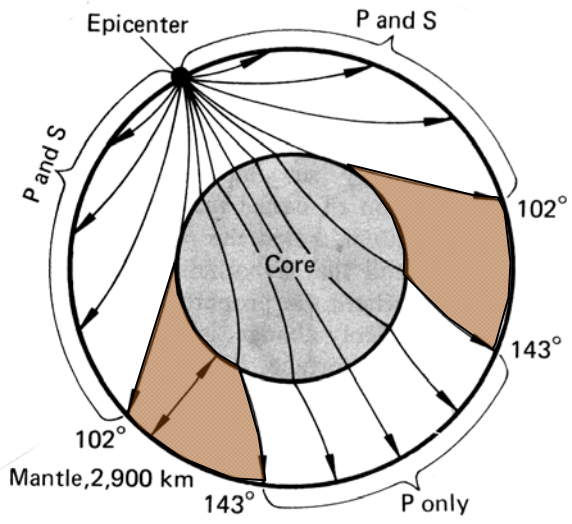
_____

_____

d. Place an "X" at the epicenter.

Shadow Zone Diagram

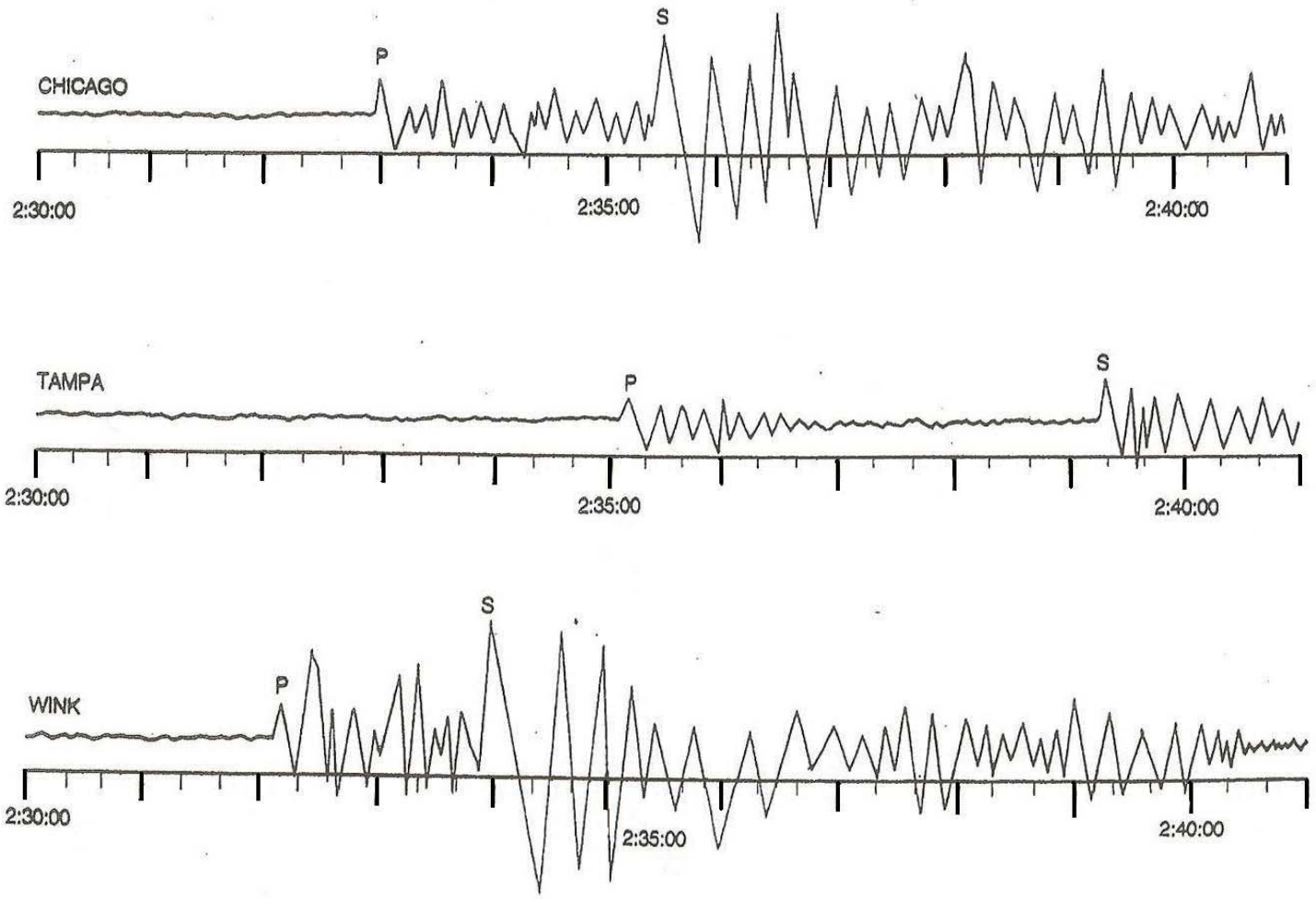
As P-waves and S-waves pass through different layers within Earth's interior they are _____ due to differences in _____



Some areas on Earth's surface only receive P-waves, because S-waves can only travel through _____ and the _____ is liquid.

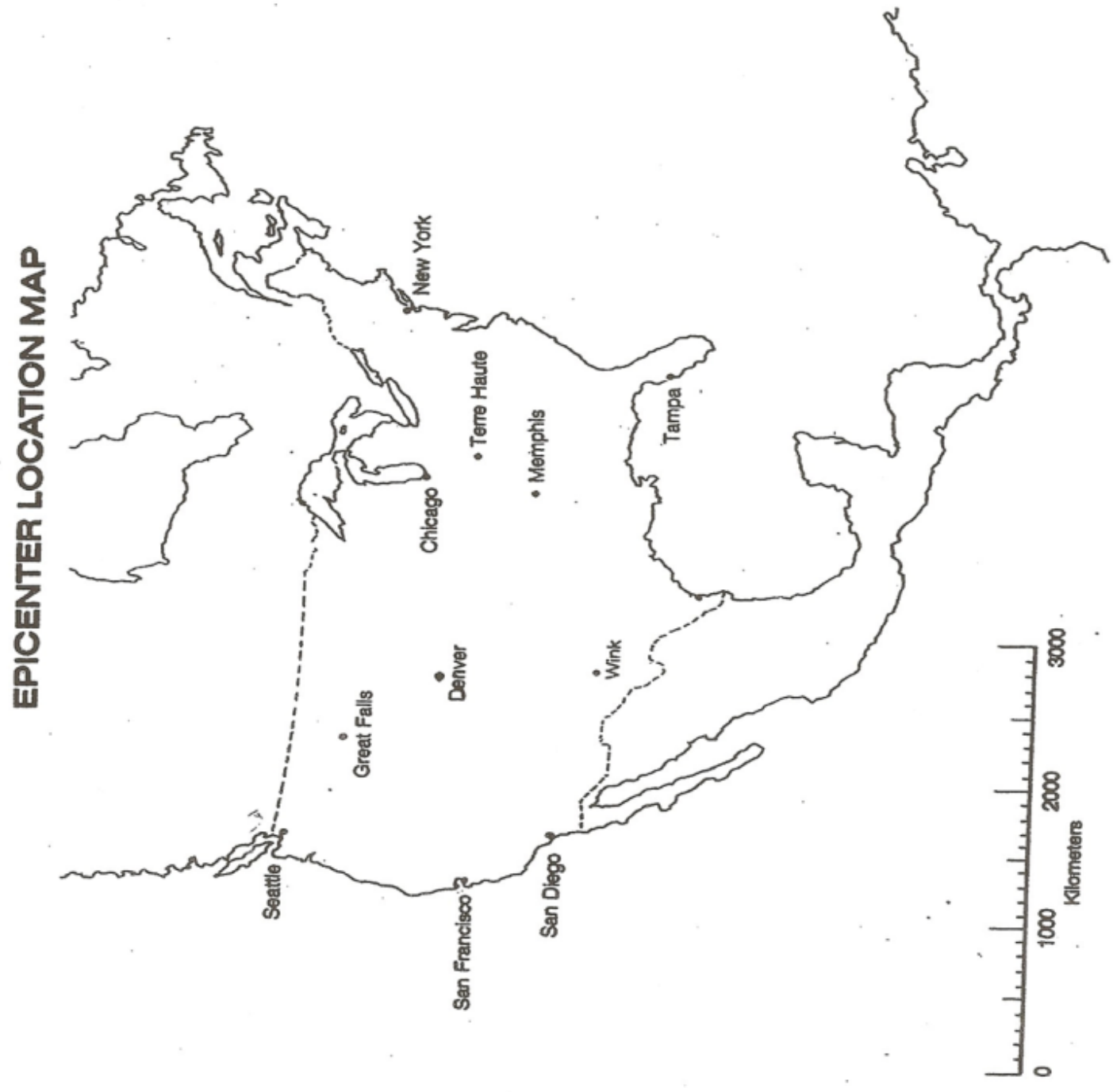
Other sections on Earth's surface receive no earthquake waves because of the way the waves _____ within the Earth.

These areas are known as the _____



DATA CHART

Seismograph Station	P-Wave Arrival Time (hr, min, sec)	S-Wave Arrival Time (hr, min, sec)	Difference in Arrival Time (min. & sec.)	Distance to Epicenter (km)	P Wave Travel Time (min. & sec.)
CHICAGO					
TAMPA					
WINK					


EPICENTER LOCATION MAP
Seattle
San Francisco
San Diego
Great Falls
Denver
Chicago
Terre Haute
Memphis
New York
Wink
Tampa
0
1000
2000
3000
Kilometers

Practice Using ESRT page 11 IMPORTANT!

For use with type 1A and 1B Questions:

1. How far will a P-wave travel for these times:

   3:00: _____ 9:40: _____ 7:20: _____ 5:00: _____

2. How far will an S-wave travel for these times:

   2:20: _____ 9:20: _____ 8:30: _____ 16:00 _____

3. How long does it take to a P-wave to travel these distances:

   1600 km: _____ 3000 km: _____ 4200 km: _____ 6400: _____

4. How long does it take to an S-wave to travel these distances:

   1900 km: _____ 7400 km: _____ 2700 km: _____ 4800: _____

For use with type 2A and 2B Questions:

5. Find the difference between the S-wave and P-wave arrival times below:

S^A: 14:28:54	S^A: 07:35:42	S^A: 09:27:20	S^A: 23:58:35	S^A: 19:27:02
-P^A: 14:25:31	P^A: 07:30:24	-P^A: 09:22:46	-P^A: 23:51:44	P^A: 19:24:46
(a)_____	(b)_____	(c)_____	(d)_____	(2)_____

6. For each difference above determine the distance to the epicenter:

(a)_____ (b)_____ (c)_____ (d)_____ (e)_____

7. For each distance below, determine the difference in arrival times between the S-wave and P-wave arrival times:

   2800 km: _____ 4600 km: _____ 5200 km: _____ 6300 km: _____

For use with type 3 Questions:

8. Add the travel time to the origin time:

12:38:24	02:45:12	00:08:40	11:19:46	15:27:56
+ 3:17	+ 5:39	+ 7:24	+ 22:35	+ 9:36

Using the Earthquake P-wave and S-wave Travel Time Graph…These start easy and get more difficult.

Type 1A Problem

1. How long would it take a P-wave to arrive at a seismic station if the station is 2000km from the epicenter of an earthquake? _____

Explain how you do this type of problem:

2. How long would it take a P-wave to arrive at a seismic station if the station is 8000km from the epicenter of an earthquake? _____

3. How long would it take an S-wave to arrive at a seismic station if the station is 2000km from the epicenter of an earthquake? _____

4. How long would it take an S-wave to arrive at a seismic station if the station is 7000km from the epicenter of an earthquake? _____

Type 1B Problem

1. If it took a P-wave 6 minutes to arrive at a seismic station, how far are you from the epicenter of an earthquake? _____

Explain how you do this type of problem:

2. If it took an S-wave 8 minutes to arrive at a seismic station, how far are you from the epicenter of an earthquake? _____
3. If it took a P-wave 9 minutes to arrive at a seismic station, how far are you from the epicenter of an earthquake? _____
4. If it took an S-wave 14 minutes to arrive at a seismic station, how far are you from the epicenter of an earthquake?

Type 2A Problem

1. A seismograph indicates the difference between the arrival of S-waves and P-waves to be 4 minutes. What is the distance of the seismograph station from the earthquake's epicenter? _____

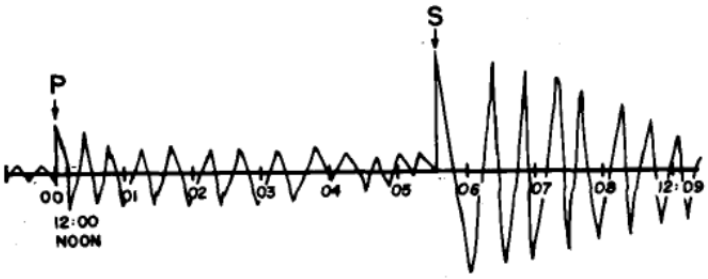
Explain how you do this type of problem:

2. How far from an earthquake epicenter is a city where the difference between the P-wave and S-wave arrival times is 6 minutes and 20 seconds? _____

3. Following an earthquake, a seismograph station recorded the arrival of a P-wave at 3:09:30 a.m. and a S-wave at 3:14:00 a.m. What is the distance from the seismograph station to the epicenter of the earthquake? _____

4. The seismogram to the right shows the arrival times of P- and S-waves from a single earthquake. How far from the earthquake epicenter was the station that recorded this seismogram?

_____



Type 2B Problem

1. What is the difference in time between the P and S wave if you are 2000km from the epicenter of an earthquake? _____

Explain how you do this type of problem:

2. A seismic station is 5000km from the epicenter of an earthquake. How long after the arrival of P-waves did the S-waves arrive? _____

3. What is the difference in time between the P and S wave if you are 8000km from the epicenter of an earthquake? _____

Type 3 Problem

1. A seismic station 2000km from the epicenter of an earthquake records the arrival of the first P-wave at 8:00:00 (8 o'clock am). At what time did the first S-wave arrive at this station?

   _____

   Explain how you do this type of problem:

2. A seismic station 5000 kilometers from the epicenter of an earthquake records the arrival time of the first P-wave at 11:00:00 (11 o'clock am). At what time did the first S-wave arrive at this station?

   _____

3. A seismic station 2000 kilometers from the epicenter of an earthquake records the arrival time of the first P-wave at 1:00:00 (1 o'clock am). At what time did the first S-wave arrive at this station?

   _____

Type 4 Problem

1. (Travel BACK in time…) A seismograph station recorded the arrival of the first P-wave at 8:01pm from an earthquake that occurred 4000km away. What time did the earthquake occur?

   _____

   Explain how you do this type of problem:

2. A seismograph station recorded the arrival of the first P-wave at 7:06am from an earthquake that occurred 2000km away. What time did the earthquake occur?

   _____

3. A seismograph station recorded the arrival of the first P-wave at 10:15:40am from an earthquake that occurred 3000km away. What time did the earthquake occur?

   _____

Fact(s) to memorize: 13 - 15

Plate Tectonics

Continental Drift: _____

_____

_____

_____

_____

_____

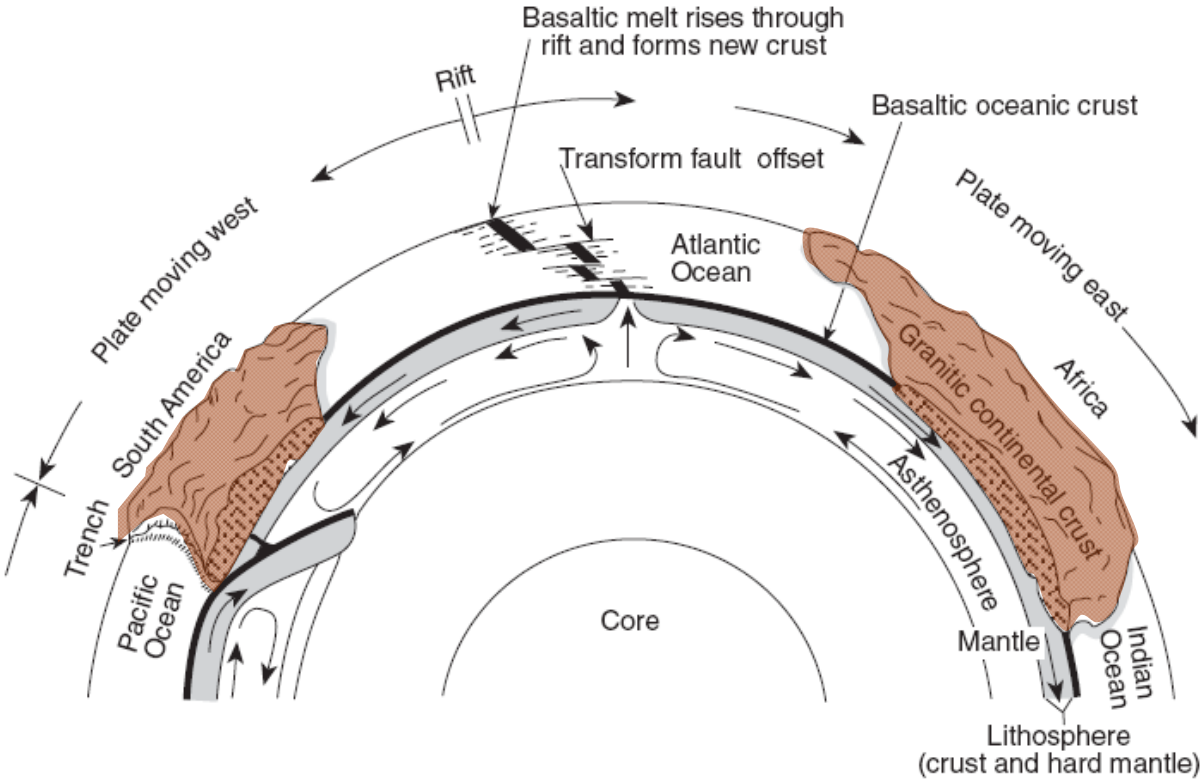
Pangea _____

_____

Evidence for Continental Drift

Movement of Plates

Fact(s) to memorize: 13 - 15



(Not drawn to scale)

Convection currents _____

Rising currents _____

_____

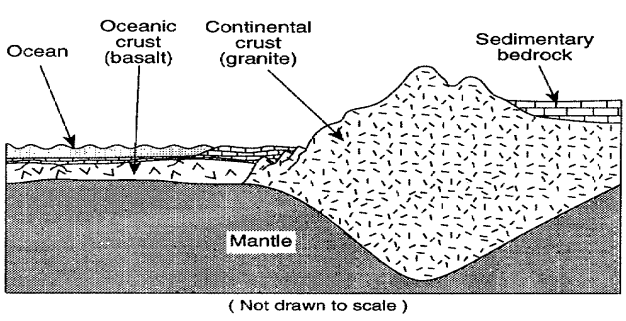
_____

Falling currents _____

_____

_____

	Continental Crust	Oceanic Crust
Composition		
Density		
Thickness		



Fact(s) to memorize 16 - 21

Types of Plate Boundaries

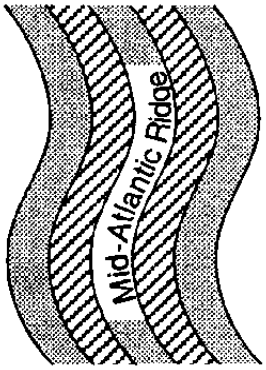
Type of Boundary	Sketch of Boundary	Direction of Movement	Description/Features of Plate Boundary (ex. Volcano chains or large earthquakes)	Examples (Use page 5 of ESRT to find examples.)
Divergent Plate Boundary				
Transform Boundary				
Convergent Plate Boundary (Collision, no subduction)	Continental-Continental			
Convergent Plate Boundary (Subduction)	Oceanic-Continental or Oceanic-Oceanic			

Fact(s) to memorize: 16 - 21

Evidence that pates are moving apart:

Normal Polarity

Reversed Polarity



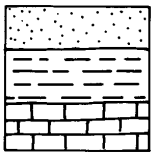
Fact(s) to memorize: 22 & 23

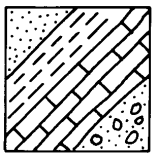
MORE Evidence for crustal movement:

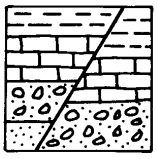
Bench Marks

Uplift of fossils

Looking at Rock Strata







Hot spot:

Plate Tectonics

Welcome to the wonderful world of plate tectonics!

Purpose: To understand the Plates of the World and how they interact with each other.

Instructions: Turn to your ESRT pg. 5. *Neatness Matters!!!* **Use Map Key to help you.** Follow the instructions in order:

1. With a ***SMALL*** star, mark where we are located. With *ANOTHER* ***SMALL*** star, mark where you are from.
2. In ***YELLOW, highlight*** all HOT SPOTS:
    a. HAWAII HOTSPOT
    b. YELLOWSTONE HOTSPOT
    c. GALLAPAGOS HOTSPOT
    d. CANARY ISLANDS HOTSPOT
    e. TASMAN HOTSPOT
    f. EASTER ISLAND HOTSPOT
    g. ST. HELENA HOTSPOT
    h. BOUVET HOTSPOT
    i. ICELAND HOTSPOT
3. HIGHTLIGHT **ALL** Plate Boundaries (on map AND key) tracing boundary with appropriate highlighters:
    a. Divergent Boundary – Blue highlighter
    b. Convergent Boundary – Green highlighter
    c. Transform Boundary – Yellow highlighter
4. Using a straight edge and a pen, draw in the **equator** and the **Prime Meridian**.
5. ***LIGHTLY*** Color the Plates (Color the entire plate, includes both ocean floor and continent):
    a. PACIFIC PLATE – *Yellow*
    b. INDIAN-AUSTRALIAN PLATE – *Orange*
    c. NORTH AMERICAN PLATE – *Brown*
    d. ANTARCTIC PLATE – *Blue*
    e. SOUTH AMERICAN PLATE – *Purple*
    f. AFRICAN PLATE – *Pink* (on both sides of map)
    g. EURASIAN PLATE– *Green* (on both sides of map)
    h. JUAN DE FUCA PLATE – *Blue*
    i. PHILIPPINE PLATE – *Red*
    j. FIJI PLATE – *Red*
    k. COCOS PLATE – *Blue*
    l. CARIBBEAN PLATE – *Pink*
    m. NAZCA PLATE – *Green*
    n. SCOTIA PLATE – *Yellow*
    o. SANDWICH PLATE – *Dark Yellow*
    p. ARABIAN PLATE – *Brown*

Instructions: Use Page 5 of the ESRTs to answer the following questions

1) Draw the symbol for each of the boundary/activity types listed below. Make sure to label when necessary (i.e. Convergent boundaries have an overriding plate and subducting plate)

Convergent	Divergent	Transform

Complex	Mantle Hotspot

2) What type of plate boundary exists between the following:

a) North American Plate & Eurasian Plate: _____

b) South American Plate & Nazca Plate: _____

c) San Andreas Fault: _____

d) Antarctic Plate & Indian-Australian Plate: _____

e) Arabian Plate & Eurasian Plate: _____

f) Scotia Plate & Antarctic Plate: _____

g) Pacific Plate & Philippine Plate: _____

3) ***Determine which plate is the <u>overriding plate</u> and which is the <u>subducting plate</u>:***

a) Eurasian Plate:_____ & Indian-Australian Plate:_____

b) Pacific Plate: _____ & North American Plate: _____

c) Cocos Plate: _____ & Caribbean Plate: _____

d) Nazca Plate: _____ & South American Plate: _____

e) Juan De Fuca Plate: _____ & North American Plate: _____

f) Eurasian Plate: _____ & Pacific Plate: _____

g) Fiji Plate: _____ & Indian-Australian Plate: _____

4) ***Determine the <u>latitude</u> and <u>longitude</u> of each of the following. Be sure to include units and compass directions.***

a) Tasman Hot Spot: _____ _____

b) Easter Island Hot Spot: _____ _____

c) Hawaii Hot Spot: _____ _____

d) St. Helena Hot Spot: _____ _____

e) Canary Islands Hot Spot: _____ _____

f) Iceland Hot Spot: _____ _____

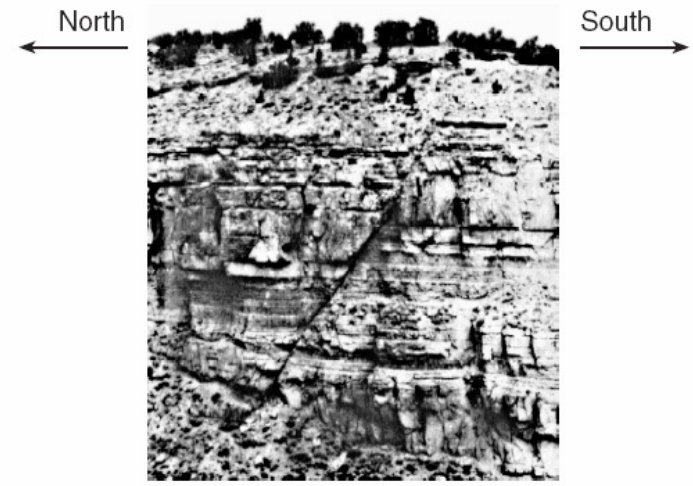
g) Bouvet Hot Spot: _____ _____

h) Galapagos Hot Spot: _____ _____

5) ***Why does Japan experience a large amount of tectonic activity while the east coast of the United States barely experiences anything? (Cite specific evidence from page 5 of the ESRTs to support your answer).***

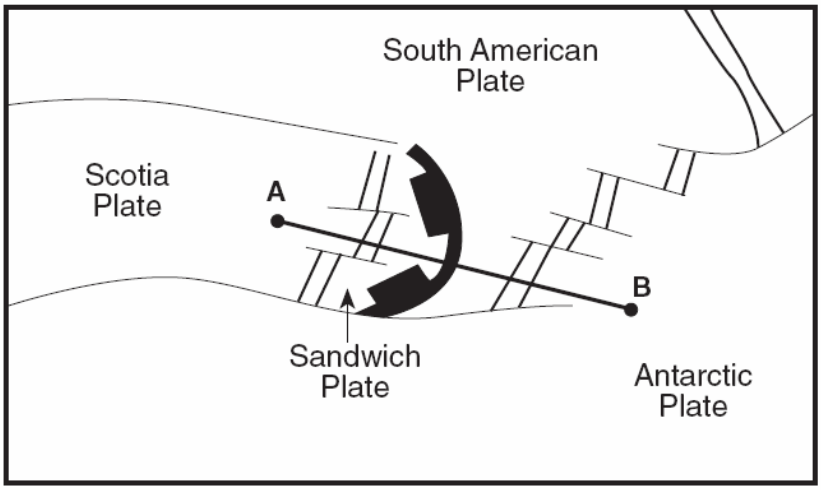
Dynamic Crust Review

Use the picture to the right to answer questions 1-3.



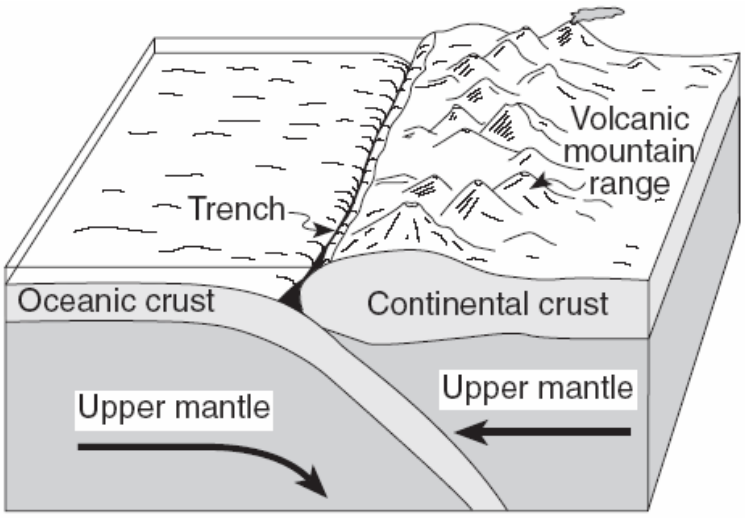
1. Label the fault in the diagram
2. What could have caused that diagonal crack or fault in the layers?
3. Which side went UP in the diagram?

Use the diagram to the right to answer questions 4-5.



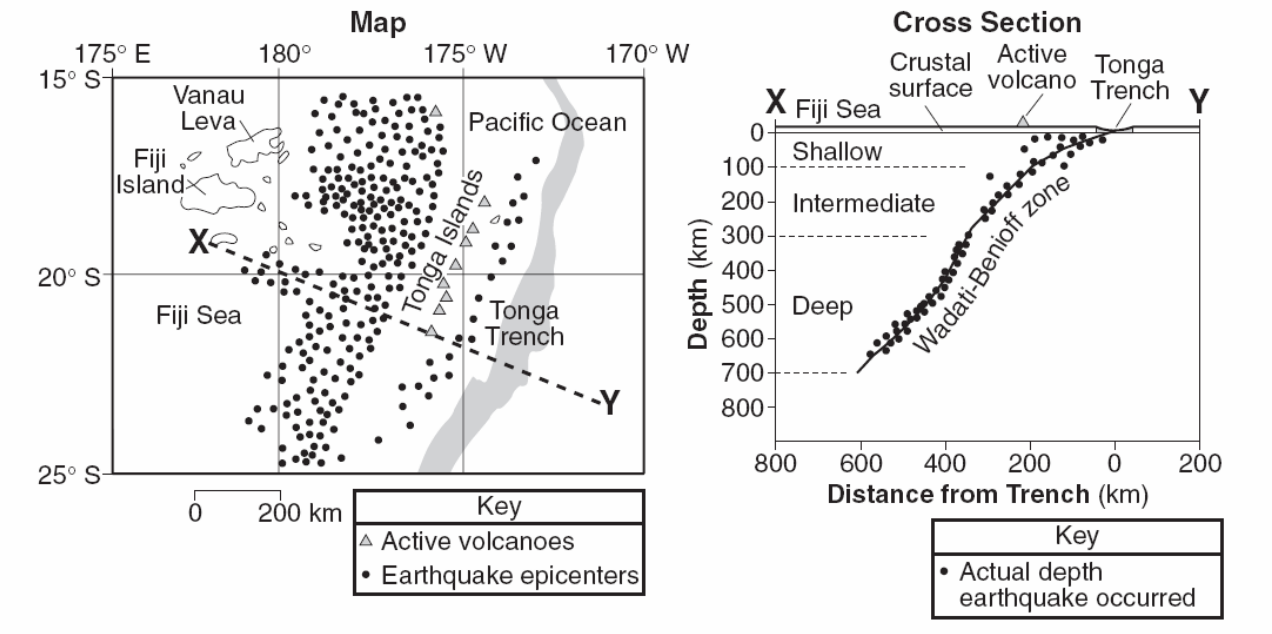
4. As you travel from point A to point B, name the plate boundaries you pass.
5. What is the latitude and longitude of the Sandwich Plate?

Use the diagram below to answer questions 6-10.



6. What is the density of the oceanic crust?
7. What type of boundary is in the diagram?
8. Label with small X's where earthquakes usually occur.
9. What is the specific name of the trench in the diagram?
10. What type of rocks are most of the continents made of?

Use the diagrams below to answer questions 11-13.



11. How did the Tonga Islands form?

12. Using arrows on the CROSS SECTION picture draw the motion of the plates.

13. Name the two plates on either side of the Tonga Trench at this location.

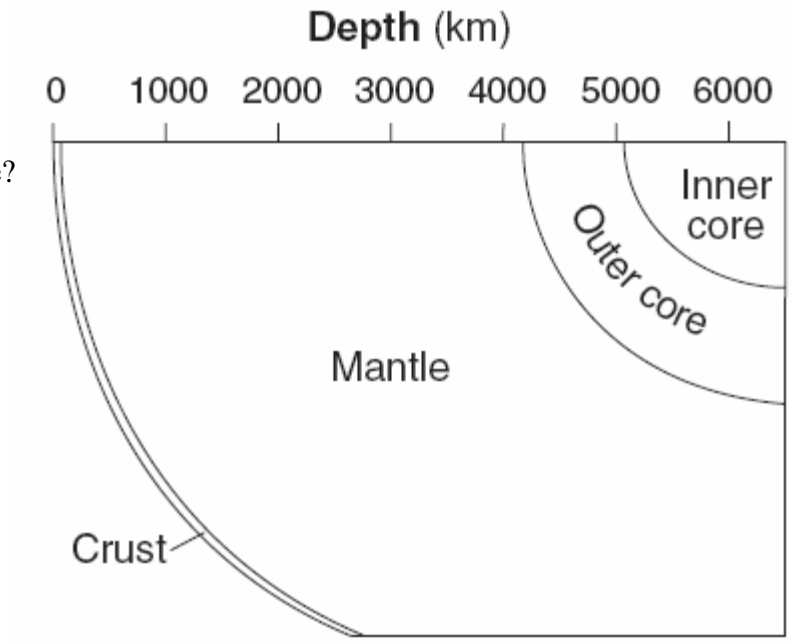
Use the diagram below to answer question 14-18.

14. At what depth below the surface does The inner core begin?

15. Approximately how thick is the mantle?

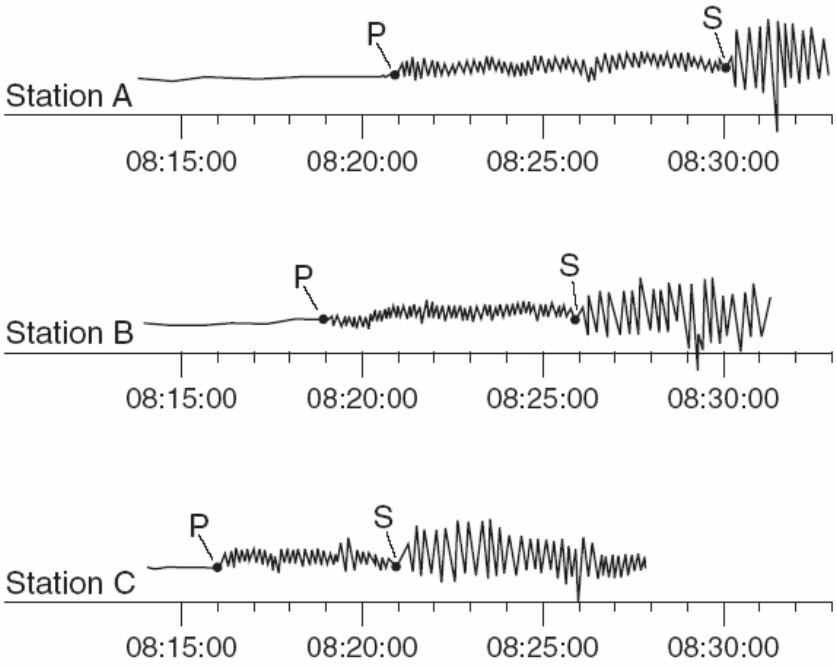
16. Which portion of the Earth's interior prevents or absorbs an earthquake's S-wave?

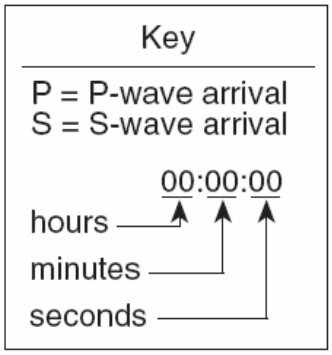
17. Which layer of the Earth's interior has a density of 9.9-12.1 g/cm^3?



18. What is the pressure at the interface between the outer core and the mantle?

Use the information below to answer questions 19-22.





19. What is the difference in arrival times of the P and S waves at station A?

20. Which location is closest to the epicenter?

21. How far from the epicenter is location B?

22. What is the P-wave travel time at location C?

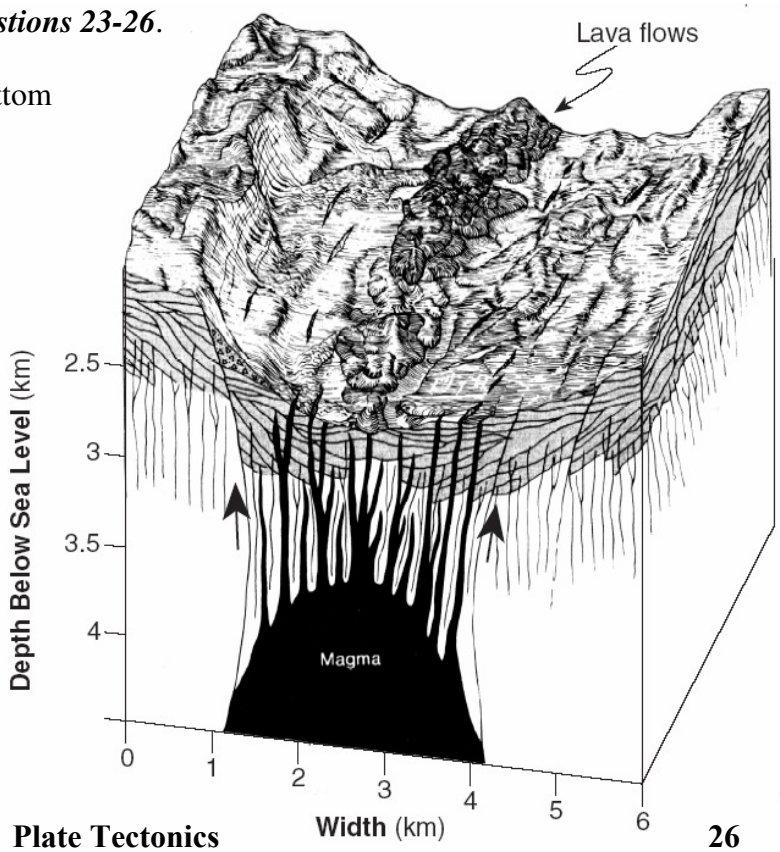
Use the diagram to the right to answer questions 23-26.

23. How thick is the magma near the bottom of the diagram?

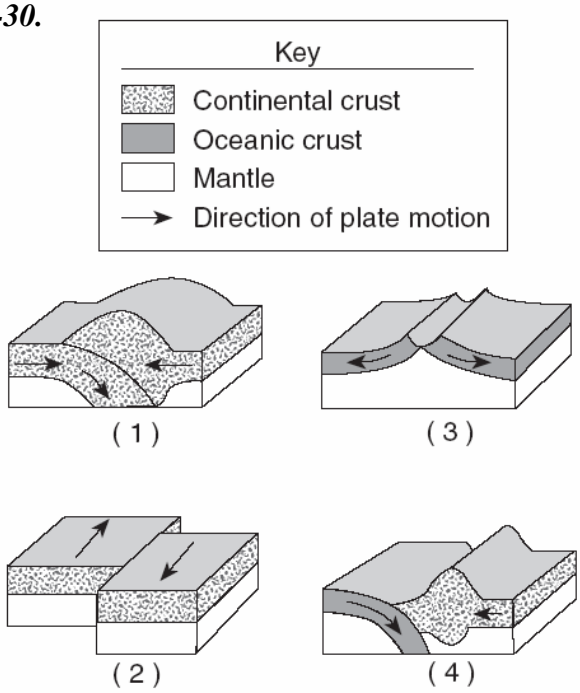
24. What is the difference between lava and magma?

25. If the lave flows are rich in PYROXENE and OLIVINE, what rock is it?

26. Why does the magma rise?



Use the following pictures to answer questions 27-30.



27. Which choice is the Mid-Atlantic Ridge?

28. Which choice is the San Andreas Fault?

29. Which choice is the Peru-Chile Trench?

30. Which choice is the Himalayan Mountains?

31. Fill in the following chart.

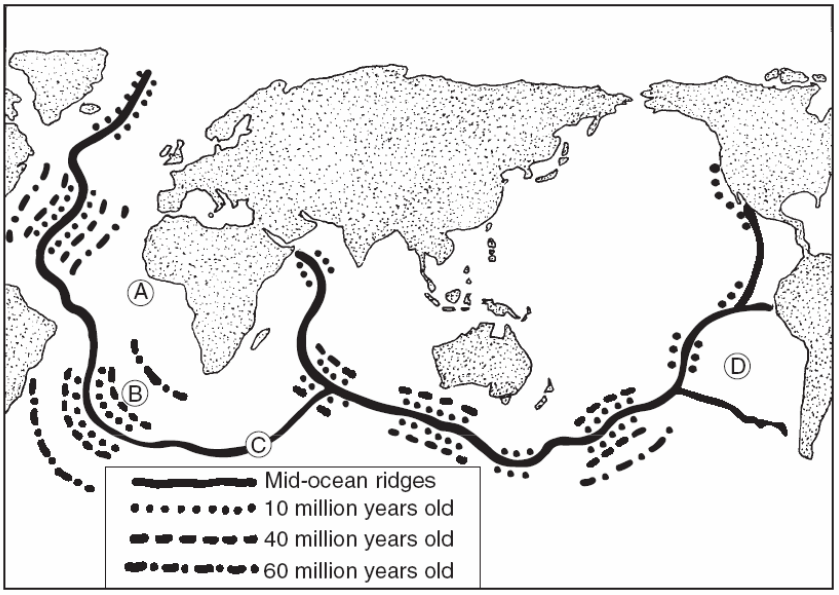
Seismic Station	*P*-Wave Arrival Time	*S*-Wave Arrival Time	Difference in Arrival Times	Distance to Epicenter
A	08:48:20	No *S*-waves arrived		
B	08:42:00		00:04:40	
C	08:39:20		00:02:40	
D	08:45:40			6,200 km

Use the picture to the right to answer questions 32-34.

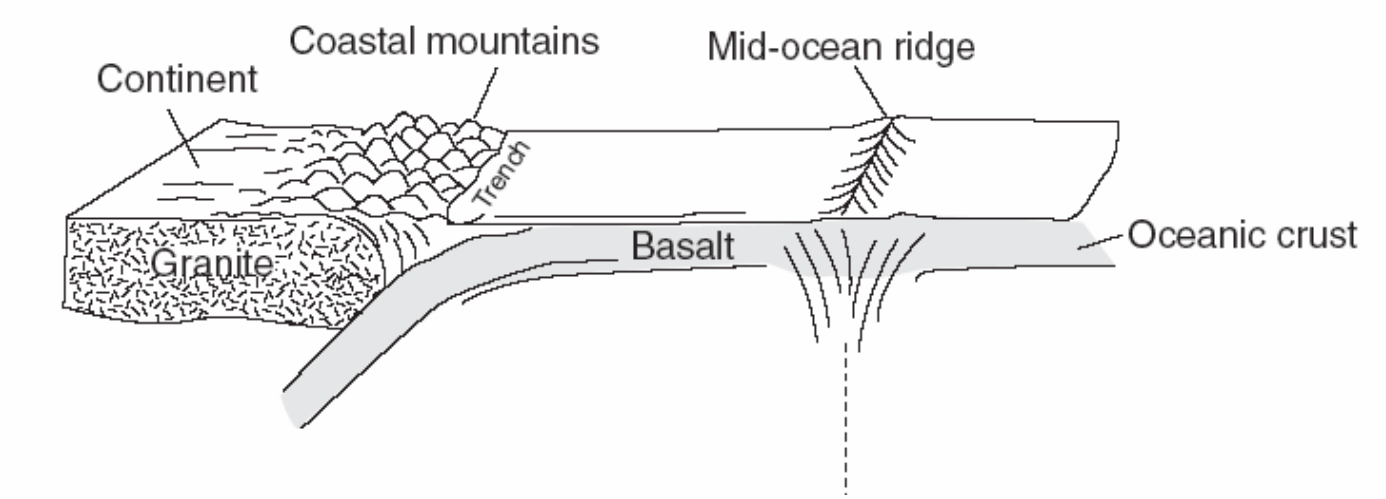
32. Which location has the youngest rock?

33. What is the approximate age of rock B?

34. Why will A and D have fewer earthquakes than C?



35. Draw the convection cells on the diagram below.



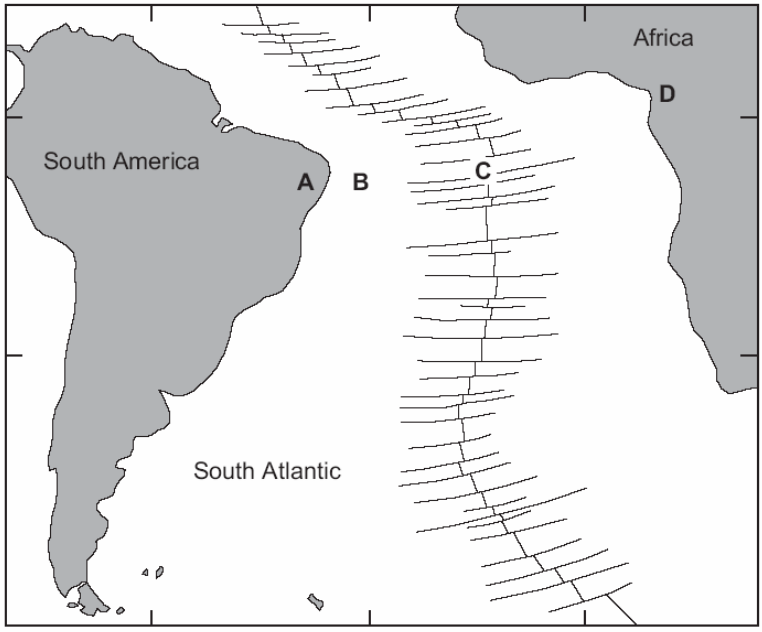
Use the following picture to answer questions 36-39.

36. How does the age of B compare to C?

37. How does the density of A compare to B?

38. What type of boundary is C?

39. What is the name of location C?



40. What could explain this overturning?