Section 11: Detecting Earthquake Waves

Jose wandered to Scott's house. It is 12 miles from Jose's house to Scott's house. It took Jose 3 hours to get there. How fast did Jose go?

It took Katherine 5 hours to ride to Sean's house at 3 miles per hour. How far is it between Katherine's house and Sean's house?

A bus traveling at an average rate of 50 kilometers per hour made the trip to town in 6 hours. If it had traveled at 45 kilometers per hour, how many more minutes would it have taken to make the trip?

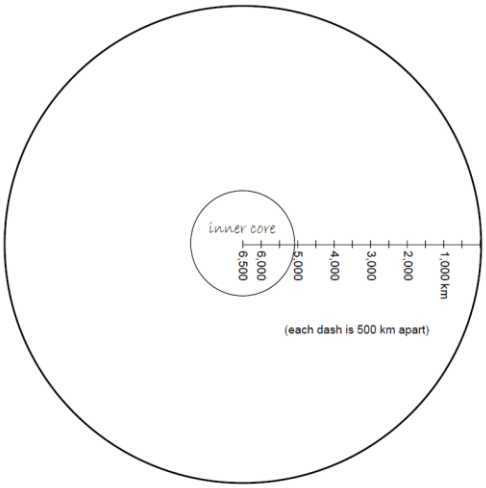
Two planes leave the same point at 8 AM. Plane 1 heads East at 600 mph and Plane 2 heads West at 450 mph. How long will they be 1400 miles apart? At what time will they be 1400 miles apart? How far has each plane traveled?

What is the formula for calculating Distance?

Section 5 Question: How can specific observations of P and S Waves determine earthquake epicenters?

What Do You See?
(cartoon)

What Do You Think?
How do earthquake waves travel?



What Do You Think Now?

Focus Question A: How does a seismometer measure the motion of an earthquake?
Predict: What is the direction of movement when a P-wave arrives? A S-wave?
Observe: (Gently shake the box in a side to side motion) (Gently shake the box in an up and down motion)
Explain: (How are these motions similar to what you observed in section 10?)

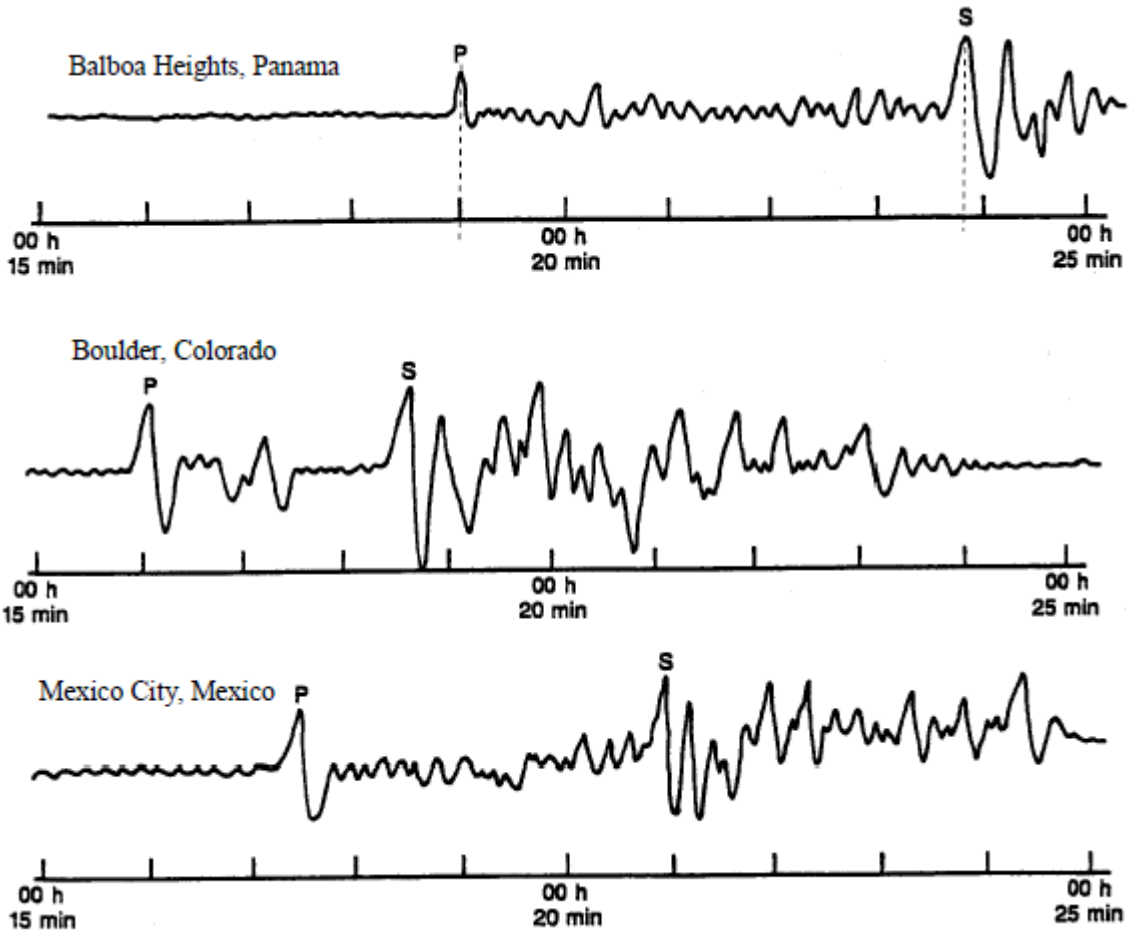
Focus Question B: How can you use Earthquake data to find the epicenter of an earthquake?

Earthquake Data:

Earthquake Epicenter Mini-Lab

An earthquake has just struck a very important location in the world. As the leading geo-scientist in the class, you and your team will determine the location of the epicenter using the techniques you learned in class today.

Three seismic stations sent in their seismometer data, they are listed below.



Investigate:

Balboa Heights, Panama:

P-Wave: 12:19:00

S-Wave: 12:23:50

Time Difference (S-wave minus P-wave): _____

Distance from epicenter (km): _____

Boulder, Colorado

P-Wave:_____

S-Wave:_____

Time Difference (S-wave minus P-wave): _____

Distance from epicenter (km): _____

México City, México

P-Wave:_____

S-Wave:_____

Time Difference (S-wave minus P-wave): _____

Distance from epicenter (km): _____

Time the earthquake occurred:_____

Location of Epicenter: _____

Refer to map on following page as well as your ESRT P and S-Waves pg. 11

Draw your epicenter circles here.

EXTENSION: Use page 11 in your ESRT to complete the chart below

#	P-wave Arrival Time	S-wave Arrival Time	Difference in Arrival Time	Distance to Epicenter	P-wave Travel time	S-wave Travel Time	Origin Time
1	6:45 PM	6:48 PM					
2	3:06:20	3:10:20					
3	17:11:00	17:16:40					
4	10:38:40	10:45:40					
5	21:21:20	21:29:00					
6				2000			6:00:00 AM
7					11 min 0 sec		5:37:24 PM
8			7 min				12:36:46 PM
9		11:24:23				15 min 20 sec	

by C.Burrows

RETURN TO WDYTN

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DIGGING DEEPER

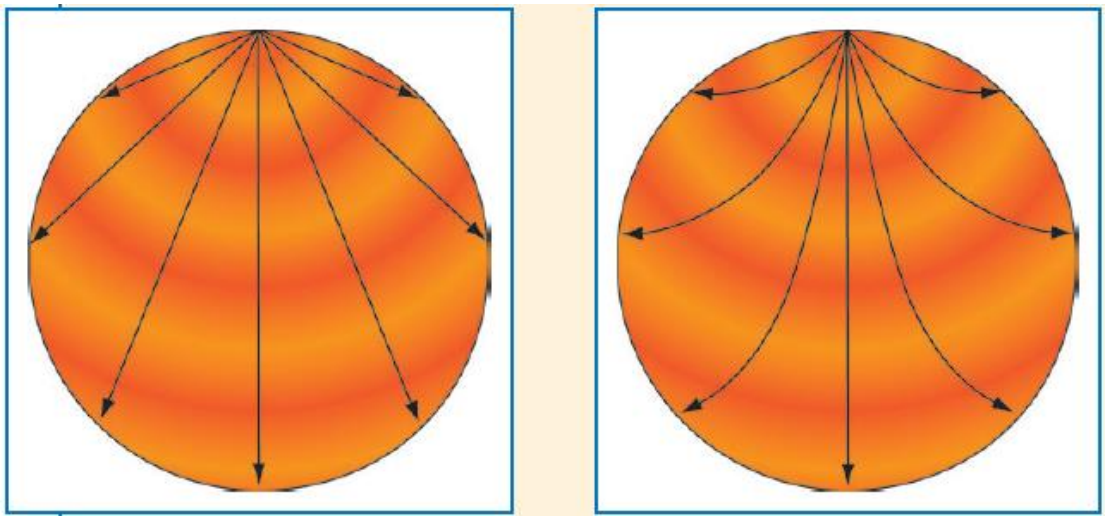
Using Seismic waves to investigate Earth's Interior

- Seismic waves can be used to determine the location and composition of Earth's interior layers.
- As the density of a material increases, the velocity of a seismic wave traveling through it will also increase.
    - Remember that density increases with an increase in pressure.
- This causes waves to refract (bend) as they travel.
- The physical state of a material also affects the velocity of a wave.
    - Liquids will slow the velocity of p-waves and prevent s-waves from continuing.

How can an earthquake be detected on the opposite side of Earth from its focus?

Describe other examples where other types of waves are refracted.

Why is it important to have numerous seismometers placed all around the world?

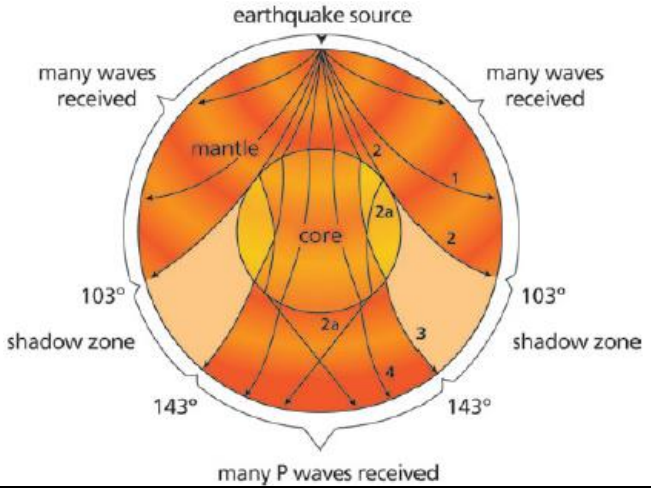


Inferred layers of the Earth from seismic data

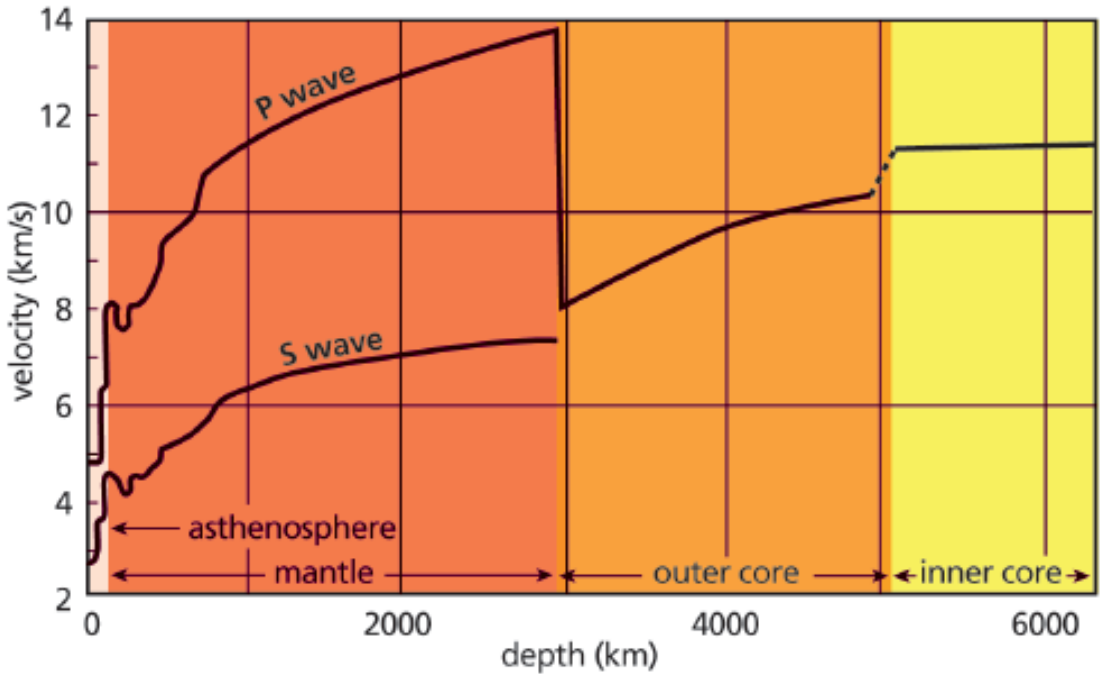
- The different interactions between seismic waves and Earth's interior has allowed scientist to determine the depth and chemical compositions of Earth's interior.
- Shadow zones are areas on the surface of Earth where no seismic waves are detected by seismometers.
- S-wave shadow zones are areas on the surface of Earth where P-waves are detected but s-waves are not.
- The reason for this is the refraction of P-waves and the absorption of S-waves by Earth's liquid outer core.
- Variations in wave velocities in the asthenosphere are due to changes in mineral composition and partially molten material.

Describe the journey of a seismic wave along path # 1 on the diagram below.

Path # 2a



Seismic wave velocities and depths of Earth's layers



Finding Details: This detail stands out to me from reading the notes closely.	Detail
I Think: How does your detail relate to the essential question for the section?	What I think about the detail

STOP H.W. HERE

My partners detail.	
How we connect the details: We re-read and think about the details, and explain the connections I find among them.	How we connect the details…

Chapter 2, Section 11 E.B.C.
Detecting Earthquake Waves

Name:_____
Period:_____

Question (2)		
Claim 1 (2)		
A. Supporting Evidence (3)	B. Supporting Evidence (3)	
Claim 2 (2)		
A. Supporting Evidence (3)	B. Supporting Evidence (3)	
Analysis (6)		

	Claim *A statement or conclusion that answers the original question/problem.*	**Evidence** *Scientific data that supports the claim. The data needs to be appropriate and sufficient to support the claim.*	**Analysis** *A justification that connects the evidence to the claims. It shows why the data counts as evidence by using appropriate and sufficient scientific principles and vocabulary*.
0	Does not make a claim, or makes an inaccurate claim.	Does not provide evidence, or only provides inaccurate or vague evidence.	Does not provide an analysis, or only provides an irrelevant analysis.
1	Makes an accurate but vague or incomplete claim.	Provides vague evidence and does not include specific data.	Repeats evidence and links it to claim, but does not include specific scientific principles.
2	Makes accurate and complete claim.	Provides correct evidence but does not include specific data.	Connects all evidence to the claims using scientific principles or vocabulary but not both.
3		Provides correct evidence and includes specific data.	Connects all evidence to both claims using scientific principles and vocabulary.

CHECKING UP: Page 242, 1 through 5 (2 points each)

____
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1.

2. a)

b)

3.

4.

5.

Why do seismic waves travel more slowly in the hot asthenosphere below the mid-ocean ridges than they do in the upper mantle? (5 points)