Seismic Waves and Plotting Earthquakes

Geology Mr. Traeger

Name: _____ Period: ____ Date: _____

Purpose

The purpose of this activity is to become familiar with the different kinds of earthquake waves. Knowledge of these waves will be used to locate and measure earthquakes.

Materials

▪ Slinky® or Spring	▪ Drafting compass	▪ Ruler
▪ Seismic Sleuths Packet	▪ Stopwatch	▪ Meter Stick

Part 1: Seismic Body Waves

Slinkies® are very good for demonstrating earthquake waves. Watch the demonstration of seismic body waves using Slinkies®. Answer the questions that follow.

1. What **is** a wave?

2. Describe and draw the motion that you saw when we simulated a P wave.

3. Describe and draw the motion that you saw when we simulated an S wave.

4. Why are the waves that we simulated called ***Body*** Waves?

5. What is the speed of P-waves? S-waves? State your answers in Km/sec and Miles/hour

P-waves?	S-waves?

6. How can you use the difference in P and S wave speeds to calculate the distance to an earthquake epicenter from a seismograph station?

Part 2: Seismic Surface Waves

Watch the demonstration of seismic surface waves using Slinkies®. Answer the questions that follow

1. Describe and draw the motion that you saw when we simulated a Love Wave.

2. Describe and draw the motion that you saw when we simulated a Rayleigh Wave.

3. After watching these demonstrations, which type of wave is more damaging to structures on the surface? Surface waves or Body waves? Why do you think this is?

Part 3: Analyzing Seismograms to Calculate Distance, Magnitude, and Epicenter

1. Explain how an older seismograph machine works. Drawing a picture is very helpful.

2. How does the Seismac seismometer work? How is it similar to an EKG heart monitor?

3. Define the 3 axes that Seismac measures. Make a drawing of them.

4. Which axis would be best for measuring the P-wave from an arriving earthquake? Why?

5. Which axes would be best for measuring the S-wave from an arriving earthquake? Why?

6. How did we make a bigger amplitude wave in Seismac?

7. Using Part I in your Seismic Sleuths packet, analyze the seismogram for each city. Fill in the following chart. Use the formula (T_S ï T_P) X 8 or the chart on the back of the packet to find the distance to the earthquake.

Seismograph Location	**Largest Wave Amplitude in mm**	**Difference in S and P Wave Travel Times ($T_S - T_P$) in seconds**	**Distance to Earthquake in km**	**Magnitude of Earthquake**
Salt Lake City, UT				
Pinyon Flats, CA				
Tucson, AZ				
Pasadena, CA				
Yuma, AZ				
			Final Magnitude (average of 5)	

8. What does a bigger *amplitude* on a seismogram reading mean? How did Charles Richter use this idea to develop his Richter Scale of magnitude?

We will skip part II in the packet.

9. Using Part III in your Seismic Sleuths packet, analyze the seismogram for each station. Fill in the following chart. Use the Time/Distance Graph to fill in the following chart.

Seismograph Station Identifier	**Difference in S and P Wave Travel Times ($T_S - T_P$) in seconds. Show work below.**	**Distance to Earthquake in km**
BAR		
GSC		
NEE		
PAS		
PFO		
SVD		
VTV		

10. Refer to the Station Map. Using the distance to the earthquake that you calculated in #3, plot circles of the appropriate radius around each station. Use a drafting compass for this. Use the scale bar at the bottom of the map to measure the appropriate radius for your circle!

11. What is the name of the place where all of your circles intersect? Don't think too much into this.

12. What is the **minimum** amount of circles needed to find the location of an earthquake?

13. What happens to the difference between S and P Wave Travel Times the farther you go away from an earthquake?

14. Calculate the slope of line P to verify the speed of a P wave. Your answer should be in Km/sec. Show work

15. Calculate the slope of line S to verify the speed of an S wave. Your answer should be in Km/sec. Show work.

16. What happens to the difference between P and S wave arrival times the farther you are from the earthquake?

Conclusion: What did you learn in this lab?