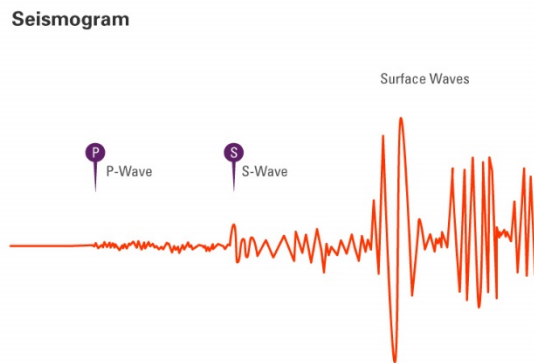
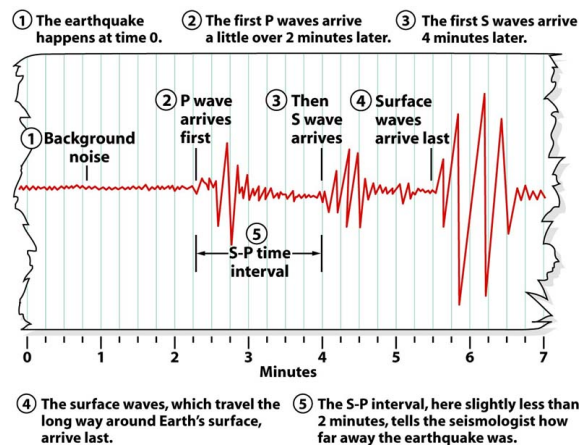


Instructions for the locating the epicenter of an earthquake exercise:

Seismographs are used to detect and record earthquake waves: P-waves, S-waves, and surface waves. We are only interested on the P- waves and S-waves because they can provide a lot information as they travel throughout the Earth. Surface waves travel on the surface of the Earth and they will not be needed for this exercise. P-waves travel faster than S-waves. P-waves (primary waves) are the fastest seismic waves, typically traveling at speeds around 6 kilometers per second (km/s) in the Earth's crust. S-waves (secondary waves) are slower, moving at approximately 4 km/s.

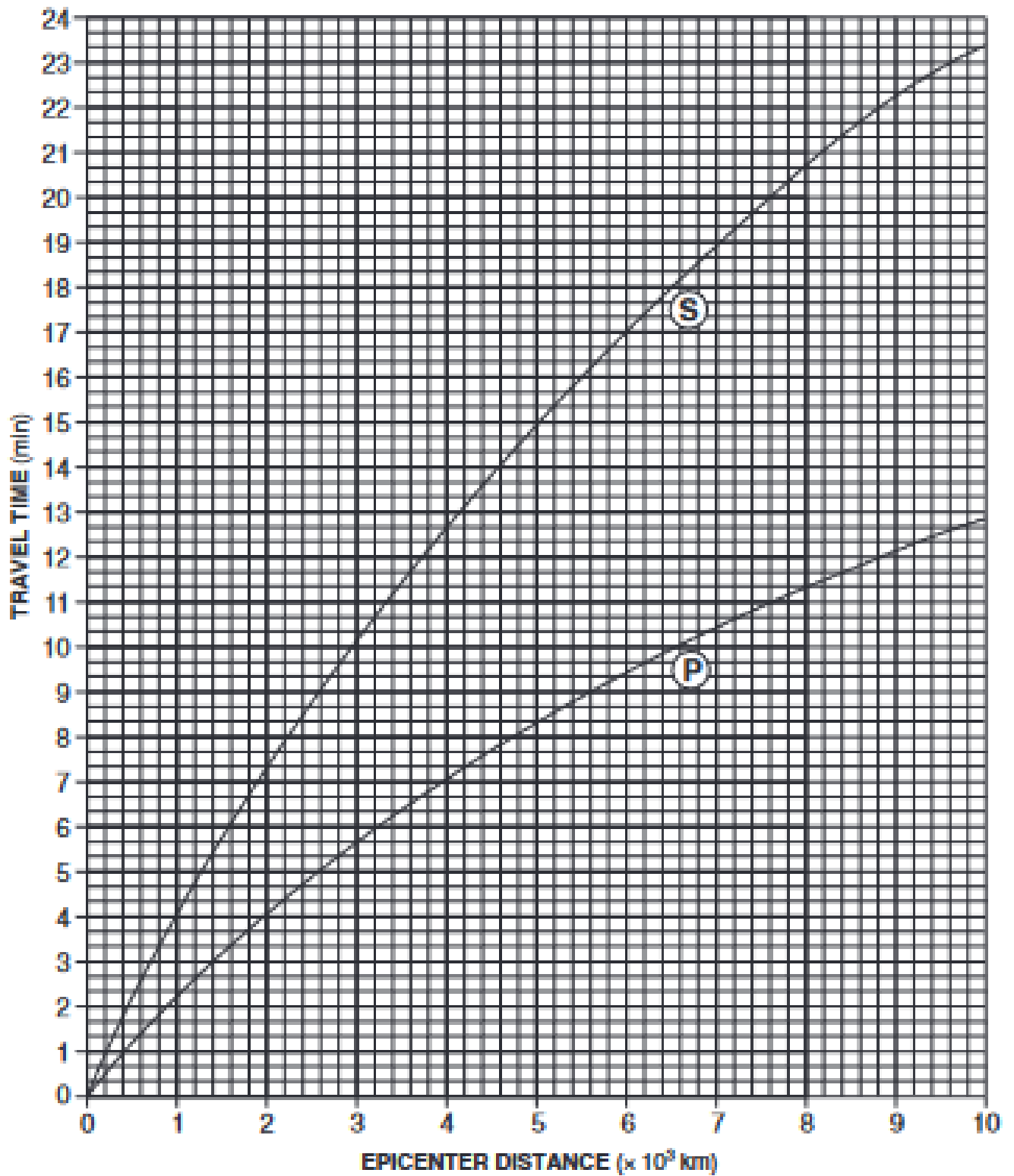


These differences in speed are crucial for understanding earthquake locations and the structure of the Earth's interior. The difference in the arrival times between the P-wave and the S-wave, also called the SP interval, can be used to find the epicenter's distance from the seismic station.



This time can be converted into a distance using the Earthquake P-Wave and S-Wave Travel Time (page 2 - next page). This distance found on the Earthquake P-Wave and S-Wave Travel Time becomes the radius of a circle around the station where the earthquake has occurred.

Earthquake P-Wave and S-Wave Travel Time



The links below show videos on how to use the SP interval to determine the distance from the epicenter of an earthquake:

https://www.youtube.com/watch?v=uR8zhKN_yE4&t=227s

<https://www.youtube.com/watch?v=3eFS4WhsrHA>

<https://www.youtube.com/watch?v=m087LO9bCX4&t=225s>

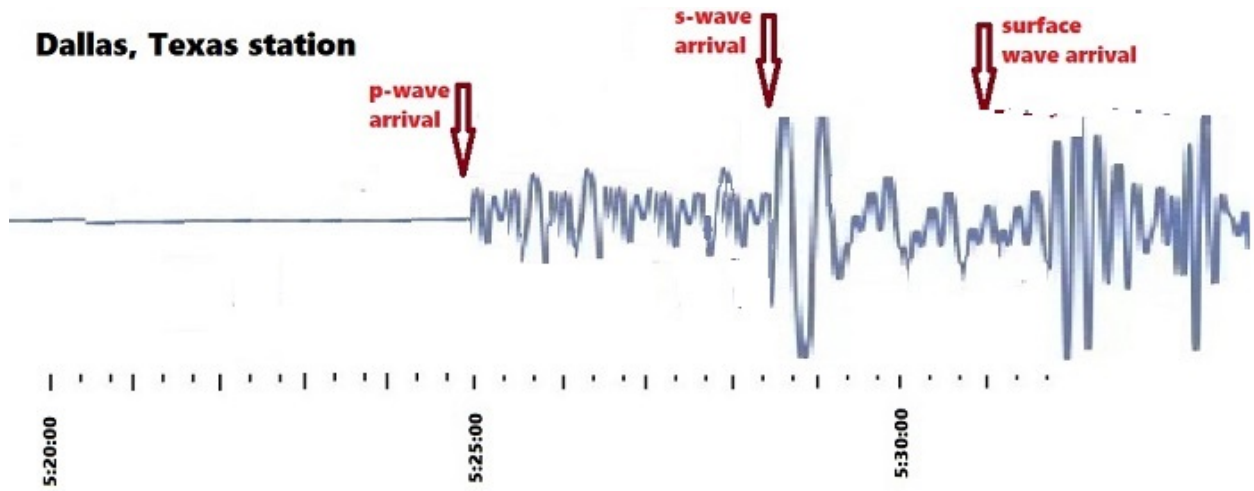


Procedure (use the seismograms on page 4):

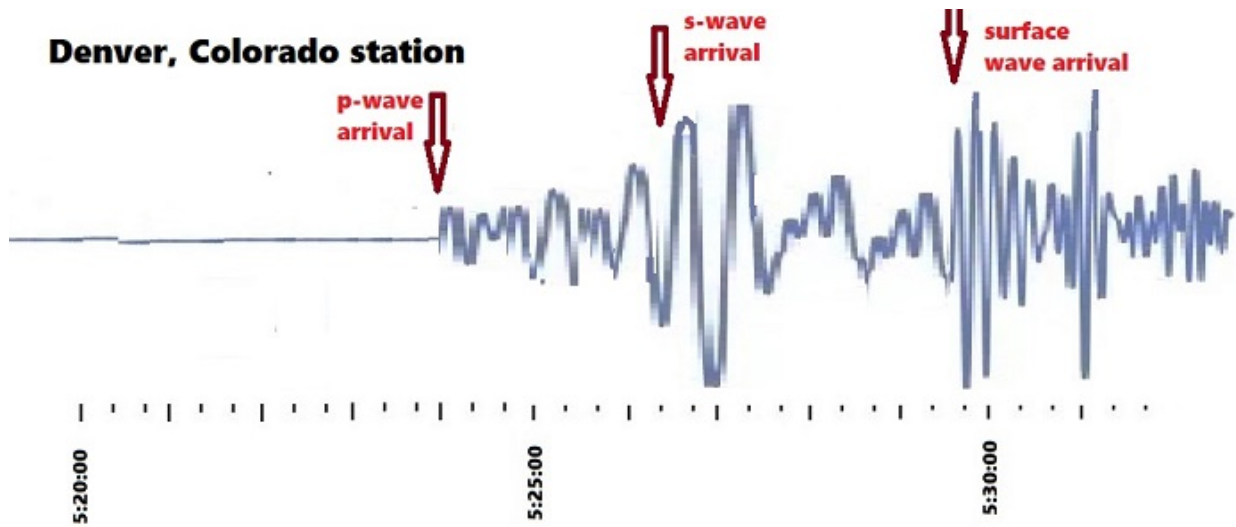
1. For each station, determine the information listed below. Record your answer on the table below.
 - a. Arrival time of the P-wave
 - b. Arrival time of the S-wave
 - c. Difference in the arrival time S-P interval. Also know as lag time between the P and S waves.
 - d. Distance to the epicenter of the earthquake (Use the graph on ESRT page 11 to determine distance based on the difference in the arrival time between P-wave and S-wave)
 - e. Travel time of the P-wave for that distance
 - f. Time of Origin (subtract: Arrival time of P-wave - Travel time of P-wave)

Seismograph Station	P-wave arrival time	S-wave arrival time	SP interval	Distance to Epicenter km.	P wave Travel time	Time of origin
Dallas, Texas						
Denver, Colorado						
Salt Lake City, Utah						

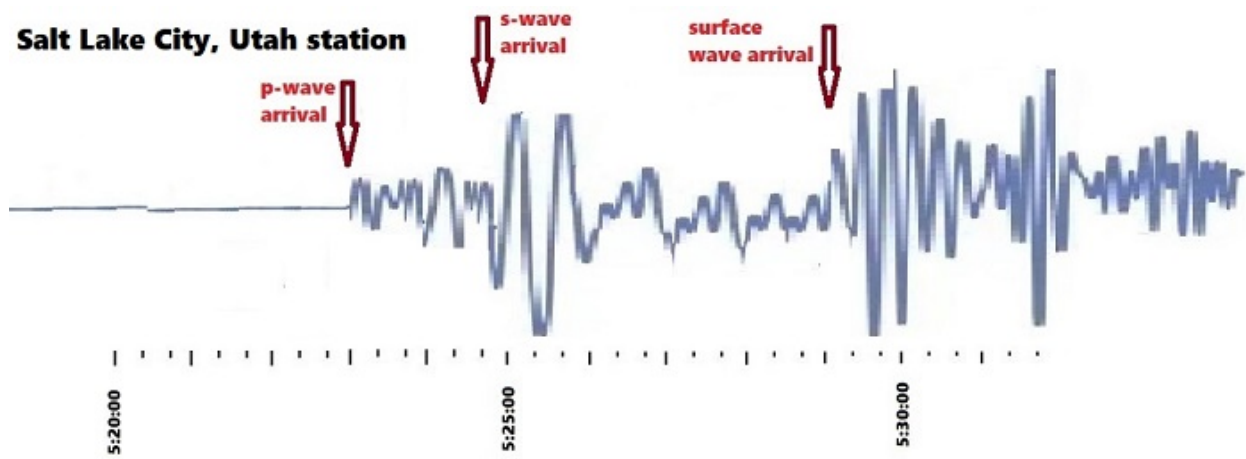
Dallas, Texas station



Denver, Colorado station



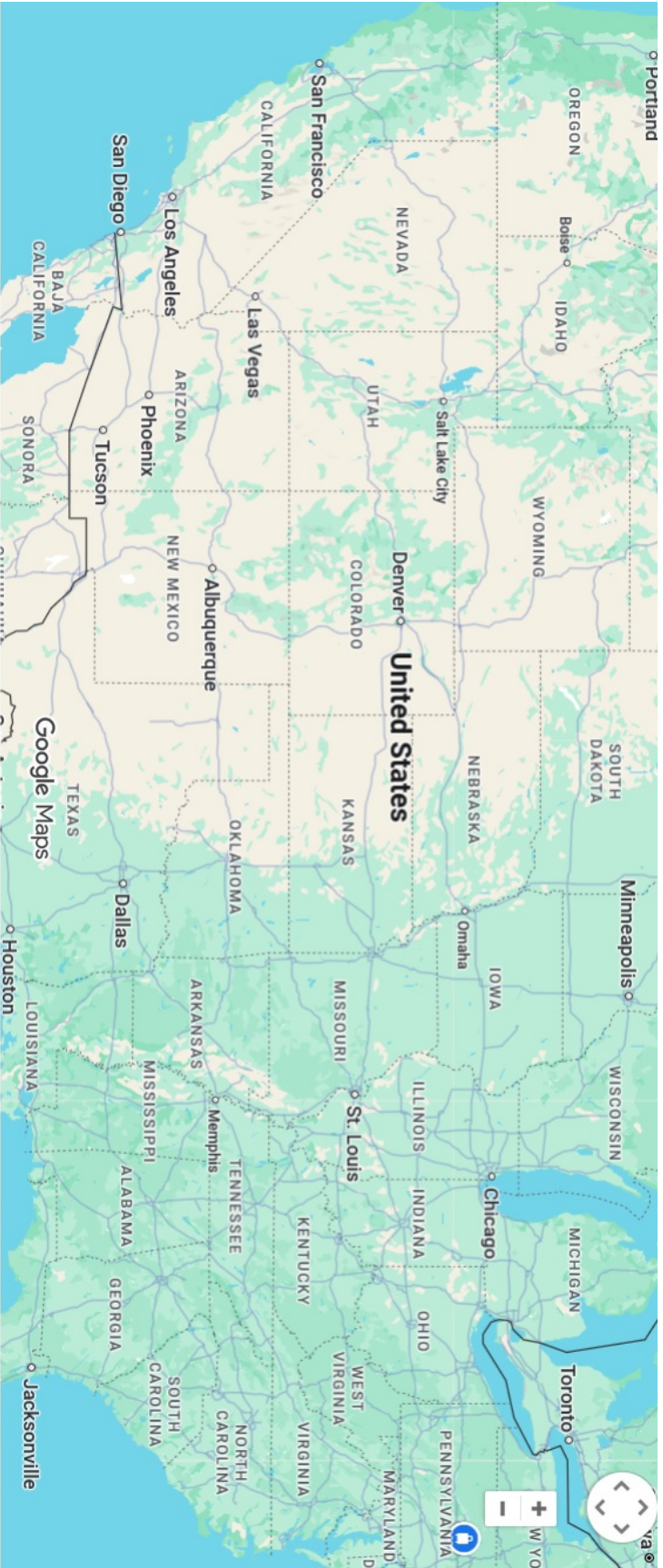
Salt Lake City, Utah station



2. On the map on page 6, the locations of Dallas, Denver, Salt Lake City, and other cities are labeled. Use the distances determined in your table above to represent the radius of the circle. Open your drawing compass to this distance by using the scale of kilometers on the map. Draw a circle for each station.
3. Draw an X at the location of the epicenter of this earthquake.
4. Name the city closest to the epicenter of this earthquake.

Discussion Questions

1. Are earthquakes predictable? Explain your answer.
2. What is the minimum number of seismic stations necessary to locate an epicenter?
3. How can you determine the epicenter of an earthquake using data from seismic stations worldwide?
4. What happens to the time differences between P- and S-waves as your distance from the epicenter increases?
5. Compare the differences in velocity of P- and S-waves.
6. What state(s) of matter do P-waves travel through? Refer to the lecture slides Chapter 5 – Earthquakes.
7. What state(s) of matter do S-waves travel through? Refer to the lecture slides Chapter 5 – Earthquakes.
8. What are the three different scales used to determine the severity of earthquakes? Explain the differences between these scales. Refer to the lecture slides Chapter 5 – Earthquakes.



Map data ©2025 Google, INEGI 200 km