SUCCESS ACADEMY EDUCATION INSTITUTE

Earth's Changing Landscape

Name: ____________________

Teacher: ____________________

Class: ____________________

Earth and Space Science
Unit 2
Lab Notebook

Lesson 1:
What Are Natural Disasters?

Directions: Respond to the following questions in the space below.

1. Do you think natural disasters are a threat to New York City? Why or why not?

   Why do we study them?

Thoughts	Questions We Have

Lesson 1

Additional Notes: Record any additional information from your research below.

Lesson 2:
Mapping Natural Disasters

Directions: Examine the maps and record your notes below.

Where Earthquakes Occur

Where Volcanoes Occur

Sketch the patterns from the maps below.

Image credit: Skimel, CC0, via Wikimedia Commons

Lesson 2

Additional Notes:

Discussion Questions:

1. What do the maps seem to have in common?
    - Predict the cause(s) of these patterns.

Lesson 3:
Shaky Ground

Directions: Move your spring in different ways to replicate P-waves, S waves, and surface waves.

1. Use the tape markers to model buildings on the Earth's surface.

2. Analyze the effects each wave type has on the tape markers.

3. Record your observations below.

Strategy 1

Drawing
Wave Type:

Observations

Lesson 3

Strategy 2

Drawing
Wave Type:

Observations

Strategy 3

Drawing
Wave Type:

Observations

Lesson 3

Discussion Question:

1. How does the speed and motion of an earthquake wave relate to the amount of damage it causes?

Lesson 4:
Volcano Formation

Part 1: Construct a volcano model.

1. Combine vinegar and baking soda in a cup to simulate a volcano.

2. Observe the results and record notes below (connect observations to the buildup of gas in the Earth's mantle).

Lesson 4

Part 2: Test magma viscosity.

1. Blow into each magma sample using straws.

2. Observe and record the reactions for each magma type.

Viscosity	Eruption Observations	Volcano Formation Observations
Low		
Medium		
High		

Lesson 4

Part 3: Build volcanoes from different types of magma.

1. Pour each lava sample onto a corresponding plate.

2. Observe the lava flow for each plate and the resulting structures it builds.

3. Record your notes below (think about how each type of magma might create the different types of volcano shown at the beginning of class).

Discussion Question:

1. How does viscosity affect eruption style and volcano formation?

Lesson 5:
Measuring Earthquakes, Day One

Directions:

1. Read through the eyewitness accounts and give each one a ranking using the Mercalli scale.

2. Record each ranking on the isoseismal map below and draw isolines to indicate areas with the same amount of damage.

Image credit: Shakeout Earth Science Activity

Lesson 5:
Measuring Earthquakes, Day Two

Directions: Use the machines to create three different seismograms and observe how various intensities of "earthquakes" impact the way the seismogram looks. Answer the questions that follow.

Important: Try to include P-, S, and surface waves in each seismogram. Refer back to your notes from Lesson 3 if you don't remember which direction each wave travels in.

"Earthquake" Type	Observations
No movement (Do not shake the table)	Draw the seismogram here: Write down your observations:
Slight movement (Shake the table lightly)	Draw the seismogram here: Write down your observations:

Lesson 5, Day Two

"Earthquake" Type	Observations
Vigorous movement (Shake the table a lot)	Draw the seismogram here: Write down your observations:

Analysis Questions:

Why does the distance from the epicenter of an earthquake affect the amount of damage done by the earthquake?

Lesson 5, Day Two

How can we use earthquake measurements to assess future risk?

Which earthquake measurement system is more useful? Why?

Lesson 6:
The Aftermath

Directions: View the videos and complete the readings on the effects of volcanic eruptions. Record your notes below and answer the questions that follow.

Source of Information	Notes

Lesson 6

Analysis Questions:

What are some ways that volcanoes impact people and their environments?

What makes some volcanoes more dangerous than others?

Are there any positive effects of volcanoes? What are they?

Lesson 7:
Finding the Epicenter, Day One

Directions: Use three seismograms and the time–distance graph (also called a travel–time graph) to calculate each location's distance from the epicenter. Brainstorm how to use the distances you calculated and the map below to determine the earthquake's epicenter.

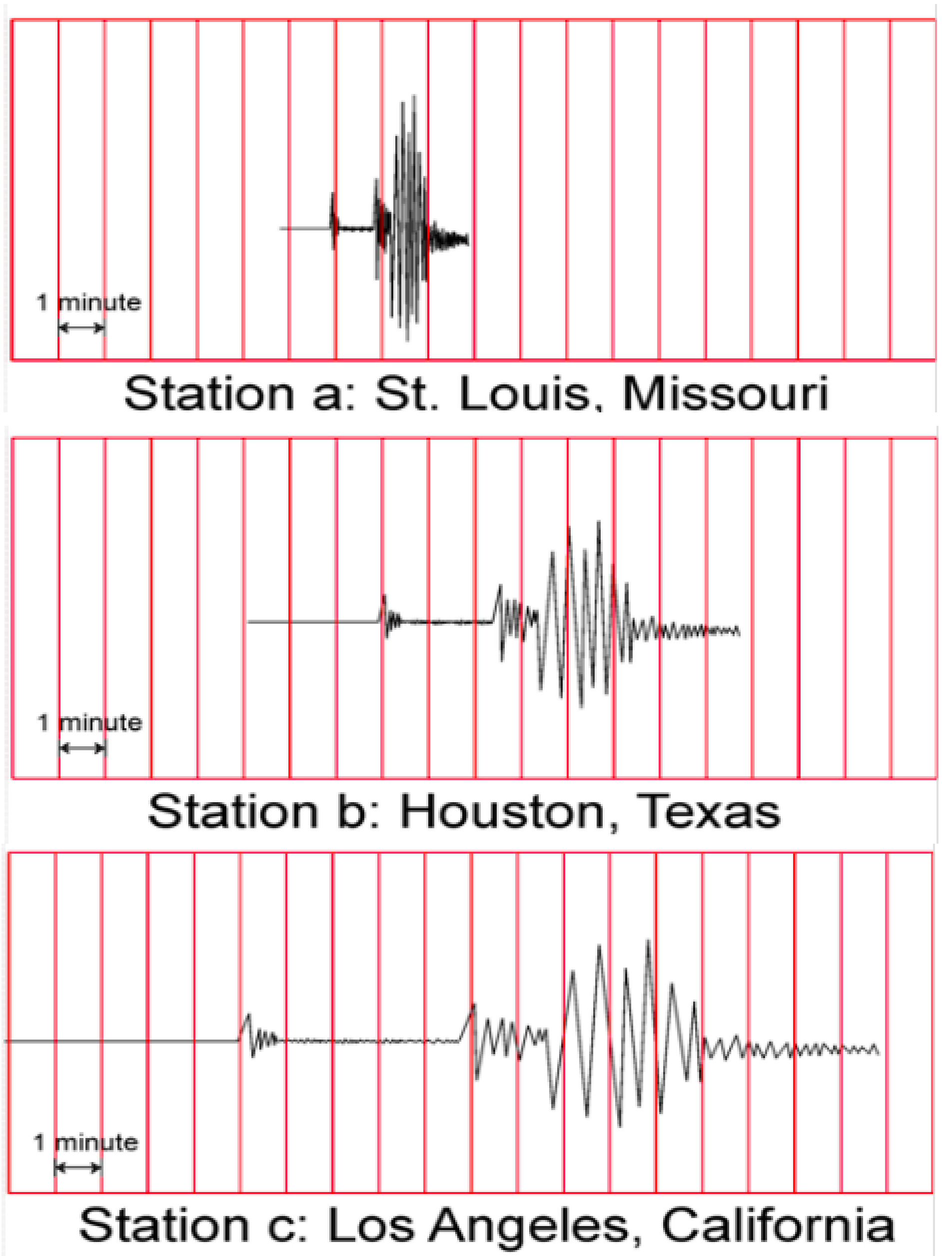

Image credit: Arkansas Geological Survey, Activity 4: Locating an Earthquake Epicenter

Lesson 7, Day One

Data:

	Arrival Time of P-Waves (min.)	Arrival Time of S Waves (min.)	Difference in Time Between the P-Wave and S Wave (min.)	Distance of Epicenter from Station (Miles)
Station a				
Station b				
Station c				

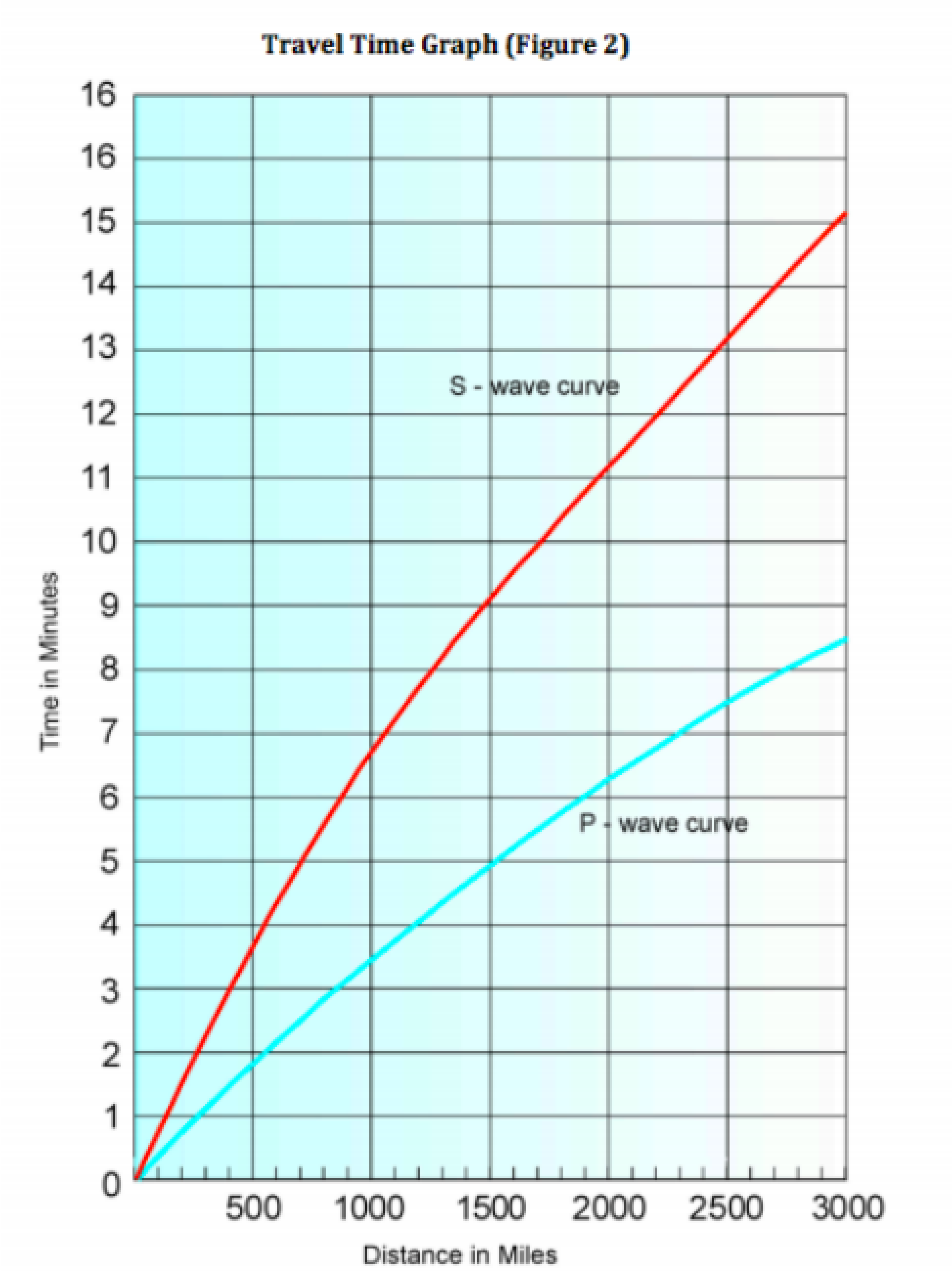

Image credit: Arkansas Geological Survey, Activity 4: Locating an Earthquake Epicenter

Lesson 7, Day One

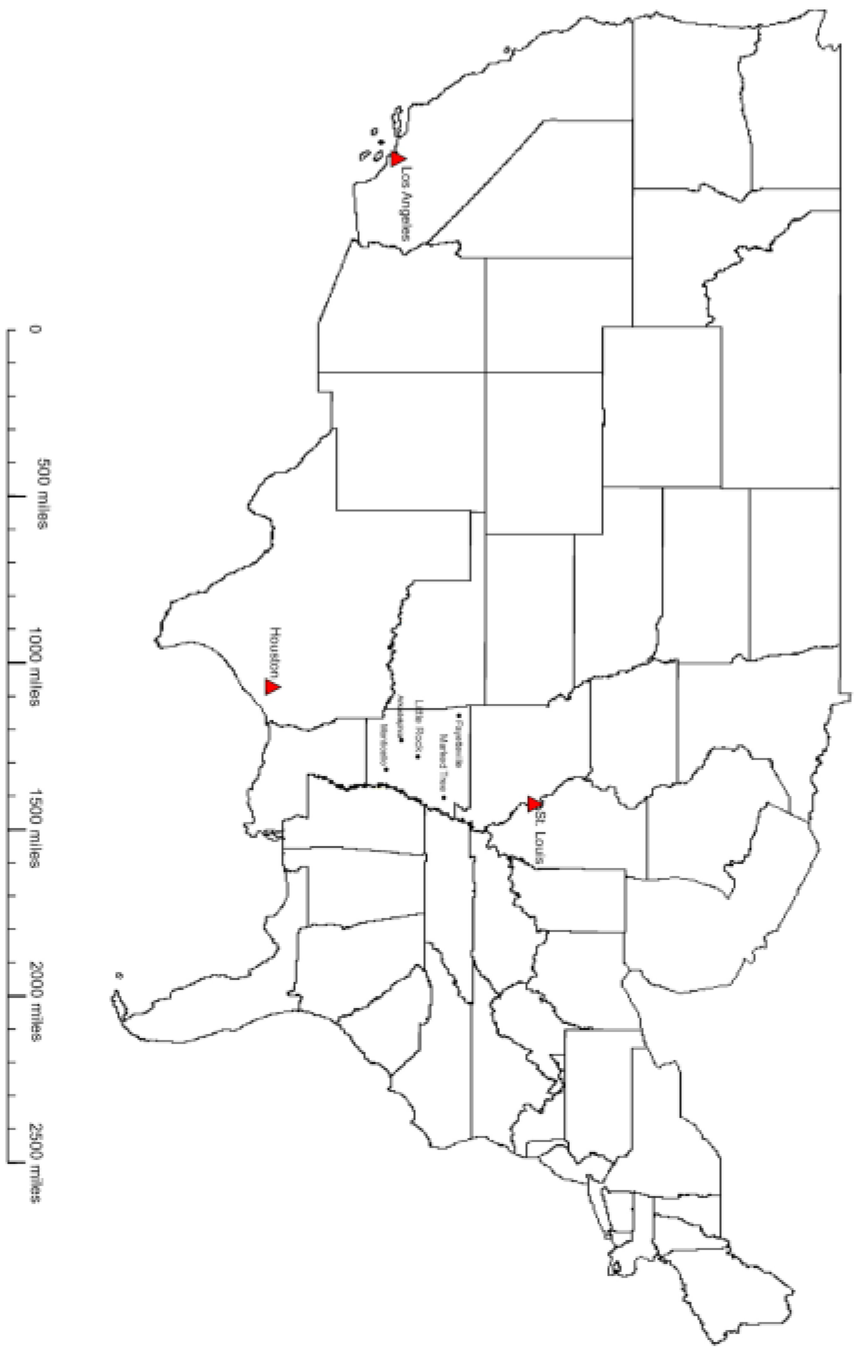

Image credit: Arkansas Geological Survey, [Activity 4: Locating an Earthquake Epicenter]

Lesson 7, Day One

Analysis Questions:

Can the exact location of an earthquake's epicenter be located with only one seismic station?

Assume that the same earthquake occurred but the seismic station in Los Angeles malfunctioned and did not record the earthquake. With only the information from seismic stations in St. Louis and Houston, brainstorm how a geologist might determine the location of the earthquake's epicenter.

How does locating the epicenter allow us to better prepare for earthquakes in the future?

Lesson 7:
Finding the Epicenter, Day Two

Directions: Complete the online triangulation lab and take notes below. After triangulating a location, compare it to a map of the United States and record the state of the earthquake's epicenter below.

State of earthquake epicenter:

Discussion Questions:

1. What is triangulation?

2. Compare triangulation to using the Mercalli scale to determine an earthquake's epicenter.

Lesson 8:
Topographic Maps, Day One

Directions:

1. Create your own mountain models out of clay with your group.
    - To begin, shape a lump of clay into a mountain about 12 cm high on white paper. Making the map is more fun if you make your mountain a little lopsided or oddly shaped. However, the mountain should be flat on the bottom.
2. Determine how to create a topographic map of your mountain on the cardboard base.
    - To begin, use the long pencil to poke two holes straight down through the center of the mountain. (Make sure your two holes go all the way through the mountain.)
3. Label your work with units and a scale, and record notes on the process.
4. Record notes on what worked and what didn't when creating your topographic map.

Lesson 8:
Topographic Maps, Day Two

Directions:

1. Rebuild the mountain based on the map from a different group.

2. After construction is complete, answer the questions that follow.

Analysis Questions:

What does it mean when the contour lines are closer together?

Looking at your map, where would be the best place to build a trail to climb to the top of the mountain? Why?

How do topographic maps help us assess risk?

Lesson 9:
Earthquake Design Challenge

Imagine that you and your group have been hired as the structural engineers in charge of designing a new earthquake-resistant two-story building. There are many building codes you must follow. Each floor of the building must support ***at least*** 250 grams of mass. Also, the building will be located near a fault line, so your building must be able to withstand earthquakes. The building will be used for art classes, so you may be as creative as you like with the shape and design of the building (it does not need to be box-shaped).

Your building must meet the following requirements:

- Your building must fit on the base.
- Your building must be at least 36 cm tall.
- Your building has two stories that are each at least 18 cm tall (approximately the height of one straw).
- Each story must hold at least one sandbag (250 grams) without collapsing.
- A construction drawing must be completed *before* earthquake testing.
- To survive an earthquake test, the building must not collapse for 10 seconds after the earthquake begins. The sandbags must stay on the building.
- You will have time to repair any damage to your building before the next earthquake test.

Planning Space:

Lesson 9

Building Diagram

Remember to clearly label all construction materials! Include quantities.

Lesson 10:
Using Historical Data

Directions: Conduct research and take notes to answer the question “Which natural disaster is most dangerous to NYC?”

Earthquakes	Volcanoes
Evidence for:	**Evidence for:**
Evidence Against:	**Evidence Against:**

Lesson 10

Answer the Unit's Essential Question:
Do New York City residents need to worry about earthquakes and volcanoes? Use at least two pieces of evidence and justify your response by explaining the evidence. [4]