Name: _____ **Date:** _____

The Theory of Plate Tectonics Worksheet

Objective: Gather evidence to explain the theory of plate tectonics.

1. What continent do you live on?

2. Define a continent.

Now watch https://www.youtube.com/watch?v=3uBcq1x7P34

3. Now what is a Continent?

4. Can you think of any ways the continents have changed over time?

Explore: Navigate to the Earthquakes Living Lab at http://www.teachengineering.org/livinglabs/earthquakes/.
Notice the four main components of the Earthquakes Living Lab.

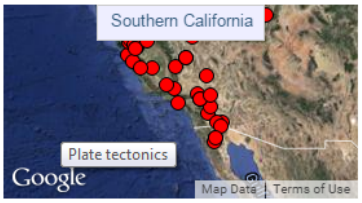


Plate tectonics

5. Select the second option, the "Southern California" box. > click the third link on the right side of the page titled, "How have the Earth's continents changed over time?" at http://www.ucmp.berkeley.edu/geology/anim1.html.

How have the Earth's continents changed over time?

Click to learn!

6. Compare the map of the world today (such as the real-time earthquake map) to a map of the world 250 million years ago (called Pangaea). Use the interactive continental drift map to watch the change in the Earth's landforms over millions of years.
   - As you watch the animation, record at least three examples of how the continents have changed their positions over time.

- If the plates continue to move in this pattern, draw a sketch of what the world might look like 250 million years in the future.

7. **Explain:** Navigate back to the Earthquakes Living Lab main page and click on the second and fourth links titled, "What is the Theory of Plate Tectonics? What evidence supports the Theory of Plate Tectonics?" and "General information on plate tectonics, including images, animations and explanations." Explore more about the theory. Read the background information and answer the following questions:

8. What might have caused the continents to move? (Hint: What is the name of this theory?)

9. Describe some important information related to this theory.

10. **Elaborate:** Find and record evidence used to explain how continents have moved over time. Explore the following links to identify explanations and examples of evidence. You may also use any of the other links located on the Earthquakes Living Lab page. Use a graphic organizer (such as the chart below) to record your ideas.
    - Seafloor spreading and earthquakes: http://pubs.usgs.gov/gip/dynamic/developing.html
    - Fossils: https://education.seattlepi.com/list-describe-evidence-plate-tectonics-theory-5600.html
    - Volcanoes: http://www.divediscover.whoi.edu/hottopics/seamounts.html

Category	Evidence Examples and Explanations
sea floor spreading	
fossils	
earthquakes	

volcanoes	

11. Looking at the information you compiled in your chart above, explain one way the theory of plate tectonics can relate to engineering.

12. **Evaluate:** In the early 1900s Alfred Wegener, among many others before him, proposed the continents were "drifting." The scientific community did not support his theory due to a lack of scientific evidence. Using what you learned in this activity, would you support Wegener's hypothesis or not? On a separate sheet of paper write a two-paragraph essay that explains your position.

13. Now read https://en.wikipedia.org/wiki/Continental_drift
Pick one question to answer under each header and write it on a separate sheet of paper (you will have a total of 5 questions)

Historical Development of Continental Drift

1. Analyze the evolution of the continental drift theory.
    - Compare and contrast Alfred Wegener's hypothesis with earlier ideas proposed by Abraham Ortelius and Antonio Snider-Pellegrini. How did Wegener's approach improve upon these earlier speculations, and why was his hypothesis initially rejected?
2. Evaluate the role of interdisciplinary contributions to the acceptance of continental drift.
    - How did advancements in oceanography, paleontology, and seismology contribute to the eventual acceptance of Wegener's hypothesis? Provide specific examples from the article.

Mechanisms and Evidence for Continental Drift

1. Synthesize the evidence supporting the theory of continental drift.
    - How do fossil distributions (e.g., Mesosaurus and Lystrosaurus), glacial striations, and complementary coastlines collectively reinforce the concept of Pangaea?
2. Assess the significance of Arthur Holmes's mantle convection theory.
    - Why was Holmes's proposal of mantle convection cells a critical development in explaining the mechanism behind continental drift? How did it address one of the major criticisms of Wegener's hypothesis?

Geological and Environmental Implications

1. Interpret the environmental consequences of continental drift over geological time.
    - How has the movement of continents influenced global climate patterns, ocean circulation, and biodiversity over Earth's history?
2. Apply the concept of plate tectonics to modern environmental issues.
    - How might the understanding of tectonic plate movement help predict and mitigate natural disasters such as earthquakes and volcanic eruptions?

Scientific Debate and Progress

1. Critique the persistence of the "fixist" model during the early 20th century.
    - What factors contributed to the dominance of the fixist perspective, and how did this hinder the acceptance of continental drift?
2. Examine the importance of skepticism in scientific progress.

- How did the rejection of Wegener's theory by the scientific community ultimately lead to stronger evidence and a more comprehensive understanding of plate tectonics

Technological Advancements and Modern Evidence

1. Analyze the role of technology in confirming the theory of plate tectonics.
    - How did mid-ocean ridge mapping, magnetic striping, and GPS measurements provide definitive proof for the theory of plate tectonics?
2. Predict future geological changes based on current tectonic activity.
    - Considering the current movement of tectonic plates, what might Earth's continents look like millions of years from now? What environmental impacts could these changes have?

Earthquakes

Now go to https://www.teachengineering.org/livinglabs/sanfran and click on "What factors influence the magnitude of an earthquake?" watch the video.

1. How did they use the lightbulb help you understand how you "feel" an earthquake?

2. Draw a three circle VENN diagram and compare and contrast the Richter scale, moment magnitude scale, and the Mercalli scale

Click on the bottom of the page Earthquake Magnitude Scale read about the different sized earthquakes on the magnitude scale. Now click on Modified Mercalli Intensity Scale and read about the Modified Mercalli Scale.

Now go back to http://www.teachengineering.org/livinglabs/earthquakes/ and click on "How do soil types and the geology of an area affect the land after an earthquake?" and read the page.

1. Fully explain how soil type impact what you feel and damage from an earthquake.

Go to https://cob.org/services/maps/map/environmental-maps and click on the geological hazards map

And look at the Geologic hazard map of Bellingham. What are some Very high Seismic areas? Why do you think that is?

Find some coal mines in Bellingham (wait there's coal mines in Bellingham?!!) What are some hazards from mines during an earthquake?

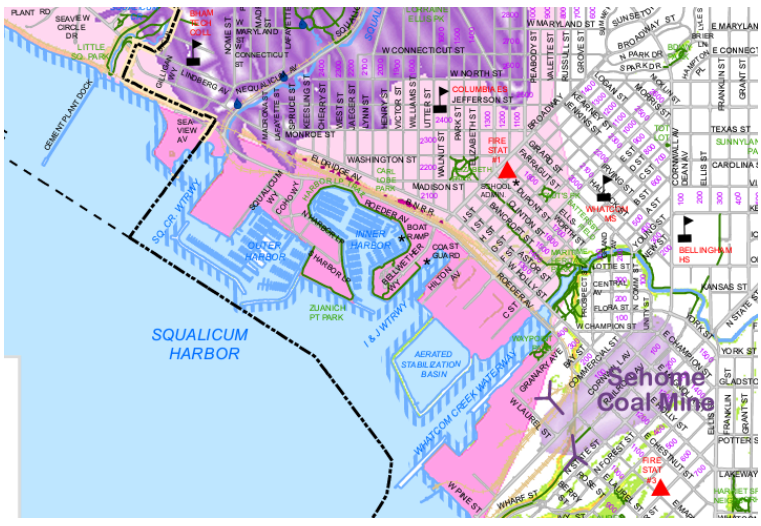
What are some other earthquake hazards in Bellingham that you can identify using this map? Be specific. How and why are they hazards?

Go to https://cob.org/services/maps/map/historic-maps and click on the coal mine map. Tell me about the coal mine. There is also a paper copy on the back table

No go to https://www.usgs.gov/media/videos/shaking-frontier-building-anchorage-alaska-during-mw71-earthquake-january-24-2016 and look at how buildings shake.

Now go to https://www.exploratorium.edu/faultline/damage/building.html and read the article.

We are doing major development in Bellingham in a Very High seismic area. If you were in charge how would you suggest moving forward with development. Be as specific as possible.



No read
https://www.seattletimes.com/pacific-nw-magazine/a-deadly-earthquake-absolutely-positively-will-ravage-seattle-at-some-point-heres-how-to-survive-it/

What can we do to prepare individually, school, as a city, county, region, and a utilities manager