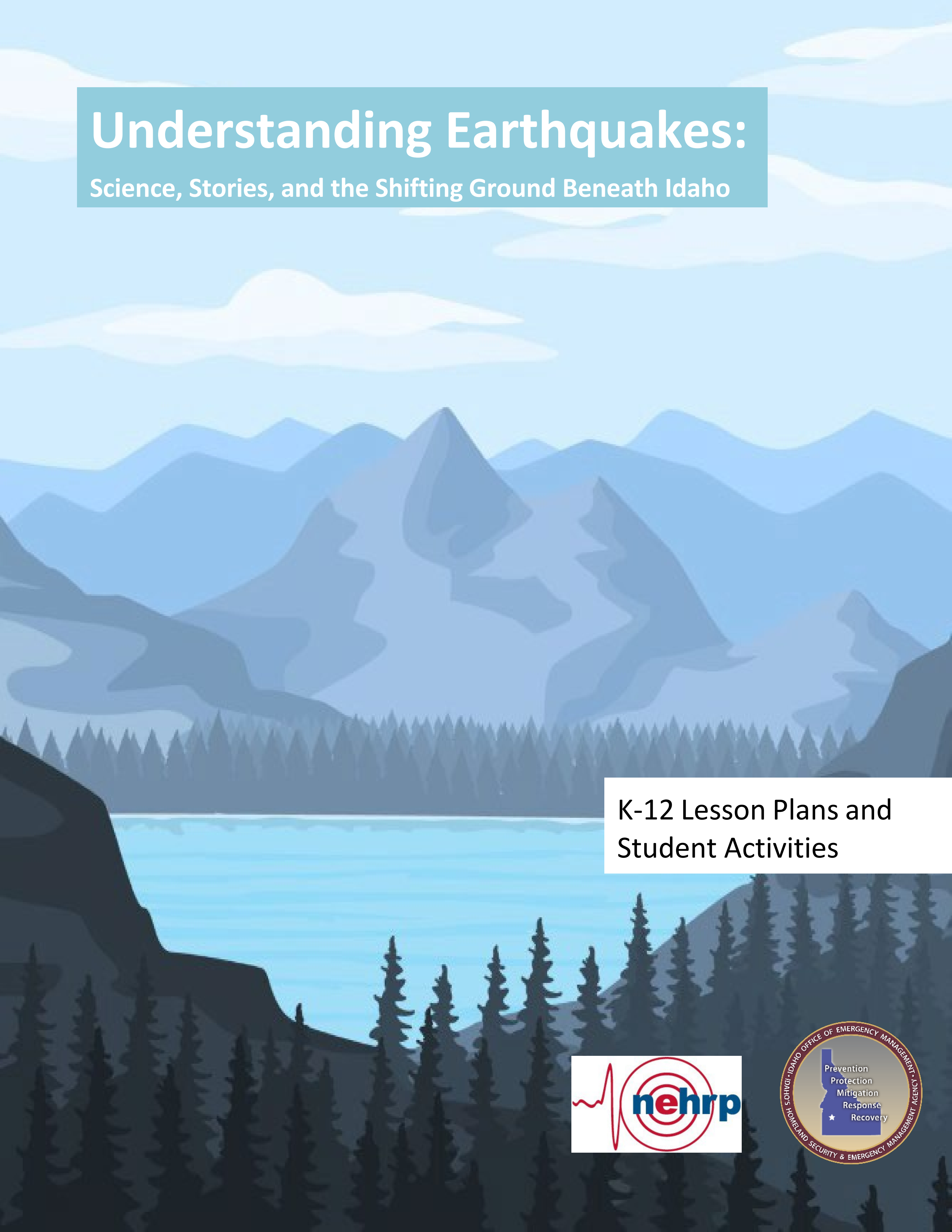
Understanding Earthquakes:

Science, Stories, and the Shifting Ground Beneath Idaho



K-12 Lesson Plans and Student Activities

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Organization and Overview

This lesson package is designed to enhance standard curriculum with dynamic lessons and hands-on activities that support student engagement across grade levels.

Unit 1: Introduction to Earthquakes.

This unit builds on what students already know about earthquakes and gives basic understanding of earthquake myths, plate tectonics, magnitude, and intensity.

Unit 2: Ripple Effects: Shake, Slide, Splash!

This unit introduces students to the common, and not so common, impacts of earthquakes.

Unit 3: Earthquakes in Idaho.

This unit focuses on earthquakes that occur in Idaho. Students will map Idaho's historic earthquakes and look for patterns to understand the geographic areas most likely to experience them within Idaho.

Unit 4: Earthquake Preparedness.

This unit focuses on survival kits, hazard identification, and community safety.

Unit 1: Introduction to Earthquakes

Contents

Introduction to Earthquakes

Grade Level: K-12
Idaho State Standards: N/A
Objectives:
Students will be able to demonstrate their level of knowledge of earthquakes before instruction.

TEACHING ADAPTATIONS
For younger children, this activity can be done verbally as a class discussion. For older children, this activity may be done as an introduction to levels 2 and 3, or it may be used as a review, or facts check at the end of Unit 1.

MATERIALS:
- Copies of the student worksheet, one for each student
- Teacher Answer Key

LESSON OUTLINE:

ENGAGE (5-10 min):
Discuss with the class the following questions:
- If an earthquake happened here, right now, what would you do?
- Can you imagine what your classroom would be like during an earthquake?
- How could you make your classroom and your school a safer place to be?
- How could you make your home safer?

EXPLORE (10 - 15 min):
Explain that in this Unit they will be learning about earthquakes. But first you'd like to know what they already know about earthquakes, especially in Idaho. Give clear instructions of how the following activity is to be done. This can be adapted based on the age, reading and writing level, and behavioral accountability of your students.

Classroom Activity Instructions:

1. Walk around the classroom and talk to your classmates.
2. Ask them if they know the answer to a question on your worksheet.
3. Try to get help from a different person for each question.
4. When someone gives you an answer:
   - Write their name next to the question
   - Write down what they told you in the answer box

We're working together to learn—so be kind, ask nicely, and share what you know!

EXPLAIN (5-10 min):
After students have completed their worksheets, go over the answers together, allowing time for discussion.

EXTEND (5 min):
When you have discussed the correct answers to questions 1-10, have students complete the following questions on their worksheet.

- What new things did you learn about earthquakes?
- What would you like to learn about earthquakes?

EVALUATE:

- Engagement in Class Discussions: Student will be assessed on contributions to conversations including thoughtful comments, respectful listening, and participation.
- Worksheet Activity: All responses are considered correct. This activity is designed to explore current knowledge and is a chance for students to show what they already know and what they're curious to learn more about.

Introductory Activity – Earthquakes

Instructions: Only answer questions 1-10. The Follow-up Questions will be answered later.

1. Walk around the classroom and talk to your classmates.
2. Ask them if they know the answer to a question on your worksheet.
3. Try to get help from a **<u>different</u>** person with each question.
4. When someone gives you an answer:
   a. Write their name next to the question.
   b. Write down what they told you on the blank lines.

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1. Have you felt the ground or a building shaking during an earthquake:

   ____

2. Have you personally observed damage from an earthquake:

   ____

3. Do you know the three steps to take for personal safety during an earthquake:

   ____

   These steps are _______________, ______________, and ______________

4. Can you explain the difference between magnitude and intensity of an earthquake:

   ____

   Magnitude is: ____ and
   Intensity is: ____

5. Do you know where and when the largest earthquake in the World occurred:

   ____

   Where:______________________ When: ________________________

6. Do you know where and when the largest earthquake in the United States occurred:

   ____

   Where: ________________ When: ____________________

7. Do you know where and when the largest earthquake in Idaho occurred:

   ____

   Where: ________________ When:____________________

8. Do you know how often magnitude 6.0 earthquakes occur in Idaho?

   ____

   How often:___________________________________

9. Do you know how many earthquakes occurred in Idaho in 2024?

   ____

   How many: ___________________________________

10. Do you know how many earthquakes occurred in Stanley, Idaho between June 1 – June 6, 2025. ______________

    How many: ___________________________________

Follow-up Questions:

- What new things did you learn about earthquakes?

- What would you like to learn about earthquakes?

ANSWER KEY to Introductory Activities – Earthquakes

1. Student answers will vary
2. Student answers will vary
3. Drop, Cover, Hold on
4. An earthquake has one magnitude, but many intensities.

   • **Magnitude**: is a quantitative and exact measurement of the size of the earthquake (amount of energy released). It is expressed as a number usually from 1-10.

   • **Intensity:** is a qualitative measurement and is subjective and is a measurement of the earthquake effects and is expressed as a Roman numeral I-XII. Intensity can be influenced by distance to hypocenter, type of ground material, and strength.

5. The **largest earthquake ever recorded** was the **1960 Valdivia Earthquake** in **Chile**, which struck on **May 22, 1960**. It registered a **magnitude of 9.5**, making it the most powerful seismic event documented. It lasted for approximately **10 minutes.** There were an estimated 1,000 – 6,000 casualties. The quake triggered a massive tsunami that sped across the Pacific Ocean at speeds of up to **200 miles per hour**, causing destruction thousands of miles away in Hawaii, Japan, the Philippines, and even New Zealand.

6. The **largest earthquake ever recorded in the United States** was the **1964 Great Alaska Earthquake**, in Prince William Sound, Alaska. It struck on March 27, 1964, and registered a **magnitude of 9.2**, making it the second most powerful ever recorded globally. The quake lasted for roughly **4.5 minutes** and triggered a devastating tsunami with wave heights reaching over 30 feet that affected coastal areas as far away as California and Hawaii. The quake caused vertical ground shifts of up to **38 feet** in some areas, and ground fissures, landslides, and liquefaction reshaped the landscape. In Anchorage, entire neighborhoods were destroyed and **131** people died as a result of the earthquake.

7. The **largest earthquake ever recorded in Idaho** was the **1983 Borah Peak Earthquake**, which struck on **October 28, 1983,** near the town of **Challis** in central Idaho. The **magnitude 6.9** quake was felt across **eight U.S. states** and parts of **Canada.** The earthquake created a dramatic **fault scarp almost 22 miles long,** with vertical displacement up to almost **9 feet.** The earthquake caused landslides, rockfalls, sand boils, and changes to groundwater levels in the area, and the aftershocks continued for months. There were two fatalities and several injuries because of this quake. This quake remains Idaho's most powerful and geologically significant seismic event.

8. Based on historical data and probability a **6.0 magnitude** earthquake could occur approximately every **10 years** in Idaho.

9. Idaho experienced **1,455 earthquakes in 2024.** The largest one was **M 4.9.** The 2025 Stanley earthquake swarm in Idaho began around June 1st, and by June 6th, the U.S. Geological Survey had logged **103 total earthquakes** of varying magnitudes. On March 31, 2020, Stanley experienced an **M 6.5** earthquake which was felt statewide and precipitated thousands of aftershocks.

Science, Stories, and Shifting Ground

Grade Level: K-12
Idaho State Standards: N/A
Objectives:
Students will be able to:

- Explain what causes earthquakes using the theory of plate tectonics.
- Distinguish between scientific and cultural explanations of earthquakes.

TEACHING ADAPTATIONS:
This lesson can be taught all at once or broken out into three separate learning experiences for younger students. Tectonic plate instruction can be taught through discussion or with the accompanying video. The hands-on lab portion of this lesson can also be done as a stand-alone STEM activity.

MATERIALS:

- Khan Academy. *"Introduction to Plate Tectonics."* YouTube video, 4:35. Posted July 28, 2020. https://www.youtube.com/watch?v=7jbwX1Uvd18
- "Layers of Earth Labeled Diagram (Upper Mantle, Lithosphere, Asthenosphere)." *The Classroom.* https://images.ctfassets.net/cnu0m8re1exe/4QNixeXaVtgjv9jOg5PHoI/6049d11d035685329324becfcca6d15f/Layers-of-Earth-Labeled-Diagram-Upper-Mantle-Lithosphere-Asthenosphere.jpeg?fm=jpg&fl=progressive&w=660&h=433&fit=pad
- Lab materials: graham crackers, frosting, paper plates

LESSON OUTLINE:

ENGAGE (15 min): Earthquake Stories
Imagine you could go back in time to the year 500 A.D. You find yourself in a small village, just as a big earthquake hits! How would you help the villagers understand what caused the ground to shake so hard? Would you talk about tectonic plates, or explain it in a way that fits the time period? Let's hear your ideas!

Allow students to discuss their ideas

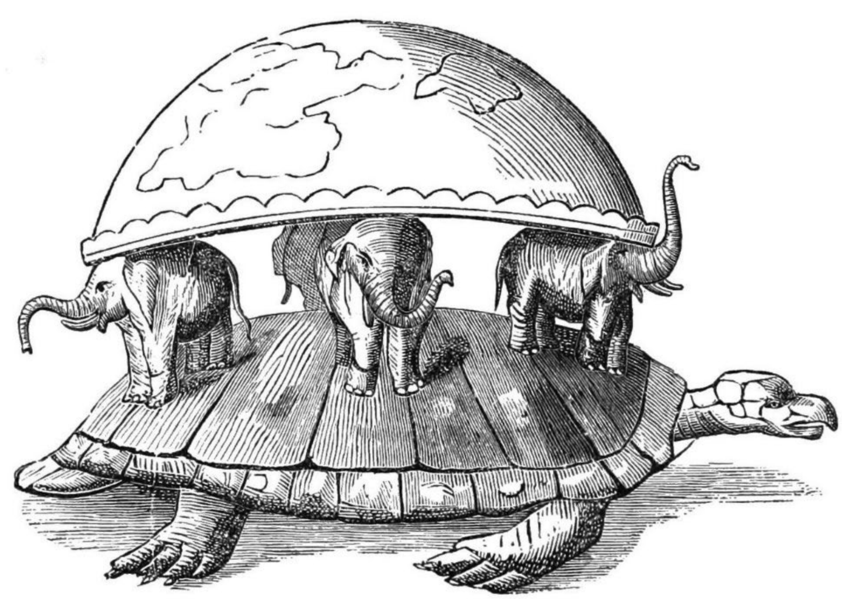
A long time ago, people didn't have science tools like we do today. So, when the ground suddenly started shaking and things fell over, it felt mysterious—like the earth was angry or alive!

To help make sense of it, people told stories or legends. For example, in Japan, they imagined a giant catfish living underground. If it wiggled too much, the earth would shake! These stories helped explain what was going on in a way that made sense to them back then. Let's look at a few earthquake legends from around the world.

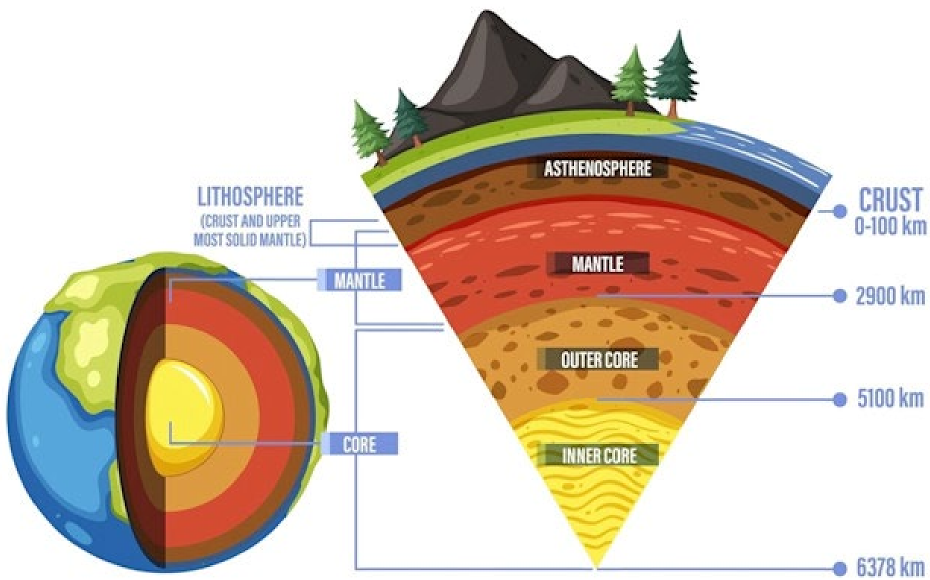
Introduce stories from different cultures about earthquake legends.
https://www.usgs.gov/programs/earthquake-hazards/earthquake-legends

Some examples of earthquake legends include:

- In India, the Earth is held up by four elephants that stand on the back of a turtle. The turtle is balanced on top of a cobra. When any of these animals move, the Earth trembles and shakes.
- In China, a giant frog held up the Earth.
- In Central America, earthquakes were believed to be caused by the anger of the gods.
- In Greece, earthquakes were believed to be caused by the god Poseidon.
- In East Africa, earthquakes were believed to be caused by the god Mulungu.
- In Belgium, earthquakes were believed to be caused by an angry angel sent by God to strike the air that surrounds our planet.
- In the United States, the Chickasaw chief was in love with a Choctaw princess. When she died, he cried so much that the Earth shook.



EXPLAIN (15 min): Science of Tectonic Plates
Tectonic plates – show Layers of Earth Labeled Diagram



Through many scientific observations, scientists now believe that earthquakes are caused by huge pieces of the Earth called *tectonic plates* moving and shifting.

Think of the Earth like a big ball made of different layers. The very top layer, Earth's outer shell is called the lithosphere and is split into large puzzle-like pieces known as tectonic plates. These plates move slowly over time, shaping Earth's surface.

When tectonic plates push against each other, stress builds up in the surrounding rocks. Eventually, the rocks break or slip suddenly, releasing the stored energy. This energy travels outward in the form of seismic waves, shaking the ground. The amount of energy released can be enormous. That's why earthquakes can cause powerful shaking, damage to buildings, and changes to the landscape.

Tectonic plates can:

- Push together (Convergent boundaries)
- Pull apart (Divergent boundaries)
- Slide past each other (Transform boundaries)
- Sink beneath one another at subduction zones

Scientists still don't fully understand what causes the plates to move. One idea is that heat deep inside Earth creates slow-moving currents in the mantle, kind of like a lava lamp, which push the plates around.

No matter what powers them, the movement of these plates can cause earthquakes, volcanic eruptions, and shape Earth's surface—especially in areas where plates meet.

- Khan Academy. *"Introduction to Plate Tectonics."* YouTube video, 4:35. Posted July 28, 2020. https://www.youtube.com/watch?v=7jbwX1Uvd18

EXPLORE (15 min): Hands-on lab - Tectonic Plate Experiment

What you need:

- A plate
- A spoonful of frosting or whipped cream (this is your asthenosphere)
- Two graham crackers or rectangular cookies (these are your tectonic plates)

Steps:

- Spread the frosting on the plate to make a gooey, soft layer.
- Place the crackers gently on top of the frosting. These are your tectonic plates floating on the softer layer beneath.
- Have students demonstrate and correctly identify tectonic plate movements and discuss what geographic changes or hazards might result.
  - Convergent Boundary - slide the crackers toward each other. (mountains)
  - Divergent Boundary - pull the crackers apart. (*rift* or *mid-ocean ridge*)
  - Transform Boundary - slide one past the other side-to-side (*earthquakes*)
  - Subduction Zone – slide one cracker underneath the other. (earthquakes, tsunamis, etc.)

What's happening?

This shows how the Earth's crust moves on a softer layer underneath, causing earthquakes, volcanoes, and mountains.

ELABORATE/EXTEND (Optional homework or follow-up lessons):

Earthquake legend art experience.

- Students illustrate one of the legends mentioned or create their own legend about what causes earthquakes.

Short reflective writing.

- Students write 3-5 sentences answering the prompt *"Why do people tell stories about earthquakes?"*

Advanced reflective writing.

- Students write a short essay exploring these ideas:
    - *How have scientific observations and theories changed people's understanding of the causes of earthquakes over time.*
    - *What did people understand before?*
    - *What do scientists understand now?*

Compare cultural legends to scientific understanding of earthquakes.

- Separate into small groups. Each group creates a mini-presentation (poster, skit, PowerPoint) answering the following questions:
    - *What does science say about earthquakes?*
    - *What do stories say?*
- Groups take turns presenting to the class.

EVALUATE:

- Engagement in Class Discussions: Student will be assessed on contributions to conversations including thoughtful comments, respectful listening, and participation.
- Lab Participation: Students will be assessed on participation and engagement in lab activity.
- Optional Activities: Assessment is up to the individual teacher and can be based on participation, content, or pre-determined rubric.

Understanding Magnitude

Grade Level: K-3
Idaho State Standards: N/A
Objectives:
Students will be able to

- Understand that earthquakes release energy.
- Learn that magnitude measures how much energy is released.
- Discover that each step in magnitude means much more energy.
- Use spaghetti to model the energy differences between magnitude levels.

MATERIALS:

- Uncooked spaghetti (1 box per group)
- Chart paper or whiteboard
- Markers, crayons, paper

Preparation:
Bundle the spaghetti prior to the class

- Single piece of spaghetti
- Bundle of 30 pieces of spaghetti
- Bundle of 900 pieces of spaghetti

LESSON OUTLINE:

ENGAGE (5-10 min): Spaghetti Demonstration
Imagine the ground shaking under your feet—what do you think causes that?

Ask focus questions:

- Have you ever felt an earthquake?
- What do you think makes the ground shake?
- How do you think scientists measure how big an earthquake is?

Scientists use a scale called the Richter scale or Moment Magnitude scale for earthquakes. It’s like a ruler for measuring earthquakes, but instead of inches, it measures energy. The scale is based on the amount of energy released or generated during earthquakes.

Show students the bundles of spaghetti and explain that each bundle represents a different earthquake magnitude.

EXPLORE and EXPLAIN (10–15 minutes)
Use the chart and fill in the magnitudes as you do each step below:

Magnitude	Pieces of Spaghetti	Energy Level
M 5	1	Low
M 6	30	Medium
M 7	900	Very High

Step 1: Bend and break a single piece of spaghetti. (M5)
Was that easy or hard to break?”

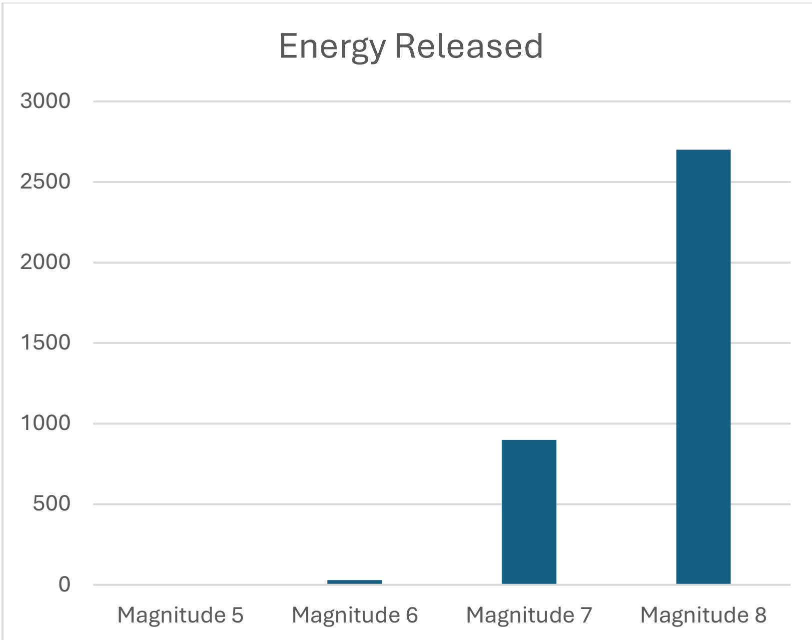
Step 2: Bend and break a bundle of 30 spaghetti pieces. (M6)
Did that take more energy?”

Step 3: Bend and break the rest of the package (~900 pieces).
What did you hear when the big bundle broke? Did you hear all the little cracks?”

EXPLAIN (5-10 min):

- Magnitude is the number that tells us how much energy an earthquake releases.

Draw a bar graph on the board, labeling each magnitude and how much energy is released to show how exponentially the energy output multiplies.



- Each step up in magnitude releases **30 times** more energy than the previous magnitude.
- Earthquakes don't just get a little stronger—they get much stronger with each step.
- A magnitude 6 earthquake releases 30 times as much energy as a magnitude 5 earthquake.
- A magnitude 7 earthquake releases 900 times as much energy as a magnitude 5 earthquake.
- Can you predict how much energy a magnitude 8 earthquake releases? (900 x 30 = 2700) It would take 2,700 pieces of spaghetti to represent a magnitude 8 earthquake.

ELABORATE/EXTEND (5 minutes): Foreshocks and Aftershocks
When we snapped the big bundle of 900 spaghetti pieces, the pieces didn't all break at once. What did you notice before and after the main break?
You probably heard lots of little cracks before the big snap, and more cracking sounds afterward. Earthquakes work in a similar way. Before a large earthquake, there are often smaller shakes called **foreshocks**. After the big quake, more small shakes can follow; these are called **aftershocks**.

EVALUATE (10 minutes)

- Engagement in Class Discussions: Student will be assessed on contributions to conversations including thoughtful comments, respectful listening, and participation.
- Lab Participation: Students will be assessed on participation and engagement in lab activity.
- Students complete the sentence: *"A magnitude 7 earthquake is stronger than a magnitude 6 because …"*

Magnitude vs. Intensity

Grade Level: K-12
Idaho State Standards:
PS4 – 4th, 5th, MS, HS
ESS2 – 3rd, 4th, 5th, MS, HS
Objectives:
Students will be able to identify the difference between magnitude and intensity of earthquakes and gain an appreciation for how intensity can vary with magnitude, depth, and distance from the epicenter.

ENGAGE (5 min):
How do you think scientists measure how big an earthquake is?

- Accept all answers—some may be qualitative (e.g., “how scary it felt”) and some quantitative (e.g., “a number on a scale”).

EXPLAIN (5 – 10 min):
The severity of an earthquake can be expressed in terms of both magnitude and intensity. However, the two terms are quite different, and they are often confused.

Magnitude is how strong an earthquake is. It tells us how much energy the earthquake released deep underground. Scientists use special machines called seismographs to measure this energy. No matter where you are, the strength of the earthquake (its magnitude) stays the same. We measure magnitude using special number scales like the Richter Scale and the Moment Magnitude Scale.

Each time the number goes up by one, the earthquake gets much stronger:

On the **Richter Scale**, each step means 10 times more shaking.
On the **Moment Magnitude Scale**, each step means 30 times more energy.

Intensity is different. It tells us how strong the shaking feels in different places. Some people might feel the earthquake a lot, while others farther away might barely notice it. Intensity depends on:

- How close you are to the earthquake
- What kind of ground is under you
- What buildings or trees are nearby

Intensity is measured by looking at what people felt and what got damaged. So even if an earthquake is big, you might not feel it much if you're far away.

Feature	**Magnitude**	**Intensity**
What it measures	Energy released at the source	Shaking effects at a location
Tool used	Seismograph	Human observation & damage reports
Scale	Richter / Moment Magnitude	Modified Mercalli Intensity (MMI)
Value type	One value per quake	Varies by location
Scientific objectivity	High (instrument-based)	Lower (subjective observations)

EXPLORE (15 min): Earthquake Lightbox - OMSI Activity
Incorporated Research Institutions for Seismology (IRIS). *"Earthquake Lightbox – OMSI Activity."* https://www.iris.edu/hq/inclass/activities/magnitude_and_intensity

Advanced Prep – 60 min
Set Up – 10 min

Activity – 15+ min
Clean Up – 5 min

Description: In this activity, students explore light as an analog to understand earthquake magnitude and intensity. In this demo, the absolute brightness of the light corresponds to earthquake magnitude. The *perceived* brightness of the light corresponds to shaking intensity. By manipulating small lights inside of a lightbox, learners gain an appreciation for how intensity can vary with magnitude, depth, and distance from the epicenter.

After this demo, visitors will understand:

- Magnitude is the amount of energy released during an earthquake
- Intensity is the amount of shaking felt at a particular location
- Intensity depends largely on the earthquake's magnitude, depth, and one's location relative to the epicenter.

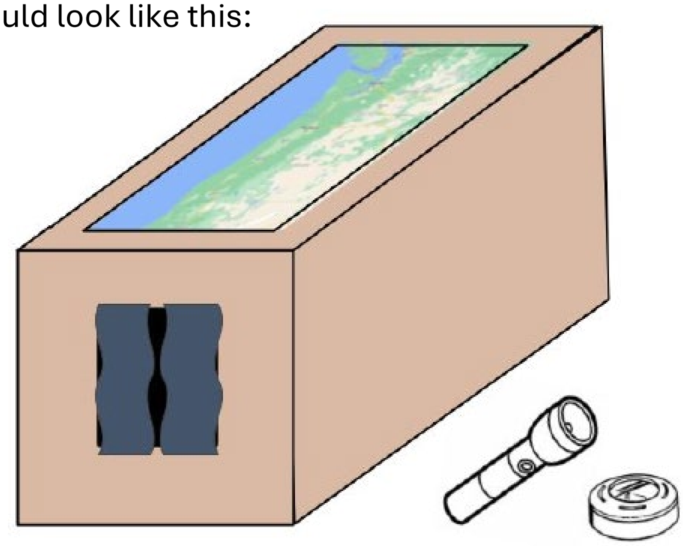
Lightbox Supplies:

Cardboard box (at least 10"X10"X12"
Felt (approx. 6'X6")
Utility knife
Tape and/or glue
Printed map (8.5X11")
Small, battery operated lights of various strengths (flashlights, "puck" lights, electric candles, etc.)

Prepare the lightbox as follows:

1. Using tape or glue, secure the ends of the box so that they remain in a closed position.
2. Optional: paint the box a solid color and/or cover in butcher paper.
3. Choose one side of the box to be the top. Using a utility knife, carefully cut out a 7.5"x10" rectangular opening. Place the printed map over the opening and secure around the edges with glue or tape. (If you plan to use the model repeatedly, you can laminate the map first).
4. On the front end of the box, cut another hole, this one just large enough to comfortably reach a hand inside. About 6"x6" should be good.
5. Using the felt, make two small curtains for the hole, so that when you reach a hand inside the box, less external light gets in.

Your final result should look like this:



When you put a small light (i.e., an "earthquake") inside the box, it will illuminate the map from below, indicating where "shaking" is felt. Experiment with the model and get a feel for how using different lights and/or placing the lights at different positions within the box changes the effect.

Set up:
Place lightbox, lights (turned on) on the table.

Activity:
Let students speculate before offering answers to any questions. The answers given are provided primarily for the instructor's benefit.

Question: How do you measure how big an earthquake is?
(*Responses may vary and may include qualitative as well as quantitative factors.)*

There are a lot of different ways to talk about the size of an earthquake. Two measures that scientists often use are **magnitude** and **intensity.**

When an earthquake occurs, it releases energy. Because I can't hold an earthquake in the palm of my hand, we're going to use something else that releases energy to represent an earthquake--**a light**. These two lights [hold up small and large lights] represent two earthquakes.

Which one releases more energy? (*The big light.)*

The big one releases more energy. It's more powerful. If it was an earthquake, we'd say it had a higher magnitude. **Magnitude** is essentially the amount of energy that an earthquake releases. Often, when we hear about an earthquake on the news, this is what we hear about: "It was a Magnitude 6, or a Magnitude 7," or so on. Magnitude is measured on the Moment Magnitude scale, which goes from 1-10. The most powerful earthquake ever recorded was a 9.5.

This box represents a chunk of earth's crust. The top, where the map is, represents the surface of the earth. Now, let's see what happens when we put the smaller light--the smaller magnitude "earthquake"--inside the box.

What do you notice? (Answers will vary, but will likely include an observation about how the surface "lights up.")

In this model, the parts of the map that are lit up are the areas where people feel shaking. **Intensity** is a measure of how much shaking. Notice that, right above the light, shaking intensity is pretty high, but farther out from the center, shaking intensity is lower. The same is true of earthquakes. In general, the closer you are to the center of an earthquake (the epicenter), the more shaking you will feel.

EXPAND (15 min):
From here, there are multiple options for exploration, based on the age, skill level, and interests of the learner. Some things to try, in order of complexity:

- Swap out the lights. Notice that, in general, higher magnitude earthquakes (i.e., higher powered lights) produce greater shaking intensity, spread out over a wider area.
- Identify points of interest on the map (cities, bodies of water, etc.). Experiment with moving the light north, south, east and west underneath the surface of the earth. Notice how shaking intensity varies; people in one city may experience intense shaking, while people 100 miles away experience mild shaking.
- Experiment with changing the depth of the earthquake (i.e. moving the light vertically up and down inside the box). Notice how deeper earthquakes tend to produce lower intensity shaking at the surface, spread across a wide geographic area. Shallow earthquakes tend to produce higher intensity shaking at the surface, concentrated in a smaller geographic area.
- Invite learners to consider whether, and under what circumstances, a magnitude 5 earthquake could cause more damage than a magnitude 6 earthquake, and to model those conditions using the lightbox. (A relatively low magnitude quake can cause significant damage if it occurs near a large population center and/or at shallow depth; a higher magnitude earthquake can be relatively harmless if it occurs far from populated areas and/or very deep in the earth).
- Using a geologic map for reference, draw plate boundaries and/or faults on the map. Note that earthquakes are most likely to occur along these boundaries.

- Invite learners to consider the limitations of the model. What isn't represented here?
  - For one, this model doesn't capture differences in soil or rock type, which significantly affect the intensity of shaking felt in different locations.
  - Also, this model doesn't emphasize the exponential nature of the magnitude scale, which increases by a factor of 32 for each degree magnitude. If a magnitude 5 is represented by a tiny electric candle (about 10 lumens), then a magnitude 6 would be represented by a powerful flashlight (about 300 lumens) and a magnitude 7 would have to be represented by an industrial flood light (about 10,000 lumens). Our model is far too small to accommodate this exponential scale.

EVALUATE:

- Engagement in Class Discussions: Student will be assessed on contributions to conversations including thoughtful comments, respectful listening, and participation.
- Lab Participation: Students will be assessed on participation and engagement in lab activity.
- Have students write a 3-5 sentence paragraph answering one of the following questions:
  - "What's the difference between magnitude and intensity?"
  - "Can a small magnitude earthquake cause more damage than a larger one? Why?"

Unit 1 Resources

Idaho Geological Survey. *"Southeast Idaho Earthquake Fact Sheet (Version 4)."* Great ShakeOut – Rocket. https://idahogeology.org/pub/Other/SE_Idaho_EQ_Fact_Sheetv4.pdf

Incorporated Research Institutions for Seismology (IRIS). *"Earthquake Lightbox – OMSI Activity."* https://www.iris.edu/hq/inclass/activities/magnitude_and_intensity

Incorporated Research Institutions for Seismology (IRIS). *"Faults and Folds—Models of Deformation."* YouTube video, 5:53. Posted March 23, 2012. https://www.youtube.com/watch?v=rjn2ZJwpqQA

Khan Academy. *"Introduction to Plate Tectonics."* YouTube video, 4:35. Posted July 28, 2020. https://www.youtube.com/watch?v=7jbwX1Uvd18

"Layers of Earth Labeled Diagram (Upper Mantle, Lithosphere, Asthenosphere)." *The Classroom.* https://images.ctfassets.net/cnu0m8re1exe/4QNixeXaVtgjv9jOg5PHoI/6049d11d035685329324becfcca6d15f/Layers-of-Earth-Labeled-Diagram-Upper-Mantle-Lithosphere-Asthenosphere.jpeg?fm=jpg&fl=progressive&w=660&h=433&fit=pad

Oak National Academy. *"Lesson: How Does an Earthquake Occur?"* https://www.thenational.academy/teachers/lessons/how-does-an-earthquake-occur-6dk3gt#video

U.S. Geological Survey. "Earthquake Legends." U.S. Department of the Interior. https://www.usgs.gov/programs/earthquake-hazards/earthquake-legends

U.S. Geological Survey (USGS). *"Earthquakes: A Whole Lot of Shaking Going On!"* YouTube video, 3:01. Posted October 19, 2016. https://www.youtube.com/watch?v=pCcH2gLrqnA

U.S. Geological Survey (USGS). *"Earthquake Magnitude vs. Intensity: What's the Difference?"* YouTube video, 1:55. Posted October 19, 2016. https://www.youtube.com/watch?v=tsqfEhHXwsY

Unit 2: Ripple Effects: Shake, Slide, Splash!

Contents

Earthquake Hazards

Grade Level: K-12
Idaho State Standards: N/A
Objectives:
Students will be able to:

- Identify common earthquake hazards (e.g., ground shaking, building collapse, landslides).
- Recognize uncommon hazards (e.g., soil liquefaction, tsunamis, fires, dam failures).
- Understand how these hazards affect communities and the environment.

MATERIALS:
Video clip of earthquake events
Technology to show videos
Hazard cards (printed or digital)

- Unknown Author. *"Module 3: Earthquake Hazards."* Scribd, uploaded 2025. https://www.scribd.com/document/742582490/MODULE-3-EARTHQUAKE-HAZARDS

LESSON OUTLINE:

ENGAGE (5 min): Show one of the following videos of earthquake damage.

- KTVB News. *"Coverage of March 31, 2020, Magnitude 6.5 Stanley Earthquake."* YouTube video, 1:18. Posted March 31, 2020. https://www.youtube.com/watch?v=GMKApCkXp1w (*video might be sensitive to younger viewers as it references the 1983 Challis earthquake that killed two children while they were walking to school).
- Anchorage School District. *"Earthquake Classroom Video – Footage from Inside an Anchorage School District Classroom during the Nov. 30, 2018, Earthquake."* YouTube video, 3:45. Posted December 1, 2018. Accessed December 17, 2025. https://www.youtube.com/watch?v=NJZqREPc9k0

- Guardian News. *"Before and After Drone Footage Kahramanmaraş, Turkey in February 2023."* YouTube video, 1:53. Posted February 13, 2023. https://www.youtube.com/watch?v=GJDjEEvxi0E

EXPLAIN: (10 min):
What damage do you think most often happens during an earthquake in Idaho?

Common Hazards During Earthquakes:
1. Ground shaking – the most common hazard
    - Earthquakes make the ground shake.
    - In small quakes, things can fall off shelves, dishes rattle, and tall or heavy objects like bookcases or wall hangings may tip over.
    - This shaking is the main cause of damage in most earthquakes.

2. Building damage or collapse
    - Older or poorly built buildings are more likely to crack or break during an earthquake.
    - Chimneys, water heaters, and houses not firmly attached to their foundations can be especially dangerous.
    - In very strong earthquakes, even big structures like bridges or dams can be damaged or destroyed.

3. Cracks in the ground (ground displacement or rupture)
    - Earthquakes can split the ground open along fault lines.
    - Roads, pipes, and utility lines may break when the ground shifts.
    - Buildings sitting directly on a fault line can be torn apart.

4. Landslides on hills and mountains
    - Shaking can loosen rocks and soil, causing landslides.
    - Roads may be blocked, and avalanches can happen if there's enough snow.
    - Even small earthquakes can trigger rockfalls on steep slopes.

Did you know earthquakes can cause hazards that aren't always visible, like the ground turning into quicksand?

Uncommon Hazards During Earthquakes:
1. Soil liquefaction – when the ground acts like liquid

- In some places, the soil is very wet or loose.
- During an earthquake, this soil can lose its strength and behave more like a liquid than solid ground.
- Buildings, roads, and pipes sitting on this type of soil may sink, tilt, or break.
- Sometimes water can burst out of the ground like a fountain, and septic systems or wells may stop working properly.

2. Inland tsunamis

- Earthquakes can shake lakes and reservoirs, causing big waves to form.
- These waves are called inland tsunamis, lake tsunamis or *seiches [sā(t)SH]*.
- Large waves may flood shorelines, damage buildings near the water, or even harm dams.
- If a dam is overtopped or broken, it could cause dangerous flooding downstream.

EVALUATE:

- Engagement in Class Discussions: Student will be assessed on contributions to conversations including thoughtful comments, respectful listening, and participation.

Potential Earthquake Hazards

Ground Shaking

The first main earthquake hazard (danger) is the effect of ground shaking.

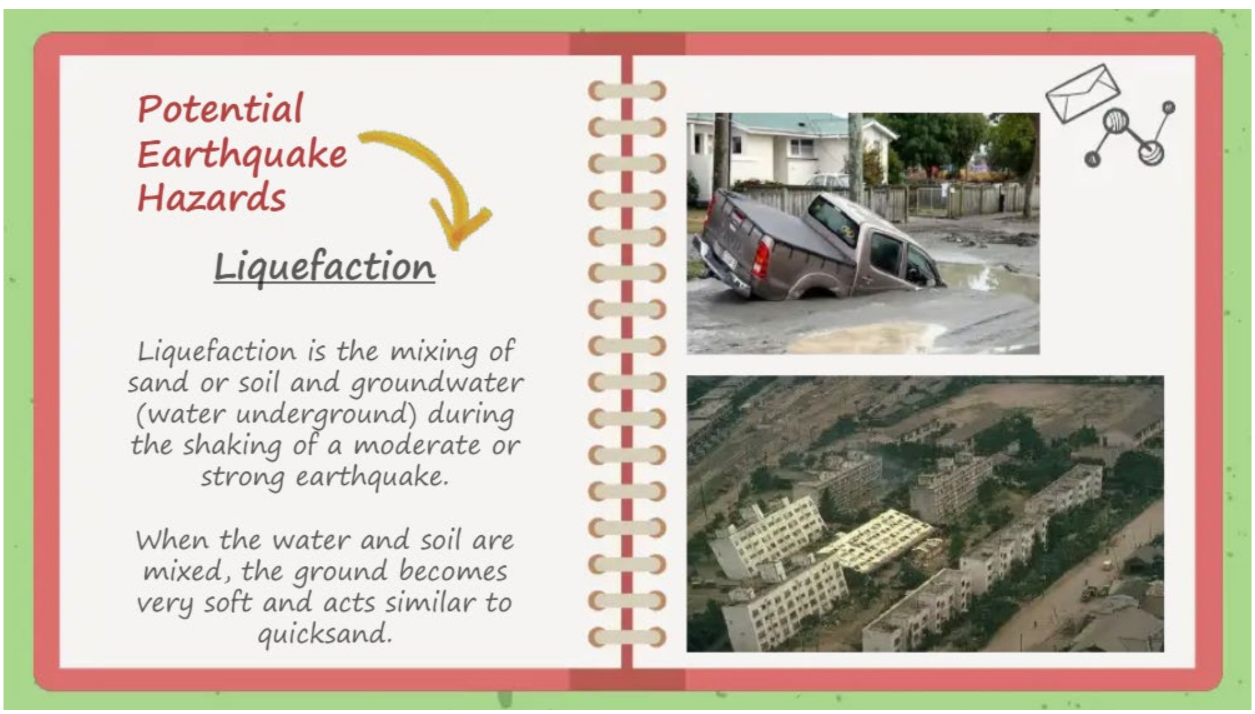
Buildings can be damaged by the shaking itself or by the ground beneath them settling to a different level than it was before the earthquake (subsidence).

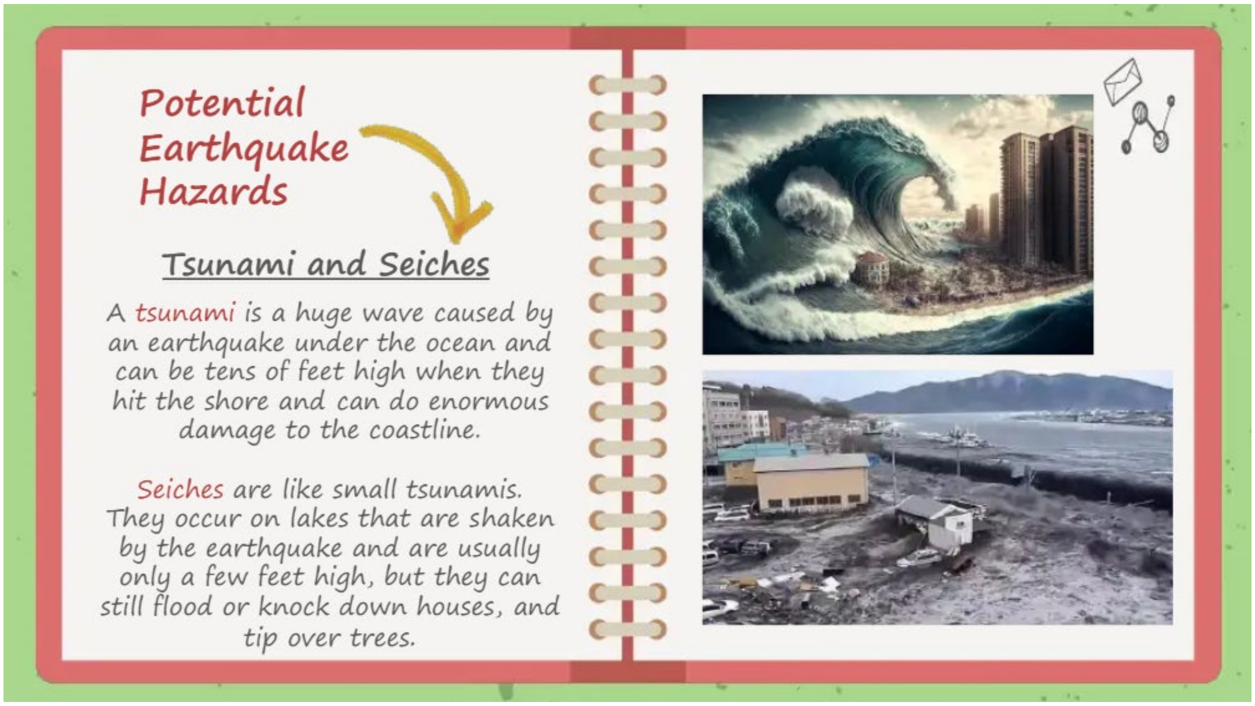
Potential Earthquake Hazards

Ground Rupture

Deformation on the ground that marks the interaction of the fault with the earth's surface.


Potential Earthquake Hazards
Earthquake-Induced Landslide
Downslope movement of rocks, soil and other debris commonly triggered by strong shaking.


Potential Earthquake Hazards
Liquefaction
Liquefaction is the mixing of sand or soil and groundwater (water underground) during the shaking of a moderate or strong earthquake.
When the water and soil are mixed, the ground becomes very soft and acts similar to quicksand.


Potential Earthquake Hazards
Tsunami and Seiches
A tsunami is a huge wave caused by an earthquake under the ocean and can be tens of feet high when they hit the shore and can do enormous damage to the coastline.
Seiches are like small tsunamis. They occur on lakes that are shaken by the earthquake and are usually only a few feet high, but they can still flood or knock down houses, and tip over trees.

Liquefaction: That Sinking Feeling

Grade Level: K-12
Idaho State Standards: N/A
Objectives:
Students will be able to:

- Interact with a model to demonstrate liquefaction.
- Assess potential damage to homes, lifelines, and schools.

MATERIALS:

- Sandbox or clear container with moist sand
- Toy buildings (blocks, small figurines)
- Small capped containers (e.g., mini-M&M tubes) as buried pipes
- Water
- Spoon or stick for tapping
- Photos of liquefaction effects (Japan 1964, Northridge 1994, etc.)

LESSON OUTLINE:

ENGAGE (5 min): *Liquefaction Sandbox Lab*

1. Prepare moist sand in a clear container.
2. Bury small, capped containers (pipes) and place toy buildings on top.
3. Ask students what comes in and out of pipes in our community (water, sewer, electricity).
4. Simulate an earthquake by gently tapping or shaking the container.
5. Observe:
   - Water rising to the surface
   - Buildings tipping
   - Pipes surfacing

Prompt students to describe what they see.
"Why do you think the buildings are falling?" "Where is the water coming from?"

EXPLAIN (15 min): ***Clarify the science behind liquefaction.***
Use visuals to explain:

- Earthquake vibrations cause sand grains to bounce.
- Water between grains is squeezed upward.
- Soil loses strength and behaves like a liquid.

Here in Idaho, earthquakes of various magnitudes occur regularly. During a strong quake, one possible effect is **liquefaction**—a process where saturated soil temporarily behaves like a liquid. Write the word ***liquefaction*** on the board and invite students to identify its root word: *liquid*. This helps them connect the concept to what they already know.

When an earthquake shakes soil that has a high-water content—like near a river or in a floodplain—the soil can lose its solid strength and start acting more like a thick liquid, similar to pudding or quicksand. The shaking causes the sand grains to bump into each other, squeezing the water trapped between them. Since the water has nowhere else to go, it pushes upward to the surface while the sand grains settle and pack more tightly together.

Emphasize:

- Liquefaction is caused by an earthquake, not the other way around.
- It happens in wet, sandy or clay soils.
- Earthquakes of magnitude 5.0 or higher can trigger it.

Students have experienced liquefaction on a small scale if they have ever walked along the beach or by a river and seen water rise to the top of the sand at every step.

ELABORATE (15 min):
When liquefaction happens on a large scale, it spells disaster.
If our experiment were an occupied building and liquefaction occurred over a large, inhabited area, what would be the effect on:

- People?
- Homes and schools?
- Buried lifelines (gas, water, electricity)?
- Farms and crops?
- Emergency services?
- Big cities and industrial areas?
- Old buried materials?

Apply understanding to real-world examples.

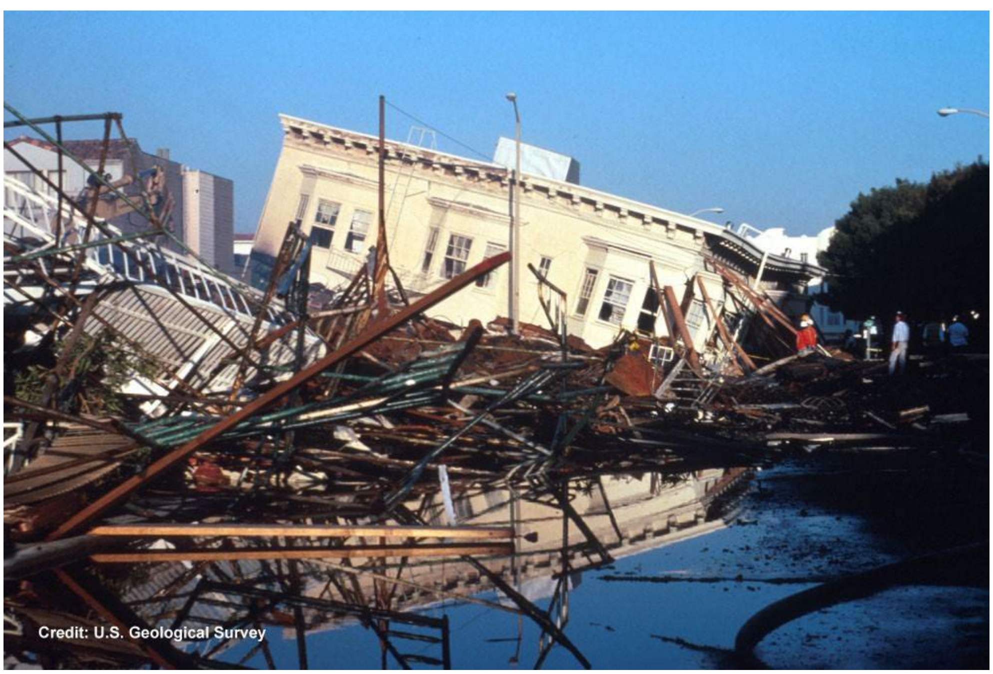
Niigata, Japan (1964) – buildings tipped slowly.

As a result of how slowly these buildings tipped over, there were no reported injuries in these buildings . After this earthquake, engineers learned more about how to make buildings safer in areas where liquefaction can occur.

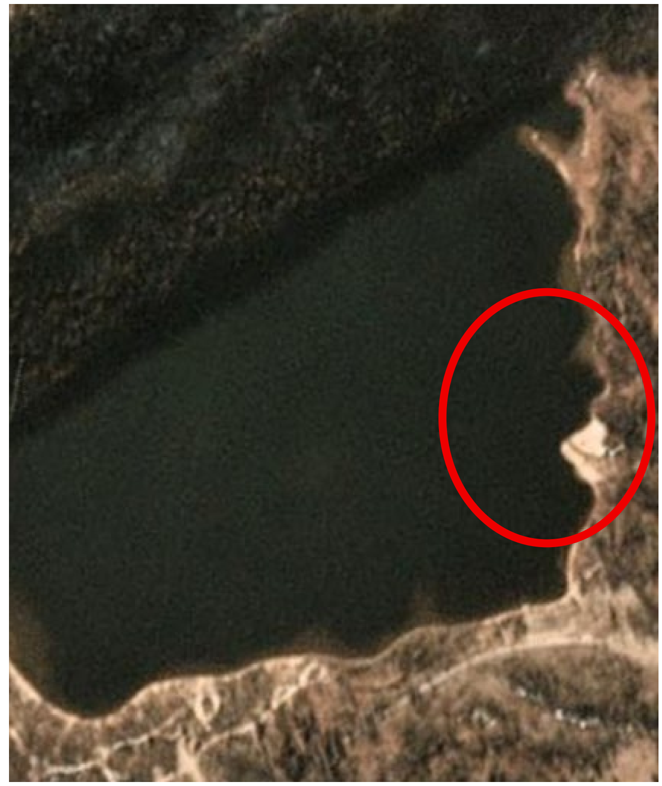
Northridge, California (1994) – gas pipeline broke, causing fires.

This picture is from the 1994 Northridge earthquake in Southern California. There is a large flame that seems to be coming out of the street. The cause of the fire was a broken gas pipeline. The pipeline didn't break because of the earthquake shaking, but because of the pipe movement due to liquefaction.

Loma Prieta, California (1989) – widespread damage.



Stanley Lake, ID (2020) – Disappearing Delta



Following the March 31, 2020, M6.5 earthquake, liquefaction caused the delta that used to be a popular beach and recreation site near the inlet of Stanley Lake to sink fully underwater.

Stanley Lake, ID (2020)

EVALUATE:

- **Engagement in Class Discussions**: Student will be assessed on contributions to conversations including thoughtful comments, respectful listening, and participation.
- **Lab Participation:** Students will be assessed on participation and engagement in lab activity.

Inland Tsunamis and Seiches: Wave Goodbye

Grade Level: K–12
Objectives:
Students will be able to:

- Understand that tsunami-like waves can occur in lakes
- Identify causes of lake tsunamis (earthquakes, landslides, weather)
- Recognize safety measures during such events
- Compare lake tsunamis to oceanic tsunamis

MATERIALS:

LESSON OUTLINE:

ENGAGE (5 min):
NOAA Ocean Today. *"What Causes a Tsunami."* YouTube video, 3:08. Posted March 5, 2015. https://www.youtube.com/watch?v=-IGsn3Ozfxs

Misconception Check: Use a quick true/false quiz:

- "Tsunamis only happen in oceans." (False)
- "Lakes are too small for big waves." (False)

Display a photo of a large lake and ask students to imagine big waves there. Just like a big splash in a bathtub, lakes can have huge waves when something shakes or pushes the water really fast.

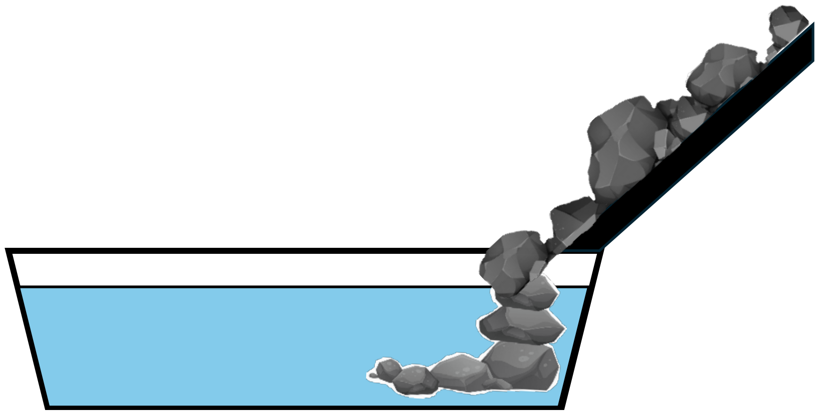
EXPLORE(15 min): Inland Tsunami / Seiche [sā(t)SH] Simulator
Investigate 3 different ways inland tsunamis and seiches occur by using a large clear bin partially filled with water.

Use the following discussion prompts for each simulation:

- What caused the waves?
- How are these waves similar to ocean tsunamis?

1. Landslide Simulation:

Drop or slide a large rock, or large handful of gravel into one side of the tub of water to simulate a landslide and observe wave formation.



2. Earthquake Shake Simulation:

Gently shake a tray of water to mimic earthquake-induced waves.

3. Wind / Weather Simulation:

Use a fan to simulate strong winds causing waves. (Waves caused by wind and weather are called meteotsunamis).

EXPLAIN (10 min):
Tsunamis in lakes and inland waterways like rivers and reservoirs are called inland tsunamis and seiches. When an earthquake, landslide, or something else suddenly moves the water, it can make a traveling wave called an **inland tsunami**. Sometimes, instead of one big wave, the water rocks back and forth like it's sloshing in a bathtub. That rocking motion is called a **seiche**.

How could an earthquake cause large waves in a lake?

- When tectonic plates push against each other, stress builds up in the surrounding rocks. Eventually, the rocks break or slip suddenly, releasing the stored energy. This energy travels outward in the form of seismic waves, shaking the ground. The amount of energy released can be enormous. This shaking under and around lakes and reservoirs can cause big waves to form.
- Earthquakes can also cause landslides. Rockfalls or debris flows into lakes can create massive waves.

What kind of damage can inland tsunamis cause?
Inland tsunamis and seiches are rare but dangerous, especially in mountainous regions like Alaska or British Columbia where landslides into lakes are more common. Unlike big waves in the ocean, waves in lakes or rivers can pop up really fast, with almost no warning. It's kind of like when someone jumps into a swimming pool right next to you—the splash happens right away because they're so close.

- Inland tsunamis and seiches can threaten fishermen, lakeside communities, and infrastructure.
- Large waves may flood shorelines, damage buildings near the water, or even harm dams.
- If a dam is overtopped or broken, it could cause dangerous flooding downstream.

How can you stay safe during an inland tsunami or seiche?
Safety Steps:

- Know evacuation routes: Identify safe paths and move quickly to higher ground.
- Prepare emergency supplies: Keep essentials such as food, water, and a first aid kit ready.

EXPAND (15 min): Real-world case-studies.
There are several remarkable case studies of inland tsunamis and seiches that highlight how powerful and destructive these events can be. They're driven by earthquakes, landslides, and even climate-related changes like glacial melt.

1. Hebgen Lake, Montana (1959)

On August 17, 1959, a powerful earthquake measuring between magnitude 7.2 and 7.3 struck near Hebgen Lake in southwestern Montana. The tremor generated massive waves on both sides of Hebgen Dam, which sustained cracks but ultimately held.

- The quake first triggered a massive landslide in Madison Canyon, sending 36–43 million cubic yards (70,000 lbs.) of rock into the Madison River. The surge of debris created enormous waves that swept away people and homes; several cabins were later found deposited in a meadow once the waters receded. The landslide also blocked the river, forming what is now Earthquake Lake (Quake Lake).
- The northern side of Hebgen Lake also dropped drastically in the quake. This triggered a seiche, causing the water to slosh back and forth violently for hours. These waves damaged shorelines, docks, roads, and cabins, showing how waves in inland water bodies can be just as hazardous as oceans.
- Casualties: At least 28 people lost their lives, mostly due to the landslide in Madison Canyon.
- Economic impact: Damages were estimated at $11 million in 1959 (approximately $119 million today).
  Yellowstone National Park. *"Hebgen Lake Earthquake Part II."* YouTube video, 4:58. Posted August 17, 2017.
  https://www.youtube.com/watch?v=ZU6cVT2mL0I

2. Elliot Lake Tsunami, British Columbia (2020)

A massive landslide on B.C.'s remote central coast triggered a lake tsunami over 325 feet tall - that's taller than a 30-story building.

- The landslide had the mass equivalent to all the automobiles in Canada, moving at 85 mph.
- It displaced lake water, causing an outburst flood that surged down Elliot Creek, destroying over 5 miles of salmon spawning habitat and sending debris over 37 miles into Bute Inlet.

- The event was linked to glacial retreat, which destabilized the slope and set off a cascade of hazards.

3. Lituya Bay, Alaska (1958)

Often cited as the tallest tsunami ever recorded, this event was triggered by a massive rockfall into Lituya Bay.

- The wave reached an astonishing 1,720 feet high.
- Though technically a fjord, Lituya Bay behaves like a lake in terms of enclosed water dynamics.
- The wave stripped trees from the surrounding hillsides and sank boats, but due to the remote location, casualties were limited.

4. Lake Geneva Seiche (563 AD)

A historical account describes a catastrophic wave sweeping across Lake Geneva, Switzerland.

- Believed to be triggered by an underwater landslide, the wave devastated the city of Tauredunum.
- Though ancient, this event is often cited in geological literature as evidence of lake tsunami potential in populated areas.

EXTEND (optional activities):

- Role-Play: "You're at a lake and feel the ground shake. What do you do?"
- Design a Safety Poster: "How to stay safe during an inland tsunami or seiche."
- STEM Challenge: Build a model shoreline and test how waves affect different structures (e.g., docks, houses).
- Tsunami Tag - Outdoor or gym space:
    - One student is the "trigger" (earthquake, landslide, or storm).
    - Others are "waves" that spread out from the trigger.
    - Remaining students must run to "higher ground" (designated safe zones).
    - Discuss what each role represents afterward.

EVALUATE:

- Engagement in Class Discussions: Student will be assessed on contributions to conversations including thoughtful comments, respectful listening, and participation.
- Student Worksheet

Inland Tsunamis and Seiches

Name________________________________ Date__________

Inland tsunamis are large waves in lakes, rivers, or reservoirs caused by sudden disturbances such as earthquakes or landslides. A seiche is the rocking motion of water in a lake or reservoir, similar to water sloshing in a bathtub.

1. How can an earthquake cause large waves in a lake?
   -
   -

2. What kind of damage can inland tsunamis and seiches cause?
   -
   -
   -

3. What should you do to stay safe during an inland tsunami or seiche?
   -
   -

4. Compare & Contrast - Complete the chart below.

	Ocean Tsunami	**Inland Tsunami and Seiches**
Cause		
Size		
Location		
Safety Response		

5. Why is it important to have a safety plan even though inland tsunamis are rare?

Inland Tsunamis and Seiches

Answer Key - Student Worksheet

Name________________________________ Date______________

Inland tsunamis are large waves in lakes, rivers, or reservoirs caused by sudden disturbances such as earthquakes or landslides. A seiche is the rocking motion of water in a lake or reservoir, similar to water sloshing in a bathtub.

1. How can an earthquake cause large waves in a lake?
   - *ground shaking*
   - *landslides*

2. What kind of damage can inland tsunamis and seiches cause?
   - *flooding*
   - *damage to shoreline, environment*
   - *damage to buildings, dams, communities*

3. What should you do to stay safe during an inland tsunami or seiche?
   - *Know evacuation routes: Identify safe paths and move quickly to higher ground.*
   - *Prepare emergency supplies: Keep essentials such as food, water, and a first aid kit ready.*

4. Compare & Contrast - Complete the chart below.

	Ocean Tsunami	**Inland Tsunami and Seiches**
Cause	*undersea earthquake*	*earthquake, landslide, weather*
Size	*very large*	*smaller, but still dangerous*
Location	*oceans*	*lakes, reservoirs, rivers*
Safety Response	*move to higher ground*	*move to higher ground*

5. Why is it important to have a safety plan even though inland tsunamis are rare?
   - *Inland tsunamis and seiches are rare but dangerous, because waves in lakes or rivers can pop up really fast, with almost no warning.*

Unit 2 Resources

Al Jazeera English. *"Landslide Kills at Least 162 in Myanmar's Jade Mining Hub."* YouTube video, 1:40. Posted July 2, 2020. https://www.youtube.com/watch?v=9rcJzZ5vLk8

Anchorage School District. *"Earthquake Classroom Video – Footage from Inside an Anchorage School District Classroom during the Nov. 30, 2018, Earthquake."* YouTube video, 3:45. Posted December 1, 2018. https://www.youtube.com/watch?v=NJZqREPc9k0

FLOW-3D HYDRO. *"Landslide Analysis Simulation."* YouTube video, 0:20. Posted July 27, 2021. https://www.youtube.com/watch?v=dSIYW_5Z3AM

FLOW-3D HYDRO. *"Landslide into a Reservoir."* YouTube video, 0:37. Posted July 27, 2021. https://www.youtube.com/watch?v=o6o4qgobWZ

FLOW-3D HYDRO. *"Landslide Simulation into Agua del Toro Reservoir."* YouTube video, 0:40. Posted July 27, 2021. https://www.youtube.com/watch?v=JwlcEZ_x0uM

Guardian News. *"Before and After Drone Footage Kahramanmaraş, Turkey in February 2023."* YouTube video, 1:53. Posted February 13, 2023. https://www.youtube.com/watch?v=GJDjEEvxi0E

Guardian News. *"Eyewitness Video Shows Landslide's Impact on River."* YouTube video, 2:36. Posted August 12, 2017. https://www.youtube.com/watch?v=0hxNwN5dXa4

Idaho Geological Survey. *"Stanley Lake Liquefaction."* https://idahogeology.org/geologic-hazards/earthquake-hazards/stanley-lake-liquefaction

Institute for Environmental Research and Education. *"Can a Tsunami Happen in a Lake?"* https://iere.org/can-a-tsunami-happen-in-a-lake/

KTVB News. *"Coverage of March 31, 2020, Magnitude 6.5 Stanley Earthquake."* YouTube video, 1:18. Posted March 31, 2020. https://www.youtube.com/watch?v=GMKApCkXp1w (*video might be sensitive to younger viewers as it references the 1983 Challis earthquake that killed two children while they were walking to school).

NOAA Ocean Today. *"What Causes a Tsunami."* YouTube video, 3:08. Posted March 5, 2015. https://www.youtube.com/watch?v=-IGsn3Ozfxs

U.S. Geological Survey (USGS). *"Earthquake Hazards vs. Earthquake Risks (There Is a Difference!)."* YouTube video, 1:57. Posted October 19, 2016. https://www.youtube.com/watch?v=MQNKpS0xrwM

U.S. Geological Survey (USGS). *"What Causes a Tsunami."* YouTube video, 3:08. Posted October 19, 2016. https://www.youtube.com/watch?v=-IGsn3Ozfxs

Unit 3: Earthquakes in Idaho

Contents

Patterns in Place

Grade Level: K-12
Idaho State Standards:
Middle School Earth Science MS-ESS-3.2
High School Earth Science HS-ESS-3.1
Objectives:
Students will be able to:

- Identify patterns in earthquake locations across Idaho
- Recognize the relationship between earthquakes and tectonic activity
- Plot earthquake epicenters on a map and interpret seismic activity zones

TEACHING ADAPTATIONS
This activity will require students to analyze data and describe patterns associated with the data. Earthquake plotting approaches can be modified depending on the skills and academic level of the student.
K–2: Use simplified cards with city names and focus on visual patterns or use timelapse video "Earthquakes of Cascadia" to show patterns.
Grades 3–5: Introduce mapping by using latitude and longitude coordinates.

MATERIALS:

- Earthquake fact cards (with date, magnitude, location, and coordinates)
- Large Idaho state map – see Figure 1 or Figure 2. (printed or projected)
- Stickers of varying sizes/colors to represent magnitudes
- Table 1 with latitude/longitude data (optional)
- Markers or pins for plotting (optional)
- Technology to view videos

LESSON OUTLINE:

ENGAGE (5 min):
Is there a pattern to where and why earthquakes occur in Idaho?

EXPLORE (15 min): Mapping Idaho Earthquakes Activity
Instructions:
- Distribute earthquake fact cards to each student.
- Students match the magnitude to a sticker size:
  - Magnitude 2.0–3.9 → Small sticker
  - Magnitude 4.0–4.9 → Medium sticker
  - Magnitude 5.0+ → Large sticker
- Students locate the earthquake on the Idaho map and place their sticker.
- Observe overlapping stickers and emerging patterns.

EXTEND (Optional Tech Mapping Activity):
- Earthquake plotting could also be done using a digital map or projection.
- Students input latitude/longitude from Table 1 or earthquake fact cards to plot epicenters using markers or pins.

EXPLORE (15 min): Looking for Patterns in Place
What patterns do you notice when you look at the map?
Why do you think earthquakes are concentrated in certain areas?

Earthquakes along Tectonic Plate boundaries:
The surface of the earth (the crust) is made up of large masses, referred to as tectonic plates. Many of the world's earthquakes result from forces along the margins of these tectonic plates. These earthquakes occur when pressure resulting from these forces is released in a sudden burst of energy and motion. However, most earthquakes in Idaho have origins (the epicenter) far from plate boundaries.

Earthquakes along Fault Lines:
What causes earthquakes in Idaho if it's not near a plate boundary?

Much of the earth's crust in southern and central Idaho has undergone tremendous stretching, resulting in parallel, linear mountains and valleys. This region is called the Basin and Range and extends into the adjoining States of Montana, Utah, Wyoming, and Nevada. Basin and Range stretching is still continuing today. As the earth's crust stretches, the rock layers can crack and break from the pressure. These cracks are called faults and are where earthquakes occur. Earthquakes from these crustal movements can cause severe ground shaking in Idaho.

Focus Question:
How can understanding earthquake patterns help keep people safe?

Discuss how scientists use data to understand seismic risk. Knowing the recurrence interval helps people:

- Build safer buildings
- Make emergency plans
- Stay prepared just in case

ELABORATE/EXTEND:
Videos: Watch one of the time-lapse videos of all earthquakes and discuss the patterns in location and frequency.

- U.S. Geological Survey (USGS). *"Earthquakes of Cascadia: 1979–2019."* YouTube video, 3:01. Posted March 5, 2021. https://www.youtube.com/watch?v=wAJcLtBhNEM
- U.S. Geological Survey (USGS). *"40 Years of Earthquakes in the Contiguous United States: 1980–2020."* YouTube video, 3:38. Posted March 5, 2021. https://www.youtube.com/watch?v=sv7JwrWURyQ
- Earthquakes Today. *"Animated Worldwide Earthquakes Time-Lapse: December 2024 in 25 Seconds."* YouTube video, 0:46. Posted January 1, 2025. https://www.youtube.com/watch?v=hlONWGUSc5c

EVALUATE:

- Engagement in Class Discussions: Student will be assessed on contributions to conversations including thoughtful comments, respectful listening, and participation.
- Map Activity: Students will be assessed on participation and engagement in mapping activity.

Table 1 – Idaho Earthquakes over 4.5+ Magnitude

Date	Latitude	Longitude	Mag.	Location
August 18, 1959	44.79	-111.20	7.2	Hebgen Lake, Montana
October 28, 1983	44.06	-113.86	6.9	Borah Peak, Idaho
March 31, 2020	44.46	-115.12	6.5	Stanley, Idaho
August 18, 1959	44.81	-110.86	6.3	Mammoth, Wyoming
November 23, 1947	45.05	-111.56	6.1	Big Sky, Montana
March 28, 1975	42.06	-112.55	6.1	Snowville, Utah
August 19, 1959	44.65	-110.84	6.0	West Yellowstone, Montana
June 30, 1975	44.75	-110.61	5.9	Mammoth, Wyoming
February 3, 1994	42.76	-110.98	5.8	Auburn, Wyoming
August 18, 1959	44.86	-110.75	5.7	Mammoth, Wyoming
August 22, 1984	44.47	-114.01	5.6	Challis, Idaho
July 26, 2005	45.37	-112.62	5.6	Dillon, Montana
November 11, 1905	42.90	-114.50	5.5	Shoshone, Idaho
December 8, 1976	44.76	-110.79	5.5	Mammoth, Wyoming
October 29, 1983	44.28	-114.12	5.5	Clayton, Idaho
November 19, 1937	42.10	-113.90	5.4	Oakley, Idaho
October 28, 1983	44.07	-113.91	5.4	Mackay, Idaho
October 29, 1983	44.23	-114.11	5.4	Clayton, Idaho
May 13, 1916	44.20	-116.50	5.3	Banks, Idaho
December 12, 1917	43.00	-111.30	5.3	Freedom, Idaho
October 19, 1976	44.74	-110.81	5.3	West Yellowstone, Montana
October 19, 1976	44.80	-110.70	5.3	Mammoth, Wyoming
April 21, 2001	42.93	-111.40	5.3	Freedom, Idaho
September 2, 2017	42.65	-111.45	5.3	Soda Springs, Idaho
September 5, 1928	42.10	-115.20	5.2	Jackpot, Nevada
October 21, 1964	44.87	-111.57	5.2	Hebgen Lake, Montana
March 11, 1977	44.85	-111.50	5.2	Hebgen Lake, Montana
January 6, 1965	44.77	-112.75	5.1	Lima, Montana
March 31, 1973	44.51	-110.49	5.1	West Yellowstone, Montana
June 30, 1975	44.77	-110.72	5.1	Mammoth, Wyoming
September 8, 1984	44.44	-114.15	5.1	Challis, Idaho
August 20, 1999	44.79	-112.79	5.1	Lima, Montana
August 19, 1959	44.82	-111.59	5.0	Hebgen Lake, Montana
August 19, 1959	44.76	-110.96	5.0	West Yellowstone, Montana
August 20, 1959	44.70	-111.68	5.0	Hebgen Lake, Montana
March 28, 1973	44.43	-110.39	5.0	West Yellowstone, Montana
January 3, 2015	44.51	-114.11	5.0	Challis, Idaho
September 10, 2017	42.56	-111.42	5.0	Georgetown, Idaho

September 11, 1963	44.18	-114.62	4.9	Clayton, Idaho
October 8, 1965	44.71	-111.27	4.9	Hebgen Lake, Montana
April 26, 1969	44.06	-114.44	4.9	Clayton, Idaho
June 9, 1974	44.80	-111.05	4.9	Hebgen Lake, Montana
June 30, 1975	44.69	-110.59	4.9	Mammoth, Wyoming
December 9, 1976	44.77	-110.79	4.9	Mammoth, Wyoming
December 19, 1976	44.77	-110.80	4.9	Mammoth, Wyoming
July 14, 1988	44.46	-114.08	4.9	Challis, Idaho
February 26, 2024	44.39	-116.11	4.9	Smith’s Ferry, Idaho
March 30, 2014	44.77	-110.68	4.8	Mammoth, Wyoming
January 27, 1963	44.19	-114.53	4.8	Clayton, Idaho
July 1, 1974	44.56	-111.09	4.8	West Yellowstone, Montana
July 1, 1975	44.88	-110.58	4.8	Mammoth, Wyoming
January 10, 1988	44.84	-114.38	4.8	Challis, Idaho
February 11, 1994	42.76	-111.00	4.8	Auburn, Wyoming
June 7, 1994	44.49	-114.00	4.8	Challis, Idaho
April 13, 2014	44.62	-114.33	4.8	Challis, Idaho
April 1, 2020	44.32	-115.17	4.8	Stanley, Idaho
September 25, 1947	44.30	-115.40	4.7	Lowman, Idaho
August 19, 1959	44.77	-111.61	4.7	Hebgen Lake, Montana
September 24, 1963	44.90	-111.00	4.7	Hebgen Lake, Montana
October 17, 1963	44.40	-114.70	4.7	Stanley, Idaho
March 29, 1975	42.02	-112.52	4.7	Malad, Idaho
April 2, 1975	42.09	-112.44	4.7	Malad City, Idaho
June 30, 1975	44.71	-110.52	4.7	Mammoth, Wyoming
October 19, 1977	44.77	-111.81	4.7	Hebgen Lake, Montana
February 6, 1983	44.57	-110.64	4.7	West Yellowstone, Montana
February 6, 1985	44.55	-114.18	4.7	Challis, Idaho
February 4, 1994	42.71	-111.03	4.7	Fairview, Wyoming
September 3, 2017	42.64	-111.47	4.7	Soda Springs, Idaho
September 3, 2017	42.61	-111.43	4.7	Soda Springs, Idaho
September 10, 2017	42.61	-111.47	4.7	Soda Springs, Idaho
September 11, 2017	42.55	-111.44	4.7	Georgetown, Idaho

October 22, 1974	44.74	-110.81	4.6	West Yellowstone, Montana
April 7, 1975	42.04	-112.49	4.6	Malad City, Idaho
June 30, 1975	44.80	-110.54	4.6	Mammoth, Wyoming
July 2, 1975	44.79	-110.76	4.6	Mammoth, Wyoming
November 30, 1978	42.11	-112.49	4.6	Malad City, Idaho
May 8, 1979	44.75	-111.38	4.6	Hebgen Lake, Montana
October 14, 1982	42.59	-111.43	4.6	Georgetown, Idaho
October 26, 1982	44.75	-111.75	4.6	Hebgen Lake, Montana
September 26, 1986	44.04	-114.76	4.6	Stanley, Idaho
May 4, 1992	44.51	-113.98	4.6	Challis, Idaho
September 6, 2017	42.57	-111.44	4.6	Georgetown, Idaho
April 9, 2019	44.70	-112.51	4.6	Lima, Montana
June 25, 2020	44.40	-115.18	4.6	Stanley, Idaho
September 19, 1969	42.99	-111.43	4.5	Freedom, Idaho
March 28, 1973	44.36	-110.41	4.5	West Yellowstone, Montana
August 30, 1974	44.70	-110.80	4.5	West Yellowstone, Montana
August 30, 1974	44.64	-110.77	4.5	West Yellowstone, Montana
July 3, 1975	44.75	-110.46	4.5	Mammoth, Wyoming
July 5, 1975	44.71	-110.62	4.5	Mammoth, Wyoming
December 9, 1976	44.77	-110.80	4.5	Mammoth, Wyoming
February 22, 1980	44.81	-110.90	4.5	West Yellowstone, Montana
December 12, 1983	44.43	-114.10	4.5	Challis, Idaho
January 24, 1984	44.05	-114.44	4.5	Clayton, Idaho
March 2, 1984	44.35	-114.19	4.5	Challis, Idaho
March 17, 1985	44.55	-114.18	4.5	Challis, Idaho
February 7, 1994	42.66	-111.02	4.5	Fairview, Wyoming
October 31, 2005	44.87	-113.40	4.5	Leadore, Idaho
September 4, 2017	42.62	-111.45	4.5	Soda Springs, Idaho

This table is current as of 12/15/2025.

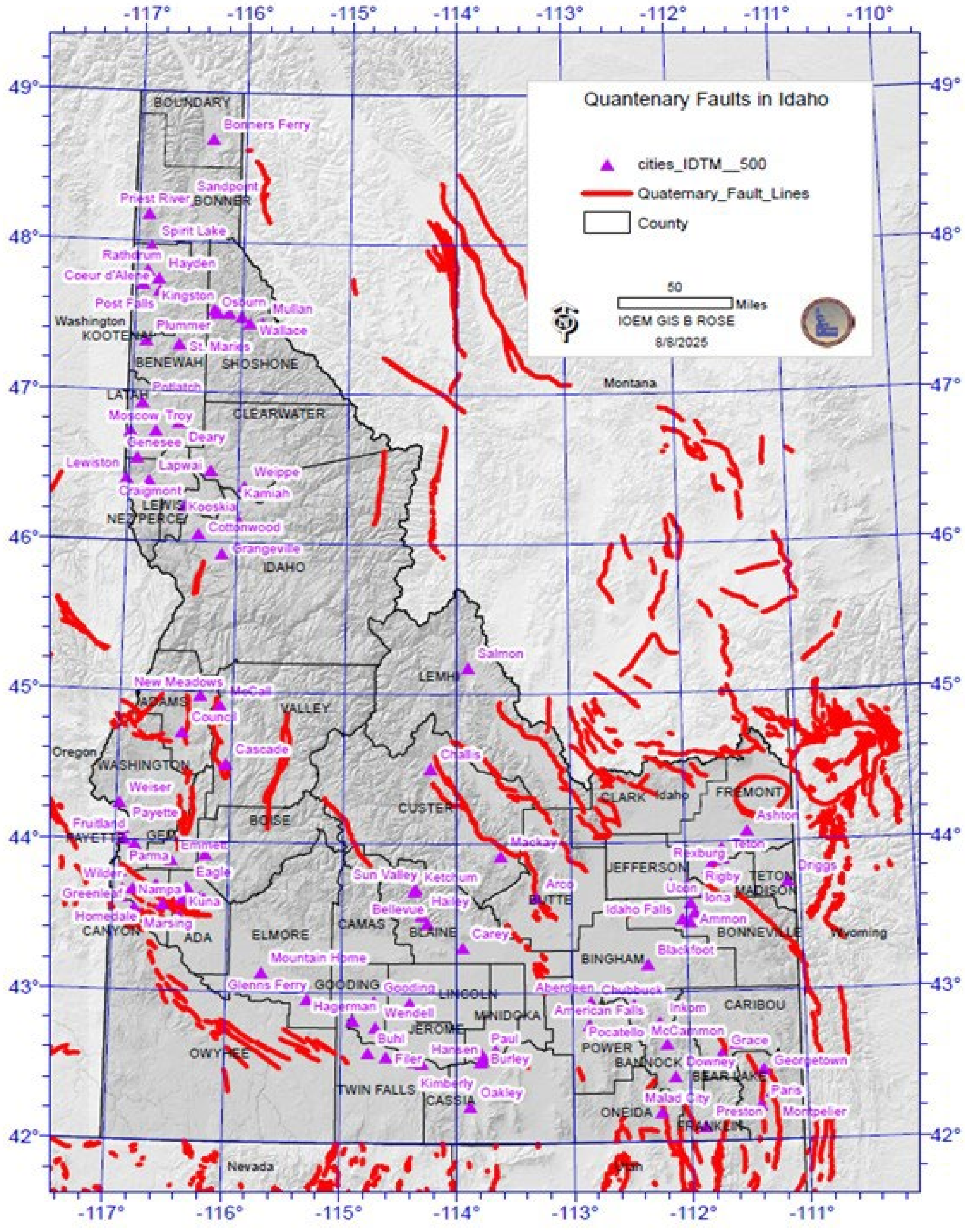


Figure 1. Fault map of Idaho and worksheet for plotting locations of earthquakes

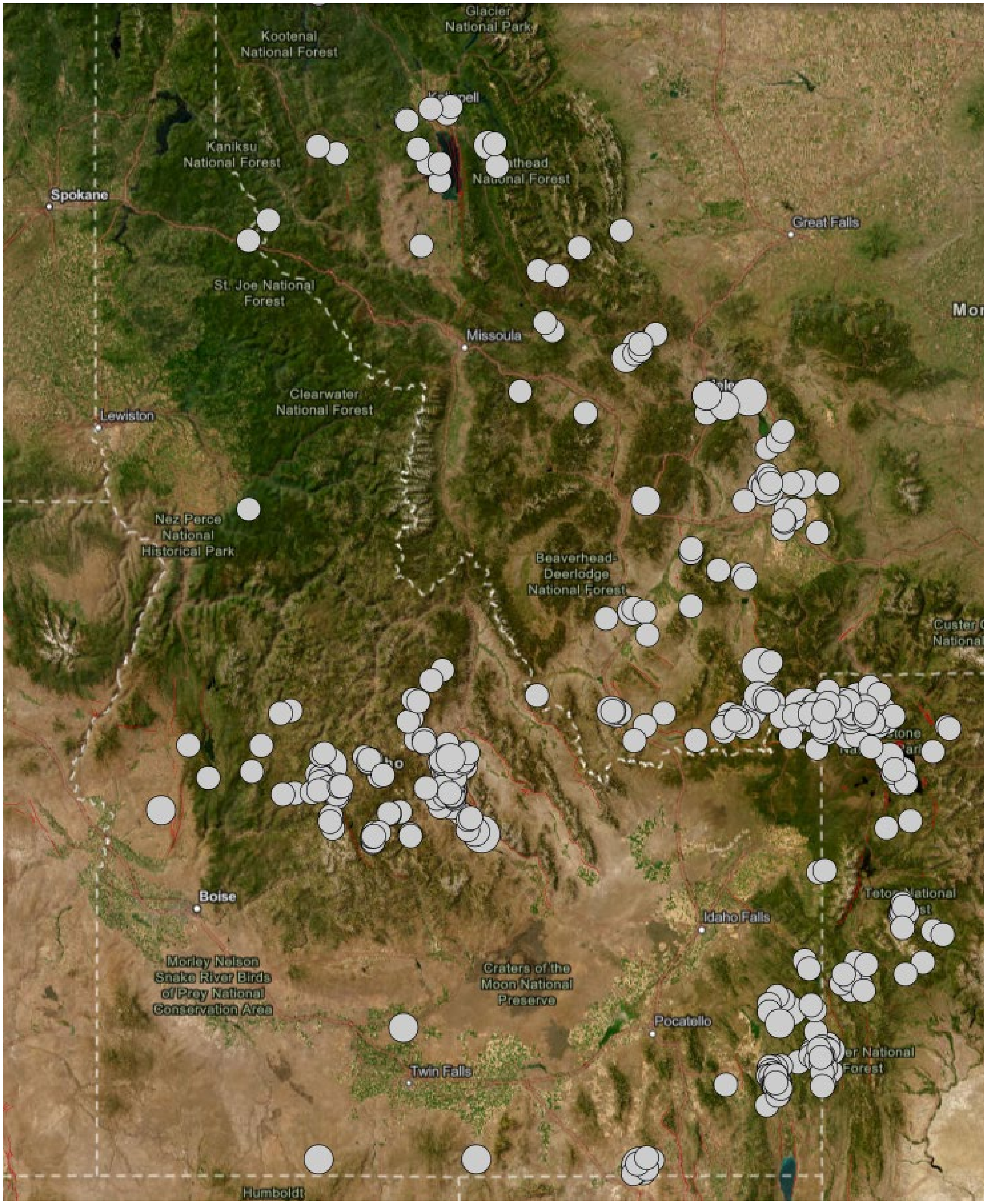


Figure 2. Regional earthquakes over M4.5 since 1900

Patterns in Time

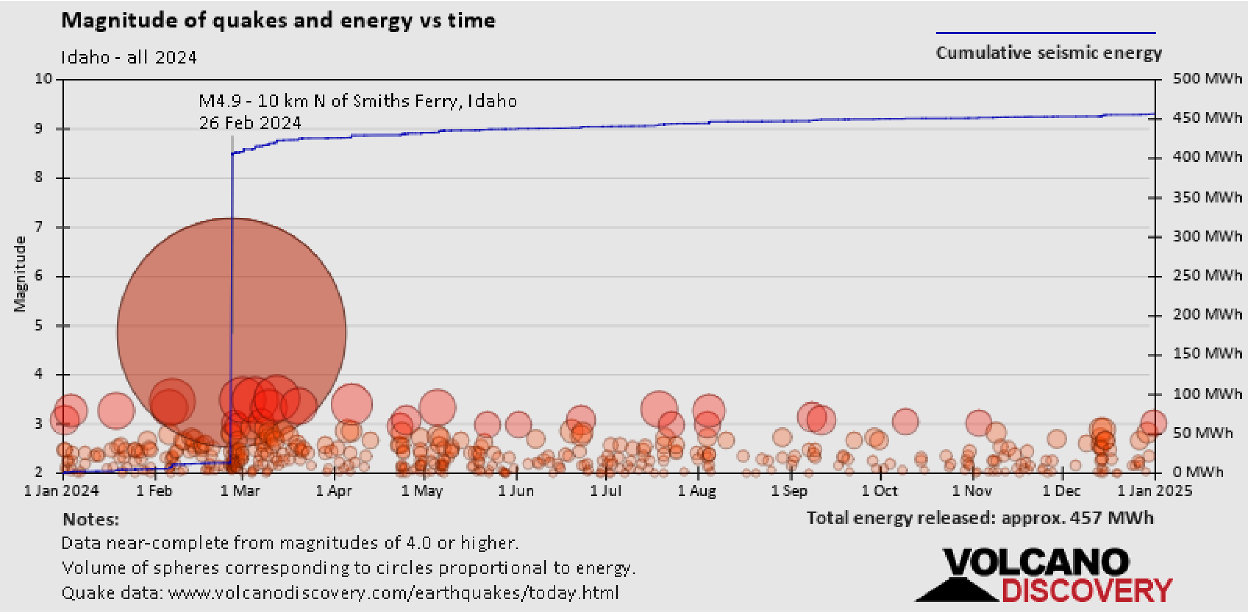
Grade Level: K-12
Idaho State Standards:
Middle School Earth Science MS-ESS-3.2
High School Earth Science HS-ESS-3.1
Objectives:
Students will be able to:

- Understand earthquake recurrence intervals
- Explain how understanding earthquake patterns can help keep people safe

LESSON OUTLINE:

ENGAGE (5 min):
How often do earthquakes happen in Idaho?

- In 2024, there were 1,455 earthquakes in Idaho. That’s about 4 earthquakes every day.



www.volcanodiscovery.com/earthquakes/idaho/stats.html

Do earthquakes happen randomly, or can we predict when they'll occur?

- Idaho has relatively few earthquakes. However, Idaho has had at least 6 quakes above magnitude 5 since 2000, which suggests that larger earthquakes of this size occur infrequently, probably on average approximately every 1 to 5 years.

How do scientists predict when earthquakes will occur?

EXPLAIN (15 min): Earthquake Recurrence Intervals
Scientists use earthquake recurrence intervals as one way to figure out how often big earthquakes happen in a certain place. Scientists look at:

- Old records and stories
- Cracks in the ground
- Layers of dirt and rock
- Special tools that measure tiny movements

They use all this to figure out how often earthquakes have happened in the past—and what might happen in the future.

Pizza Recurrence Intervals Analogy
Imagine you're keeping track of when something happens—like how often you eat pizza for dinner. If you and your family eat pizza for dinner every Friday night, that means your pizza recurrence interval is 7 days.

Just like you can't say *exactly* what time you'll eat pizza on Friday (maybe 6 PM, maybe 8 PM), scientists can't say *exactly* when the next earthquake will strike. They only know the average spacing between events. So, recurrence intervals are like your pizza schedule: regular enough to plan for, but not precise enough to predict the exact moment.

If scientists determine a place has a recurrence interval of 100 years, that means a big earthquake usually happens there about once every 100 years. It's not exact—sometimes it might happen a little sooner or later. It's just an average based on what's happened before.
If scientists notice that:

- A big earthquake happened in the year 1800
- Another one in 1900
- And another in 2000

That's a pattern of every 100 years—so the recurrence interval is 100 years!
Focus Question:
How can understanding earthquake patterns help keep people safe?

Discuss how scientists use data to understand seismic risk. Knowing the recurrence interval helps people:

- Build safer buildings
- Make emergency plans
- Stay prepared just in case

ELABORATE/EXTEND:
Videos: Watch one of the time-lapse videos of all earthquakes and discuss the patterns in location and frequency.

- U.S. Geological Survey (USGS). *"Earthquakes of Cascadia: 1979–2019."* YouTube video, 3:01. Posted March 5, 2021. https://www.youtube.com/watch?v=wAJcLtBhNEM
- U.S. Geological Survey (USGS). *"40 Years of Earthquakes in the Contiguous United States: 1980–2020."* YouTube video, 3:38. Posted March 5, 2021. https://www.youtube.com/watch?v=sv7JwrWURyQ
- Earthquakes Today. *"Animated Worldwide Earthquakes Time-Lapse: December 2024 in 25 Seconds."* YouTube video, 0:46. Posted January 1, 2025. https://www.youtube.com/watch?v=hlONWGUSc5c

EVALUATE:

- Engagement in Class Discussions: Student will be assessed on contributions to conversations including thoughtful comments, respectful listening, and participation.
- Student Worksheets
    - Earthquake & Pizza Recurrence Interval Worksheet (K-5)
    - Recurrence Intervals - How Often are Earthquakes Likely to Occur in Idaho (6-12)
- Earthquake & Pizza Recurrence Interval Quiz
- Short writing assignment answering one of the following prompts:
- Explain why Idaho still faces earthquake risk even if the last major quake was in 2020.
- Why can't scientists predict the *exact* day of the next earthquake, even if they know the recurrence interval?

Earthquake & Pizza Recurrence Interval Worksheet

Name: ______________________________ **Date:** _______________

Part 1: Pizza Recurrence Interval

1. How often do you eat pizza?

   Example: *Once a week → Recurrence interval = 7 days*

My pizza recurrence interval is: ____________________

2. Draw a timeline. Mark the days you eat pizza with a 🍕 symbol.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

Part 2: Idaho Earthquake Timeline

Here are three major earthquakes in Idaho's history:

- 1959 Hebgen Lake (M7.3)
- 1983 Borah Peak (M6.9)
- 2020 Stanley (M6.5)

1. Plot these years on the timeline below:

1950	1960	1970	1980	1990	2000	2010	2020

2. Calculate the recurrence intervals:

- 1959 → 1983 = ______ years
- 1983 → 2020 = ______ years
- Average recurrence interval = ______ years

Part 3: Compare Pizza & Earthquakes

- My pizza recurrence interval: ______________________
- Idaho earthquake recurrence interval: ______________________

Question: How is eating pizza like earthquakes?

Part 4: Reflection

Why can't scientists predict the ***exact*** day of the next earthquake, even if they know the recurrence interval?

ANSWER KEY: *Student worksheet (Grades K-5)*

Earthquake & Pizza Recurrence Interval Worksheet

Part 1: Pizza Recurrence Interval – student answers will vary

Part 2: Idaho Earthquake Timeline

1950	1960	1970	1980	1990	2000	2010	2020

2. Calculate the recurrence intervals:

- 1959 → 1983 = ___24_ years
- 1983 → 2020 = __ 37_ years
- Average recurrence interval = (24 + 37) ÷ 3 earthquakes = _about 20_ years

Part 3: Compare Pizza & Earthquakes

- My pizza recurrence interval: __varies____________
- Idaho earthquake recurrence interval: ___about 20 years_

Question: How is eating pizza like earthquakes?

Sample Answer: Eating pizza is like earthquakes because both happen at regular intervals on average, but not at exact times. Just like you might skip pizza one week or eat it twice, earthquakes don't follow a perfect schedule.

Part 4: Reflection

Why can't scientists predict the ***exact*** day of the next earthquake, even if they know the recurrence interval?

Sample Answer: Scientists can't predict the exact day of the next earthquake because recurrence intervals are averages, not precise schedules. Earthquakes depend on complex geological processes that don't happen at fixed times.

🍕 Earthquake & Pizza Recurrence Interval Quiz

Name: ___________________________ **Date:** ___________________________

1. What does "recurrence interval" mean in earthquake science?
A. The exact date of the next earthquake
B. The number of earthquakes per year
C. The average time between earthquakes of a certain size
D. The strength of an earthquake

2. If Idaho had major earthquakes in 1959, 1983, and 2020, what is the average recurrence interval?
A. 10 years
B. 40 years
C. 30 years
D. 20 years

3. How is eating pizza once a week similar to earthquake recurrence intervals?
A. Both are completely random
B. Both are predictable to the minute
C. Both happen at the exact same time
D. Both follow an average schedule but not exact timing

4. Why can't scientists predict the exact day of the next earthquake?
A. Because earthquakes don't happen anymore
B. Because earthquakes only happen in California
C. Because Idaho doesn't have faults
D. Because recurrence intervals are averages, not precise schedules

5. What was Idaho's largest recorded earthquake?
A. 1983 Borah Peak (M6.9)
B. 2000 Boise tremor (M5.0)
C. 1959 Hebgen Lake (M7.3)
D. 2020 Stanley (M6.5)

🍕 Earthquake & Pizza Recurrence Interval Quiz

✅ **Answer Key**

1. C — The average time between earthquakes of a certain size
2. D — 20 years (average of 24 and 37 years ≈ 20.33)
3. D — Both follow an average schedule but not exact timing
4. D — Because recurrence intervals are averages, not precise schedules
5. A — 1983 Borah Peak (M6.9)

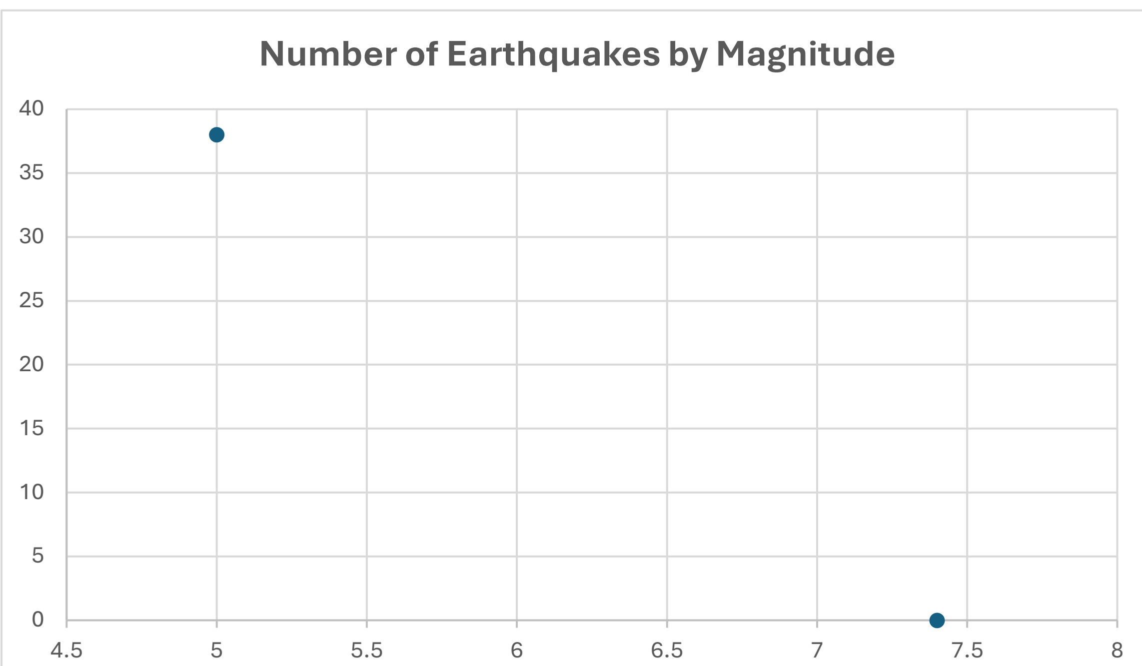
Recurrence Intervals - How Often are Earthquakes Likely to Occur in Idaho?

Name ______________________________ Class ________________ Date __________

1. Use the data in Table 1 to determine when an earthquake of magnitude 5 or greater is likely to occur in Idaho (recurrence interval). Complete the table below by entering the number of earthquakes having the **magnitude listed or greater.** The first two and last two values have already been entered.

Magnitude	Earthquakes	Magnitude	Earthquakes
5.0	38	6.4	________
5.2	27	6.6	________
5.4	________	6.8	________
5.6	________	7.0	________
5.8	________	7.2	________
6.0	________	7.4	0
6.2	________		

2. Now plot these pairs of values as points of the graph below. The first and last points have already been plotted.



3. Draw a smooth curve that passes through the plotted points or passes very close to them (instead of connecting the points with short, straight-line segments).

4. Looking at the table and the graph, how many earthquakes occurred between 1884 and 2024 (140 years) with a magnitude of 5.0 or greater?

   Answer ___________________________ earthquakes

5. Divide 140 years by the number of earthquakes having a magnitude of 5.0 or greater to find how often an earthquake above magnitude 5.0 is likely to occur in Idaho. This is called the recurrence interval.

   Answer ___________________________ years

6. Repeat steps 4 and 5 to find the recurrence interval for an earthquake magnitude 6.0 or greater.

   Answer ___________________________ years

7. Repeat steps 4 and 5 to find the recurrence interval for an earthquake magnitude 7.0 or greater.

   Answer ___________________________ years

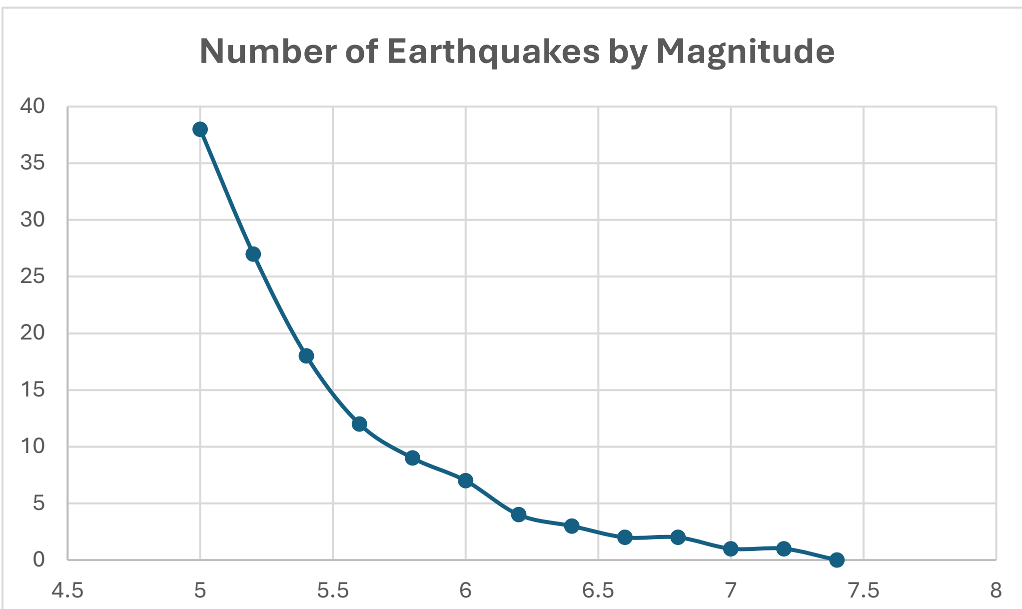
8. If the last earthquake with a magnitude of 5.0 or greater was in 2020, what does the above data suggest about the probability of a 5.0, 6.0, or 7.0 earthquake occurring in the near future? Are we due or past due for another major earth-shaking event in Idaho?

ANSWER KEY: *Student worksheet (Grades 6-12)*

Recurrence Intervals - How Often are Earthquakes Likely to Occur in Idaho?

Magnitude	Earthquakes	Magnitude	Earthquakes
5.0	38	6.4	3
5.2	27	6.6	2
5.4	18	6.8	2
5.6	12	7.0	1
5.8	9	7.2	1
6.0	7	7.4	0
6.2	4		

1. See above
2. See below
3.



4. 38
5. 140 ÷ 38 earthquakes = 3.68 years per 5.0 earthquakes
6. 140 ÷ 7 earthquakes = 20 years per 6.0 earthquakes
7. 140 ÷ 1 earthquakes = 140 years per 7.0 earthquakes
8. An earthquake over 5.0 is past due, over 6.0 could happen before 2040, over 7.0 could happen before 2099.

Unit 3 Resources

Earthquake List. *"The Complete Boise, Idaho Earthquake Report (Up to Date 2025)."* https://earthquakelist.org/usa/idaho/boise/#all-latest-earthquakes

Earthquakes Today. *"Animated Worldwide Earthquakes Time-Lapse: December 2024 in 25 Seconds."* YouTube video, 0:46. Posted January 1, 2025. https://www.youtube.com/watch?v=hlONWGUSc5c

Idaho Geological Survey. *"One Year of Stanley Earthquake Aftershocks (2020)."* YouTube video, 5:00. Posted May 6, 2021. https://www.youtube.com/watch?v=FQBeCZ9SnCo

Science Trek. *"Earthquakes: A Whole Lot of Shaking Going On!"* YouTube video, 9:56. Posted January 2025. https://www.youtube.com/watch?v=pCcH2gLrqnA

U.S. Geological Survey (USGS). *"40 Years of Earthquakes in the Contiguous United States: 1980–2020."* YouTube video, 3:38. Posted March 5, 2021. https://www.youtube.com/watch?v=sv7JwrWURyQ

U.S. Geological Survey (USGS). *"Earthquakes of Cascadia: 1979–2019."* YouTube video, 3:01. Posted March 5, 2021. https://www.youtube.com/watch?v=wAJcLtBhNEM

Unit 4: Earthquake Preparedness

Contents

Earthquake Essentials: What's in the Bag?

Grade Level: K-12
Objectives:
Students will be able to:

- Understand the importance of emergency preparedness and the role of an emergency kit in safeguarding lives.
- Identify essential items for an emergency kit such as food, water, blankets, and flashlights.
- Customize an emergency kit based on the needs of their family and pets.

MATERIALS:

Items that could be found in an emergency kit including essential items (flashlight, canned food, water bottle, blanket, first aid kit) and non-essential items (toys, jewelry, etc.)

LESSON OUTLINE:

ENGAGE (5 min): Show students a short video or news clip of earthquake aftermath.

- ABC News. *"Earthquake Rattles Utah."* YouTube video, 0:38. Posted March 18, 2020. https://www.youtube.com/watch?v=RDztGtLakO8
- GlobalQuake. *"7.5 Magnitude Earthquake Strikes Japan on December 8, 2025."* YouTube video, 3:31. Posted December 8, 2025. https://www.youtube.com/watch?v=9dgirsVbz5E

Ask: *"What items would you want to have if this happened here?"*

EXPLORE (5 min): Students brainstorm what items they think belong in a survival kit.

1. Mystery Bag Activity and Critical Needs vs. Comfort Debate
   Teacher brings a bag with a mix of real items that could be found in an

emergency kit including essential items (flashlight, canned food, water bottle, blanket, first aid kit) and non-essential items (toys, jewelry, etc.) for sorting.

- Students pull one out and explain whether it belongs in a survival kit and why (e.g., “A candle — useful for light, but risky for fire hazard”).
- Students categorize items into *critical survival* (water, food, first aid) vs. *comfort/psychological support* (books, stuffed animals, snacks). They debate which should be prioritized in limited space.

EXPLAIN (5 min):

- Teacher introduces FEMA/Red Cross guidelines for emergency kits.
- Discuss why each item is important i.e. Water – hydration, Flashlight – power outages, First aid kit – injuries or needed medicines, etc.

EXTEND (optional activities for older students):

- **Budget Challenge** (see worksheet) - Give students a pretend budget (e.g., $50 or $100). They must prioritize which survival items to buy first. This adds critical thinking and real-world decision-making.
- **Weight & Space Trade-Offs** - Students calculate how much water, food, and supplies weigh for a family of 4 for 3 days. They discuss what’s realistic to carry and what should be stored at home instead.
- **Scenario-Based Packing** – Students discuss how their emergency kits might be different in each of these different scenarios:
- *Urban apartment* (limited space, elevators may fail)
- *Rural home* (far from emergency services)
- *School setting* (shared kit for many students) Students adapt their kit to fit the situation.
- **Poster** - Students design their own “family survival kit” poster or checklist.

EXTEND (optional activities for younger students):

- **What’s in the Bag? - Emergency Kit Worksheet** – younger students can cut out items that they belong in an emergency kit and glue them on the backpack.
- **Emergency Drill Integration** - After “building” their kit, students practice a mini-drill: *“Drop, Cover, Hold On”* followed by “grab the bag and evacuate.” This reinforces the kit’s role in real action.

EVALUATE:

- Engagement in Class Discussions: Student will be assessed on contributions to conversations including thoughtful comments, respectful listening, and participation.
- Student Worksheets (optional)

Survival Kit Budget Challenge

Instructions

You have **$100** to spend on building a survival kit **for your household**. Choose items carefully — think about *necessity, cost, weight, and usefulness during an earthquake*. Record your choices and explain why you prioritized them.

How many people are in your household? ______________________________

Item List (Sample Costs)

Item	Cost	Quantity	Total Cost	Notes
Water (1 gallon per person per day)	$10			Minimum 3 days' supply
Canned food (3-day supply)	$15			Requires manual can opener
Manual can opener	$5			Essential for canned food
Flashlight + batteries	$12			Power outages likely
First aid kit	$20			Treat minor injuries
Blanket/sleeping bag	$15			Warmth if displaced
Portable phone charger	$18			Communication
Whistle	$3			Signal for help
Important documents (copies)	$2			ID, insurance, medical info
Comfort item (book, cards, etc.)	$5			Stress relief
Total Cost				

Budget Table

- **Total Budget:** $100
- **Items Selected:** ____
- **Total Spent:** ____
- **Remaining Balance:** ____

Reflection Questions:

1. Which items did you prioritize first, and why?

2. What did you leave out, and what risks might that create?

3. How would your choices change if you had only $50?

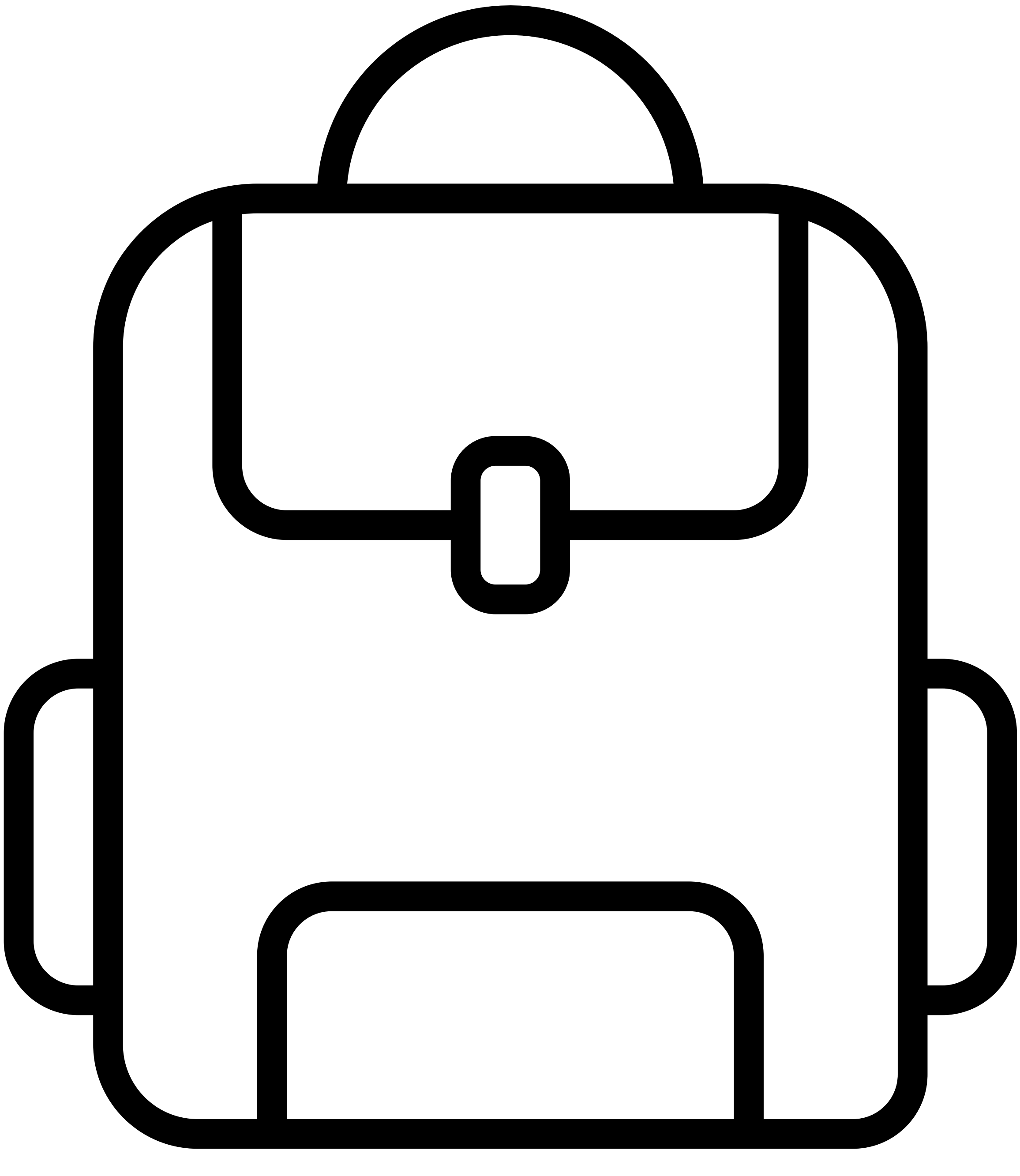
4. How would your kit differ for a family of 4 vs. living alone?

5. What science or health reasons explain why water and first aid are critical?

What’s in the Bag?

Find the things that belong in an emergency kit.
Color them and cut them out carefully, then stick them onto the picture of the backpack.

What's in the Bag?




ESSENTIAL ITEMS TO PUT IN A BASIC
EMERGENCY KIT
When a natural disaster strikes have an Emergency Preparedness Kit pre-stocked and ready to go with basic items that meet the needs of your family.
NON-PERISHABLE FOOD ITEMS
TOILET PAPER
BOTTLED WATER
FIRST AID KIT & MEDICATIONS
FLASHLIGHT
MONEY
MULTI-TOOL, WRENCH, & CAN OPENER
CLOTHING & BLANKETS
SANITATION LIQUID OR WIPES
MATCHES
IMPORTANT DOCUMENTS
WHISTLE
BATTERIES & CHARGERS
RADIO
PET FOOD & SUPPLIES
1.866.704.8614 | MyCalCas.com
California Casualty
Auto and Home Insurance

Hazard Hunters: Hazards Where We Live and Learn

Grade Level: K-12
Objectives:
Students will be able to:

- Identify possible hazards in classrooms and homes that could cause harm during or after an earthquake.
- Describe the reasons these hazards pose risks in an earthquake situation.
- Develop simple strategies to reduce or remove these hazards, helping to create safer spaces for themselves and others.

LESSON OUTLINE:

ENGAGE (5 min):
Share images of earthquake damage inside homes/classrooms (fallen bookshelves, broken glass).

Ask: *"What dangers do you notice?"*

EXPLAIN (5 min):
During an earthquake, shaking can cause a lot of damage inside buildings, classrooms, and homes. Unsecured objects are especially dangerous.

Common Hazards:

- Heavy books on high shelves → may fall and injure
- Unsecured furniture → can topple during shaking
- Glass windows near desks → risk of shattering
- Hanging plants/decorations → may fall
- Electrical cords across walkways → tripping hazard during evacuation

Safe Spots:

- Under sturdy desks/tables
- Away from windows and tall furniture
- Interior walls (not exterior walls with glass)

Solutions (Mitigation):

- Move heavy items lower
- Secure furniture to walls
- Clear walkways of cords

EXPLORE (10 min): Earthquake Hazard Hunt

- Using the Earthquake Hazard Hunt worksheet, students walk around the classroom (or their home) and identify potential hazards.
- Record observations: heavy objects on shelves, unsecured furniture, glass windows, etc.
- Suggest solutions: move heavy items lower, secure bookshelves, identify safe spots.

EXPAND: (Optional Activities)

- Students can use the Earthquake Hazard Hunt to create a “Hazard Map” of their classroom or home.
- **“Fix It” Challenge** After identifying hazards, students brainstorm and act out safe solutions (e.g., “move heavy books lower,” “secure furniture to the wall”). They can role-play as “Safety Engineers” presenting their fixes.
- **Hazard Detective Journals** Give students a “detective notebook” where they record hazards they find at home. They bring back one example and one solution to share with the class.
- **Seismic Engineering Mini-Lab** Using simple materials (cardboard, blocks, tape), students build a “room model” and simulate shaking (on a tray or shake table). They observe which items topple and propose engineering fixes.

EVALUATE:

- Engagement in Class Discussions: Student will be assessed on contributions to conversations including thoughtful comments, respectful listening, and participation.
- Earthquake Hazard Hunt worksheet – answers will vary. Teacher checks for accuracy and practicality of solutions.

⚠️ Earthquake Hazard Hunt

Student Names: ____________________ **Location:** __________________ **Date:** ____________

Part 1: Hazard Identification Checklist

Mark each item as **Safe (✅)** or **Hazard (⚠️)**

	Safe (✅)	**Hazard (⚠️)**
Heavy furniture is secured to the walls (bookshelves, cabinets)		
Large objects stored on high shelves		
Windows near desks or seating areas		
Hanging decorations or plants		
Electrical cords across walkways		
Emergency exits clear and accessible		
Fire extinguishers and first aid kits available		
Safe zones identified (under desks, away from glass)		

Part 2: Reflection Questions

1. Which hazards pose the greatest risk during an earthquake?

2. How would these hazards affect evacuation or safety drills?

3. Which mitigation steps are most urgent, and why?

4. How does hazard awareness connect to community preparedness?

Part 3: Hazard Hunt

- Instructions: Walk around your classroom/home. Write or draw the hazards you see, rate their hazard risk level, list some possible consequences if the hazard isn't fixed, and list ways to mitigate (fix) the hazard.

Hazard	***Risk Level (High/Medium/ Low)***	***Possible Consequences***	***Mitigation Plan***
Example: Bookshelf not secured	*High*	*Could topple, injure students*	*Bolt to wall, move heavy items lower*

Part 4: Action Plan

Immediate fixes: name one hazard that can be fixed today.
Long-term improvements: name one hazard that can be fixed this year.
Who can help fix these hazards?

Build it Better

Grade Level: K-12
Objectives:
Students will be able to:

- Construct a model structure and test how it responds to simulated earthquake shaking.
- Explain which design features increased or decreased stability during shake-table testing.

LESSON OUTLINE:

ENGAGE (5 min):
Begin by asking students to imagine an earthquake happening right here and right now at their school or in their town. Prompt them with questions such as:

- What would you do first
- What might happen to the buildings around us
- How could people make this area safer
- How could you make your own home safer

EXPLAIN (5 min):
Share recent Idaho earthquake data to build relevance:

- Idaho experienced 1,455 earthquakes in 2024, with the largest at magnitude 4.9.
- During the 2025 Stanley earthquake swarm, the U.S. Geological Survey recorded 103 earthquakes in six days, including 18 above magnitude 3.0 and two at magnitude 4.0.

Explain that engineers study earthquakes because Idaho experiences many each year, and they continually work to design safer, more resilient buildings.

EXPLORE (10 min): Offer students one of the following engineering design challenges using the Learning Blade: Earthquake Shaker Table (free 3d print pattern):
https://www.mrpsocialstudies.com/learning-blade-earthquake-shaker-table.html

Option 1: Build It Better – Shake Table City

Students build a small city or individual structures and test how they respond to different shaking levels.
Materials per group:

- Monopoly houses
- Jenga blocks
- LEGO bricks
- Tape
- Small paper cups

Option 2: Spaghetti & Marshmallow Earthquake-Proof Tower

Students attempt to build the tallest structure that can survive 10 seconds on the shake table.
Materials per group:

- 10 pieces of spaghetti
- 20 mini marshmallows
- 30 cm of tape
- Scissors
- Ruler

Rules:

- The structure must remain standing and intact for 10 seconds of shaking.
- Height is measured at the highest point of a true roof (no antennas).

EXPLAIN (5 min):
Have students brainstorm what construction materials they could use to build more earthquake resilient buildings. Discuss what different materials and building styles increase safety and stability, including bracing to the foundation, cross bracing, design elements, etc. Introduce some key engineering concepts:

- Bracing to the foundation
- Cross-bracing
- Symmetry and balance
- Low center of gravity
- Material strength and flexibility

Guide a discussion using questions such as:

- Which structures stayed standing the longest
- What design features improved stability
- How did different materials affect performance
- Why do engineers use cross-bracing, strong foundations, and flexible materials

EXPAND: (Optional Activities)
Invite students to apply what they learned to real-world scenarios:

- How could your classroom or school be made safer?
- What changes could make their homes more earthquake-resistant?
- How do engineers design buildings in earthquake-prone regions?

Encourage them to redesign their structures using improved strategies and test again.

EVALUATE:

- Engagement in Class Discussions: Student will be assessed on contributions to conversations including thoughtful comments, respectful listening, and participation.
- Lab Participation: Students will be assessed on participation and engagement in lab activity.
- Have students write a 3-5 sentence paragraph answering one of the following questions:
  - "Describe three ways engineers make buildings safer during earthquakes."
  - "Explain how your design changed after testing and why."

Community Preparedness: Teamwork in Action

Grade Level: K-12
Objectives:
Students will be able to:

- Identify and describe key steps communities take to prepare for earthquakes.
- Explain why collective action is essential for reducing risks and protecting lives.
- Understand practical ways individuals can contribute to community preparedness (e.g., family emergency kits, drills, and sharing safety information).

MATERIALS:
Poster paper, markers, or digital tools
Guest speaker (optional but recommended)

LESSON OUTLINE:

ENGAGE (5 min):
Ask students, "What might happen in our community if an earthquake struck tomorrow?"

EXPLORE (10 min): Earthquake Role-Play Drill

- Assign students roles (firefighters, doctors, teachers, parents).
- Act out immediate responses after an earthquake: checking injuries, guiding evacuations, setting up shelters.
- Facilitate discussion on responsibilities of each role during an emergency.

EXPLAIN (15-30 min): Neighborhood Helpers Interview
Invite a local emergency responder (firefighter, Red Cross volunteer, or city emergency manager) to explain how the community prepares for earthquakes and how they respond when one strikes.
Key topics to address:

- Community safety plans, evacuation routes, and shelters
- Safe building practices (retrofitting, zoning)
- Community drills and communication systems
- Individual roles (family plans, emergency kits, drills, spreading awareness)

- Importance of teamwork and collective action

EXPAND: Earthquake Safety PSA Project
Students brainstorm ways they can contribute to community preparedness.
Students can work as individuals or in groups.
Options:

- Create posters, skits, or digital media teaching safety actions during an earthquake (“Drop, Cover, Hold On,” avoid elevators, check gas leaks, listen to broadcasts, etc.).
- Design “Community Safety” posters highlighting emergency responders’ roles during an earthquake.
- Create posters showing items for an emergency kit.

EVALUATE:

- Class Discussions: Assess student engagement through thoughtful comments, respectful listening, and participation.
- PSA Projects: Students present their work. Teacher evaluates for accuracy, creativity, and understanding of preparedness concepts.

Unit 4 Resources

ABC News. *"Earthquake Rattles Utah."* YouTube video, 0:38. Posted March 18, 2020. https://www.youtube.com/watch?v=RDztGtLakO8

California Casualty. *"Preparedness – How to Build an Emergency Kit."* September 2019. https://mycalcas.com/2019/09/preparedness-how-to-build-an-emergency-kit/

GlobalQuake. *"7.5 Magnitude Earthquake Strikes Japan on December 8, 2025."* YouTube video, 3:31. Posted December 8, 2025. https://www.youtube.com/watch?v=9dgirsVbz5E

Great ShakeOut – Rocket. *"Staying Safe in an Earthquake."* YouTube video, 2:41. Posted October 13, 2016. https://www.youtube.com/watch?v=ay5lTN81u1Q

Mr. Peinert. *Learning Blade: Earthquake Shaker Table*. Mr. Peinert's Social Studies Site. Posted January 3, 2017. https://www.mrpsocialstudies.com/learning-blade-earthquake-shaker-table.html