Family edition

Earthquake Lab: Where Do Earthquakes Happen?

Ages 11-14 · about 45 minutes, in one sitting

Your child plays a hundred years of earthquakes onto a map in Earthquake Lab, finds where they line up and how rare the big ones are, and works out what scientists can and cannot say ahead of time.

What you need

- A computer or Chromebook with a current browser.
- The lesson link: mytekdev.com/try/earthquakelab?lesson=where-do-earthquakes-happen&ref=fam-earthquakelab-4. No account, no email and nothing to install.

Before you start: try it once yourself

Open mytekdev.com/try/earthquakelab?lesson=where-do-earthquakes-happen&ref=fam-earthquakelab-4. A short guide opens over the app: the made-up map with its nine towns and three stations, no fault yet.

1. **Past quakes.** Tick `Past quakes` under the map. A hundred years play onto it in about ten seconds, one dot per quake, a bigger dot for a bigger quake.
2. **The card.** A sample of 100 years of earthquakes, magnitude 4 and up: of 220, 28 were 5 or more and only 2 were 6 or more.
3. **The faults.** Press `Show the faults`: the lines the dots sit on.
4. **A break.** Drag along one of the lines to draw a fault and press `Break the fault`; The towns shows which towns shake hardest.

> The moment that lands is the faults appearing under the dots: children have usually traced most of the lines already.

The ideas, in plain words

Earthquakes happen where rock breaks along faults, and the same faults slip again and again. Plotted over time, quakes line up along them; on the real Earth, along plate boundaries most of all. Small quakes far outnumber large ones: worldwide there are about ten times as many of each magnitude as of the next one up.

Nobody can predict when an earthquake will happen. A map of past quakes lets scientists forecast where they are likely and how strong they could be, which tells people where to build stronger and where to prepare. The past quakes here are a made-up sample of magnitude 4 and up, spread evenly in time with no aftershocks. The map is made up, and so is every quake on it. The waves travel at 6 and 3.5 kilometers a second in straight lines; in the real Earth they speed up with depth and bend, so the 8 km rule works best within about 200 kilometers.

Common mistakes: thinking quakes can happen anywhere equally; thinking a fault that has been quiet is safe; and thinking scientists can say when the next big one will come.

Do it together

1. Open mytekdev.com/try/earthquakelab?lesson=where-do-earthquakes-happen&ref=fam-earthquakelab-4 together. A short guide opens over the app. Tick `Past quakes` under the map.

   > **You'll know it worked when:** Dots land on the map over a hundred years, and a card counts them.

2. Read the card: how many quakes of 5 or more, and of 6 or more?

   > **You'll know it worked when:** 28 of 5 or more, and only 2 of 6 or more.

3. Press `Show the faults`. Ask: where do the dots line up?

   > **You'll know it worked when:** Along a few lines: the faults.

4. Ask: where would you build a school? Where would you not?

   > **If you get stuck:** Look at which towns sit on or near the lines.
   >
   > **You'll know it worked when:** A reason that uses the map.

Talk about it

Ask these while you work together. A child who has understood it can answer them without help:

- Where do most of the dots fall?
- Are there more big quakes or small ones? By about how much?
- Which town would you not build a school in, and why?
- Can the map tell you when the next big quake will come?
- A fault has had no big quake for a hundred years. Is it safe?

> The fourth question is the real test: a child who says it tells where and how strong but not when has the forecast-prediction difference.

For younger and older kids

Younger: For a younger child, set the level menu at the top to its youngest choice and talk about the pattern.

Older: For a teenager, work out how many times rarer each step up in size is.

Keep going

- Work out the ratio from the card: how many quakes of 4 and up for each one of 5 and up?
- Compare with a real map: open the USGS latest earthquakes map and find where the last month's quakes line up.
- Write what a building code near the busiest fault should require, and why.

Bring it into other subjects

- Geography: on the USGS latest earthquakes map, find where the last month's quakes line up, and name the plate boundaries.
- Math: the card counts 220, 28 and 2. Graph them. What happens to the count each step up?
- Civics: find whether your state has a building code for earthquakes.
- English: write a short news item about earthquake risk in the made-up region that does not claim a prediction.

For your records

Ready to copy into an hour log, a portfolio or a transcript.

LESSON	Earthquake Lab: Where Do Earthquakes Happen?
SUBJECTS	Earth science
TIME	45 minutes
WHAT WE DID	Analyzed a map of a hundred years of modeled earthquakes, found they cluster along faults and that large quakes are rare, and explained forecast versus prediction.
SKILLS PRACTICED	Patterns in maps; Natural hazards; Forecast versus prediction

Activity sheet (optional)

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/earthquakelab?lesson=where-do-earthquakes-happen

Essential question: Earthquakes cannot be predicted. What can a map of past earthquakes tell us?

Warm-up: Would a hundred years of earthquakes be spread evenly on a map? Sketch what you think.

_____

1. **Vocabulary.** Pattern, fault, frequency, forecast, prediction: write each in your own words.

2. **The counting table.** Magnitude 4 and up _____; 5 and up _____; 6 and up _____. How many faults? _____ The squares they cross _____.

1. Which town would you build a school in, and which not? Use the map.

2. What can scientists say ahead of time about earthquakes, and what can nobody say?

Quick check

Name: _____

1. On the map, most earthquakes (A) are spread evenly (B) line up along faults (C) happen in the sea

2. Compared with magnitude 4 quakes, magnitude 6 quakes are (A) more common (B) about as common (C) much rarer

3. Explain the difference between forecasting earthquakes and predicting them.

Answers

QUESTION	ANSWER	WHY
1	B	The same faults break again and again.
2	C	About ten times rarer for each step up: 220 at 4 and up, 2 at 6 and up.
3	A forecast says where and how strong; a prediction says when	Past quakes show where they are likely and how strong; nobody can say when. Defining only one of the two is half.

If your state or umbrella school asks, this lesson covers NGSS MS-ESS3-2, NGSS MS-ESS2-3.

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The app this lesson uses is free and runs in the browser, with nothing to install and no account needed. It is at mytekdev.com.

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