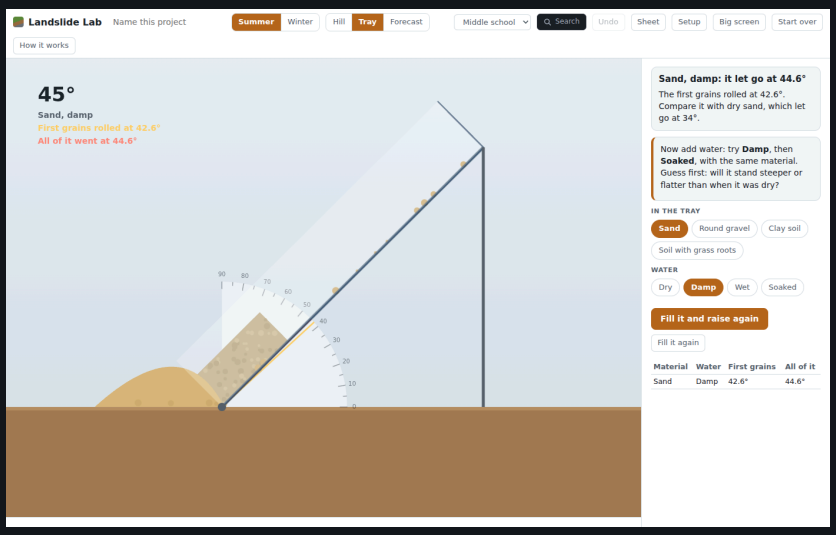
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Landslide Lab: How Steep Can It Stand?

Grades 6-8 · 45 minutes

Earth science



Slides, rubric and answer key **Print and go** **No student accounts**

Chromebook friendly

What's included

- A one-page overview: objectives, essential question, vocabulary, standards and assessment
- A 45-minute lesson sequence: warm-up, direct instruction, guided practice, independent practice, closure
- Slides for the board: a PowerPoint file that also opens in Google Slides
- A student worksheet with a QR code and a data table for twelve runs
- A 3-question exit ticket, two to a page, with an answer key
- A rubric: 3 criteria, 4 levels, scored out of 12
- Differentiation for English learners, students with IEPs or 504 plans, and students who need more support or more challenge
- Cross-curricular extensions, and notes for teaching it in grades 4 and 5 and in high school earth science
- Standards: NGSS

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The tilt tray is the classroom slope stability lab. Students raise a tray of sand until the first grains roll and then all of it lets go, dry, damp and soaked, and record both angles. Damp sand stands steeper than dry and soaked sand flows at about 19 degrees. They test other materials, change one thing at a time, and use the data to say which slopes need the most care in a storm.

At a glance

ESSENTIAL QUESTION

How does water change how steep a slope of sand or soil can stand?

OBJECTIVES

Students will be able to:

- measure the angle where the first grains roll and the angle where all of a material slides
- run a fair test: change one thing at a time and record the data in a table
- explain why a little water helps sand stand steeper and a lot makes it flow
- use the data to say which slopes are most at risk in a heavy storm

VOCABULARY

Angle of repose, Variable, Fair test, Saturated, Friction

STANDARDS

MS-ESS3-2, MS-ESS2-2

TIME AND MATERIALS

45 minutes, grades 6-8.

- One computer or Chromebook per student
- A projector
- The worksheet and exit ticket, one copy each per student
- The rubric, one copy per student if you grade the work
- Optional, for a real tray beside the app: a baking dish or box lid, dry sand, a protractor and a spray bottle of water

PREP

Make copies of the worksheet and exit ticket. Before class, open mytekdev.com/try/landslidelab?lesson=how-steep-can-it-stand&ref=tpt-landslidelab-2 once on a student computer: it opens on the tilt tray with dry sand. Run dry, damp and soaked sand yourself, about five minutes. If you can, set out a real tray too: a baking dish of sand, a protractor and a spray bottle.

ASSESSMENT

- Formative: the questions under What to look for, asked while students work, and the exit ticket (answer key included).
- Summative: the worksheet, scored with the rubric.

TECHNOLOGY AND PRIVACY

Runs in any browser, Chromebooks included, with nothing to install. Students need no account and no email: the link works signed out, and nothing they do is stored on our server unless they choose to save.

Lesson sequence

MINUTES	STAGE	WHAT YOU DO	WHAT STUDENTS DO
0 to 5	**Warm-up** Hook	Show the title, essential question and Today I can slides (about 1 minute). Then the warm-up about the sandcastle. Write the answers on the board.	Answer the warm-up on the worksheet.
5 to 12	**Direct instruction (I do)** Model it	Project the app with the starter open: dry sand in the tray. Press Raise the tray and stop talking: let the class watch the angle climb. Show Two angles. Ask for a prediction for damp sand before anyone runs it. If you have a real tray, tilt it beside the projector. > **It's working when:** Get the predictions on paper first. The surprise that damp sand stands steeper than dry is worth more when students have committed to a guess.	Predict the angles for damp and soaked sand, and fill in the vocabulary.
12 to 22	**Guided practice (We do)** The sand together	Students open the link or scan the QR code. A short guide walks them through dry, damp and soaked sand. Show Sand and water once most have three rows. > **Watch for:** Students who write only one angle. Both matter: the first grains rolling is the warning, all of it going is the slide.	Fill in the first three rows of the data table.
22 to 38	**Independent practice (You do)** Other materials	Students run round gravel, clay soil and soil with grass roots, dry, damp, wet and soaked, as many as they can, one change at a time. Walk the room with the What to look for questions. > **If they ask:** "You changed the material and the water at the same time. What can you tell from that run?" Fair test	Fill in the data table, then circle the steepest and the flattest run.
38 to 45	**Closure** Showcase and exit ticket	Show the Showcase slide. Two students answer from their data. Connect to the hill: a soaked hollow is the soaked sand. Hand out the exit ticket.	Answer the exit ticket.

Before you teach: a ten-minute walkthrough

Open mytekdev.com/try/landslidelab?lesson=how-steep-can-it-stand&ref=tpt-landslidelab-2. A short guide opens over the app on the tilt tray: a clear tray of sand on a hinge, with a protractor at the hinge.

1. **Dry sand.** Press `Raise the tray`. A few grains roll at 31 degrees (the yellow line) and all of it slides at 34 (the red line), spilling onto the bench.
2. **Damp sand.** Pick `Damp` and raise it. It stands to about 45 degrees.
3. **Soaked sand.** Pick `Soaked` and raise it. It flows at about 19 degrees.

4. **Other materials.** Round gravel goes at 31 dry. Soil with grass roots stands to 48 dry and 56 damp. Clay soil soaked goes at 13.5.

> The moment that lands is damp sand. Students who have learned that water weakens slopes see it hold steeper, and the soaked run then shows when that stops being true.

Background for the teacher

Loose material on a slope holds by friction between its grains. Dry sand slides at about 34 degrees, close to its angle of repose. A little water forms thin bridges between grains that pull them together, the way a sandcastle holds; that pull disappears when the spaces between the grains fill. Soaked, the water pushes the grains apart, they press on each other less, and the sand flows at a much flatter angle.

Roots tie soil together, which is why soil with grass roots stands steepest. Round grains roll past each other more easily than sharp ones. On a real hill the soaked case is the dangerous one: a hollow full of water after a long storm.

The tray measures a tilted layer letting go, a little different from a poured pile. The app is a model of a made-up hill and mountain. It is not a tool for judging a real slope.

What to look for

Ask these while students work. A student who has understood the lesson can answer them without help:

- What is the difference between your two angles?
- Damp sand stood steeper than dry. Why?
- Soaked sand flowed. What did the water do to the grains?
- Which run changed two things at once?
- Which material would you plant grass on to hold a steep bank?

> The second and third questions together are the real test: a student who can say why a little water helps and a lot hurts has the idea.

Cross-curricular extensions

- Math: graph the angle against the amount of water for sand, with dry, damp, wet and soaked on the bottom axis.
- Engineering: design a sand slope at 40 degrees that stands through a spray of water, and test it in a real tray.
- History: read about why the pyramid builders wet the sand in front of a sledge.
- English: write the lab report: question, prediction, method, data, conclusion.

Vocabulary

Angle of repose	The steepest a pile of loose material can stand without sliding.
Variable	Something you change or measure in an experiment.
Fair test	An experiment that changes only one variable at a time.
Saturated	Soaked: every space between the grains is full of water.
Friction	The grip between grains rubbing against each other.

Differentiation

ENGLISH LEARNERS

- Keep the vocabulary slide up, and point at the screen as you say each word: the side cut, the colors and the pit carry the meaning.
- Pair each learner with a partner; the angles are numbers and the materials have pictures in the tray.
- Accept the data table without sentences, and the pattern as an arrow drawing.

STUDENTS WITH IEPS OR 504 PLANS

- Fill in the material and water columns of the table before class, so only the angles are written.
- Zoom the browser to 125%.
- Allow six runs instead of twelve where the IEP allows a modified assignment.

STUDENTS WHO NEED MORE SUPPORT

- A sentence starter: "A little water made the sand ___ because ___."
- A check-in after the guide: every student has three sand rows before anyone moves on.
- Use the up and down arrow keys to tilt the tray one degree at a time.

STUDENTS READY FOR MORE

- Graph the angle against the amount of water for sand and for clay soil, and explain the shape.
- Do the real tray with sand and a spray bottle, and compare the real angles with the app's.
- Explain why soil with grass roots stands steepest of all, dry or damp.

Adapting for other grades

Younger students: In grades 4 and 5, run sand dry, damp and soaked together and stop there; it fits 4-ESS2-1 as a measurement of how water changes erosion on a slope. Skip the third rubric row; total 8, and 6 meets the objectives.

Older students: In high school, explain the damp sand with suction: water held between grains pulls them together, and the effect is gone when the spaces fill. Compare the soaked angle with the infinite slope equation from the hill.

Student worksheet

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/landslidelab?lesson=how-steep-can-it-stand

Essential question: How does water change how steep a slope of sand or soil can stand?

Warm-up: Dry, damp or soaked: which sand makes the best sandcastle, and why? _____

1. **Vocabulary.** Angle of repose, variable, fair test, saturated, friction: write each in your own words.

2. **Predict.** Dry sand: ____°. Damp sand: ____°. Soaked sand: ____°.
3. **The data table.** For each run: material _____; water _____; first grains rolled at ____°; all of it went at ____°. Twelve lines, one run on each.

1. A little water and a lot of water did different things to the sand. Explain both.

2. Which of your runs is most like a hillside hollow after a long storm? What does your data say about it?

Landslide Lab: How Steep Can It Stand?

Exit ticket

Name: _____

1. Damp sand stands steeper than dry sand because (A) water is sticky like glue (B) a little water pulls the grains together (C) damp sand is heavier

2. Which change is a fair test? (A) dry sand, then soaked gravel (B) dry sand, then soaked sand (C) damp gravel, then dry soil

3. A hillside of sandy soil fills with water in a long storm. Use the tray to explain what happens to it.

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Answer key: exit ticket

QUESTION	ANSWER	WHY
1	B	Thin bridges of water between grains pull them together. When the spaces fill, the pull is gone.
2	B	Only the water changes. The others change the material and the water together.
3	It can slide at a flatter angle	Soaked, the water pushes the grains apart and the slope that held when dry or damp can let go. Naming the angle with no reason is half.

Rubric

Score each row from 1 to 4.

Name: _____

CRITERIA	4 EXCEEDS	3 MEETS	2 APPROACHING	1 BEGINNING
Data	Twelve runs or more, both angles each time, in a table with units.	Six runs or more with both angles.	Some runs, or one angle only.	No data.
Fair test	Every comparison changes one thing, and the student says which variable was kept the same.	Most comparisons change one thing.	Changes two things at once in most runs.	No comparison.
Explanation	Explains both effects of water: a little pulls grains together, a lot pushes them apart, and links soaked material to a slide on a hill.	Explains both effects of water.	Describes the pattern with no reason.	No explanation.

Total: ____ / 12. A score of 9 or more meets the objectives.

Standards

The lesson is an investigation for MS-ESS3-2, with the balance behind MS-ESS2-2; it also fits 4-ESS2-1 in grades 4 and 5.

FRAMEWORK	CODE	GRADES	STANDARD	HOW THE LESSON MEETS IT
NGSS	**MS-ESS3-2**	6-8	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.	Students collect and read data on how water changes the steepest stable slope.
NGSS	**MS-ESS2-2**	6-8	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	The tray is the evidence for why a slope steeper than its material can stand changes quickly.

Checked November 2026 against: NGSS MS-ESS3-2, Earth and Human Activity, NGSS MS-ESS2-2, Earth's Systems.

Optional: save student work in a free class

The whole lesson runs at the link on the worksheet, with no accounts and no sign-up.

To keep students' work, and see it all in one place, make a free class. It takes about ten minutes, once, and covers every lesson in this series: mytekdev.com/tools/class-setup

Students in a class open mytekdev.com/tools/landslide-lab/lessons/how-steep-can-it-stand/start instead of the worksheet link. Each one gets their own copy of the starter, and the same link reopens it next time.

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