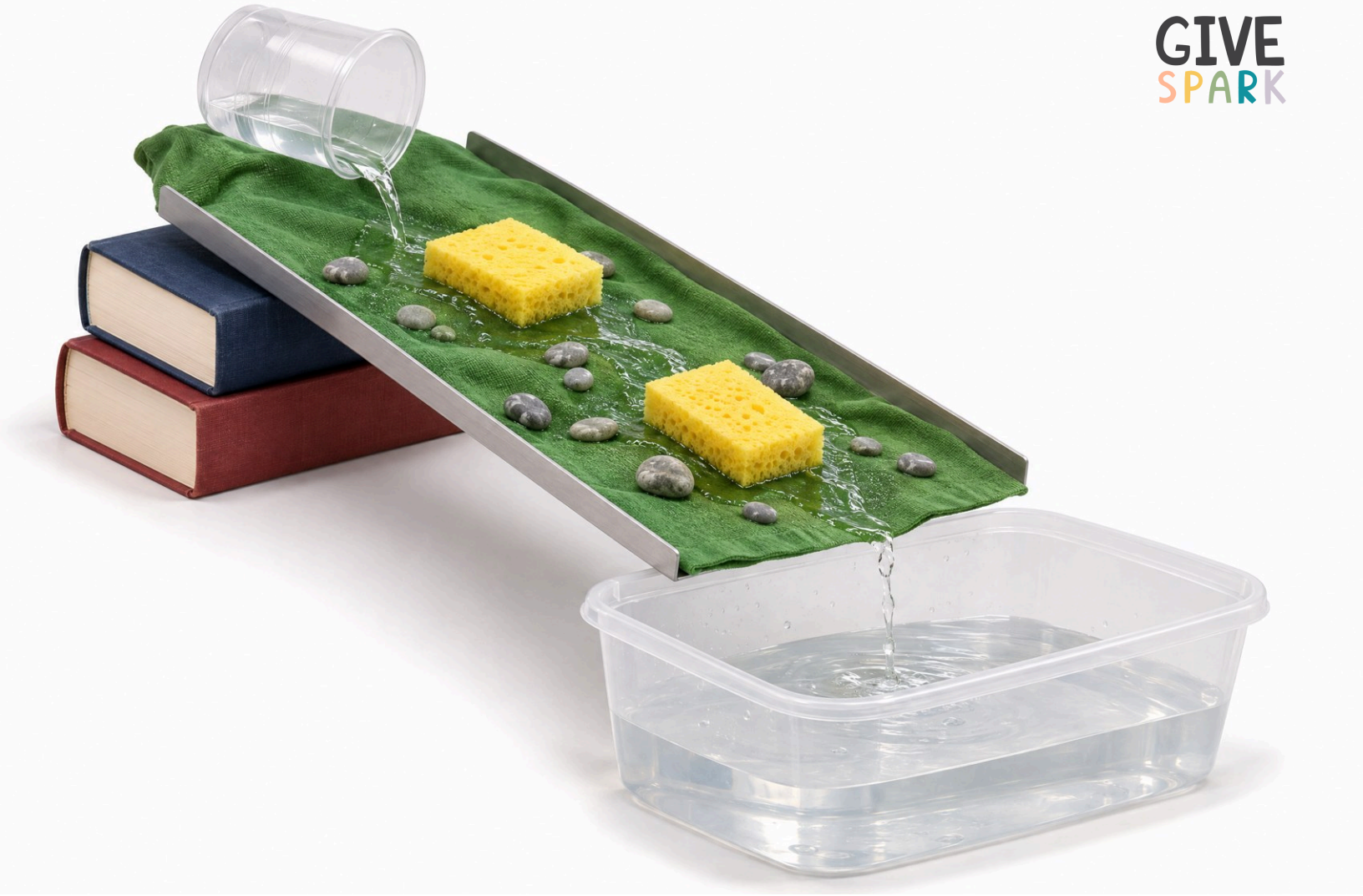

GIVE SPARK · HANDS-ON SCIENCE LAB

The Runaway Puddle

How can we reduce the water running off a slope?

Teacher Guide

Grades 3–5 · Earth science and engineering · 60 minutes

FREE LAB

OVERVIEW

The lab at a glance

One lesson, one driving question and three surfaces on the same slope.

THE DRIVING QUESTION

How can we reduce the water running off a slope?

Children answer this with measurements from a bare slope, a covered slope and a design of their own.

What children do

Teams pour the same amount of water down a sloping ramp and measure how much reaches a tub at the bottom in 30 seconds. They test the bare ramp first, then the ramp covered with a cloth. They use what they noticed to design a surface from cloth, sponges and small stones that lets even less water run off, and they test that the same way.

What children learn

Water travels differently over bare and covered surfaces. A covered surface soaks up some of the water and gets in the way of the rest, so less water runs off in the same time. Outdoors, plants, roots and fallen leaves do the same job on a hillside. Children also learn that surfaces can be compared only when the slope, the amount of water and the way of pouring stay the same.

Success looks like

1. I kept the slope, the amount of water, the pour and the time the same for every surface.
2. I measured the water collected and recorded what the water did on its way down.
3. I used what I noticed in the first two tests to design my own surface.

The fair test

WE CHANGE	WE MEASURE	WE KEEP THE SAME
The surface of the slope	The water collected in the tub after 30 seconds, in mL	The slope, the 100 mL of water, the way we pour and how damp the materials are at the start

AT A GLANCE

Time: 60 minutes.

Grouping: teams of three, with the roles of pourer, timer and measurer.

Standards link: builds understanding of runoff relevant to NGSS 4-ESS2-1. The main investigation does not directly measure erosion. It also practices the fair testing in 3-5-ETS1-3.

SESSION PLAN

STAGE	MIN
Introduce the puzzle	5
Plan the comparison	7
Test bare and covered	13
Design and test	15
Compare and explain	10
Close and clear away	10
Total	**60**

THE STUDENT RESOURCE

A separate one-page PDF with the fair test, the results table, a space to sketch the team's design and the closing sentences.

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Get ready

What to gather, how to set the slope and one pouring rule for every test.

Materials

For each team

- A waterproof ramp with an open lower edge, such as a rimless baking sheet or a rigid plastic sheet with raised side edges
- 2 books of the same thickness to raise one end
- 2 tubs to catch the water at the low end
- A measuring cup marked in mL and a second cup for pouring
- A cloth large enough to cover the ramp
- 2 sponges and a handful of small stones
- A timer and a towel
- The student page and a pencil

For you

- A bucket of water for filling the measuring cups and a second bucket for used water

Set up each station

1. Stack the two books and rest one end of the ramp on them, so that end is about 5 cm higher than the other.
2. Place one tub under the open lower edge of the ramp, so water running off the ramp falls into it. Keep the spare tub beside it.
3. Mark the top edge of the ramp with a strip of tape. Every pour starts there.

The pouring rule

1. Measure 100 mL of water into the pouring cup.
2. Pour it along the tape at the top of the slope while you count slowly to five.
3. Start the timer when the pouring starts.
4. At 30 seconds, swap the tub for the spare one, so later drips are caught and do not count.
5. Pour the water from the first tub into the measuring cup and record the amount. If no water reached the tub, record 0 mL.

Start every test equally damp

A dry cloth soaks up far more water than a cloth that is already wet. Before each test, children dip the cloth and the sponges in the bucket and wring them out well. They also tip any water left on the ramp into the used-water bucket.



One station. The open lower edge of the ramp hangs over the tub, and a spare tub stands ready.

SAFETY

Water on the floor is slippery. Keep a towel at every station and wipe up spills as they happen.

ROLES

Pourer: measures and pours the water.

Timer: runs the 30 seconds and moves the tub.

Measurer: reads the amount collected.

Rotate the roles for each test.

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TEACHING SEQUENCE

Run the lesson

A racing stream of water raises the question. Three measured tests answer it.

Introduce the puzzle 5 MINUTES

DO Pour a cup of water down a bare ramp in front of the class and let them watch it race to the bottom.

ASK "Where does rain go when it lands on a bare hillside? What could stop so much of it running off?"

Plan the comparison 7 MINUTES

SAY *"You will test three surfaces on the same slope. The bare ramp. The ramp covered with a cloth. A surface you design yourselves."*

ASK "What must stay the same so we can compare the surfaces?"

Establish the slope, the amount of water, the pour and the 30 seconds. Children write these on the student page. Read the pouring rule together.

Test the bare and covered slopes 13 MINUTES

DO Teams test the bare ramp and record the water collected and what the water did. They lay the damp cloth flat over the ramp and test again with the same pouring rule.

ASK "Where did the water go that did not reach the tub?"

Design and test 15 MINUTES

DO Teams sketch a surface that uses the cloth, the sponges and the stones in any arrangement. They wring the materials out first, then arrange the design and test it with the same pouring rule.

ASK "What did you notice in the first two tests that gave you this idea?"

Compare and explain 10 MINUTES

DO Write each team's three amounts on the board. Teams describe the design that let the least water through and what the water did on it.

ASK

- "Did the water stop, soak in or change direction?"
- "Would one test be enough to say this design always works best?"

Close and clear away 10 MINUTES

DO Children complete the sentences on the student page. "Our results showed ___. The amounts that support our answer are ___. We think this happened because ___." Allow at least 5 minutes of this stage to empty the tubs, wring out the cloths and dry the tables.

LOOK FOR

Teams that link their design to something they saw. "The water ran down the edges of the cloth, so we put stones along the edges" is the reasoning you want.

IF THIS HAPPENS

No water reaches the tub. That is a result. Children record 0 mL and describe where the water went.

The covered slope collects as much as the bare one. Check that the cloth lies flat and reaches the top edge, so water cannot run underneath it.

Water pours over the sides. The pour was too fast. Reset and count to five.

WHERE THE WATER WENT

Ask a child to wring the cloth out over a cup after a test. The class can see the water it was holding.

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The science behind it

Why cover reduces runoff, the ideas children bring and how to adjust the challenge.

The science behind it

Water flowing over the surface of the land is called runoff. On bare, smooth ground there is nothing to hold the water or slow it, so it runs downhill quickly. Fast water has the energy to pick up soil and carry it away, which is erosion, and it reaches streams and drains all at once, which can cause flooding.

A covered surface changes two things. Some of the water soaks into the cover and stays there for a while, as it does in a cloth or a sponge. The rest has to find its way around obstacles, so it travels a longer path and moves more slowly. On a real hillside, plants, roots, fallen leaves and loose soil do both jobs.

Less water in the tub after 30 seconds shows that less water ran off in that time. It may have been soaked up, trapped or sent on a longer path. The amount alone does not show that the flowing water moved more slowly, which is why children also record what the water did.

People use the same ideas on purpose. Farmers build terraces across steep slopes. Gardeners spread mulch. Cities plant rain gardens that hold storm water and let it soak into the ground.

Ideas children often bring

A CHILD MIGHT SAY	YOU COULD RESPOND
“The water disappeared.”	Wring out the cloth. The water is still there, held for a while.
“The stones soaked up the water.”	In this model, look for how the stones block or redirect the water.
“Ours let the least through, so it is the best design.”	It was the best in one test. Ask what they would need to do to be sure.

Support and challenge

Support. Give a team two limits to choose between, such as cloth with sponges or cloth with stones, so the design decision is smaller.

Challenge. Raise the slope with a third book and ask teams to predict whether their design will still let the least water through.

ASSESSMENT

Use the student page and the team discussion.

Fair test: names what was kept the same.

Evidence: reports the three amounts and what the water did.

Reasoning: links the design to an observation from an earlier test.

TAKE IT FURTHER

Add soil. Outdoors, cover the ramp with a layer of soil and compare bare soil with soil under a layer of leaves. Look at how muddy the collected water is.

Look outside. After rain, find where water ran quickly on the school grounds and where it soaked in.

FINAL EXPLANATION

Ask every team for the same three things. Tell us what you found, show the evidence, and explain what you think caused it.

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Vicky Brooks
Give Spark

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The runaway puddle

How can we reduce the water running off a slope?

Name _____ **Date** _____

1 Our fair test

What will we keep the same for every surface?

2 Our results

Pour 100 mL at the top while you count to five. After 30 seconds, measure the water in the tub. If no water reached the tub, write 0 mL.

SURFACE	WATER COLLECTED IN 30 SECONDS	WHAT DID THE WATER DO?
Bare ramp	mL	
Covered with cloth	mL	
Our design	mL	

3 Our design

Sketch it from above before you build.

4 Why we chose it

What did you notice in the first two tests?

5 What we found

Our results showed

The amounts that support our answer are

We think this happened because

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