Where Rain Goes

Plan a test of water moving across and through soil

ESS.4.d "Plan and conduct an investigation on water's effect on surface and subsurface processes."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the question the class will test, circle the conditions kept the same, and number the two measurements that show water's effects above and below the soil. These marks will help you check whether the investigation can test its prediction.

A Cloudburst in a Tray

1. After a cloudburst, muddy water streams across a schoolyard, while some rain disappears into the ground. Where does that missing water go? A science class could test whether the speed of rainfall changes what happens above and below a soil surface. Their question is: Does faster water delivery increase soil carried away by runoff and decrease water draining through the soil? They predict that a rapid pour will send more water over the surface, giving less time for water to enter spaces between soil grains. The prediction is a claim to test, not a result already known.

2. The class prepares six identical trays with drainage holes and fine screens that hold the soil in place. Each tray gets the same mass of dry soil, the same packing pressure, and the same slope. A container at the lower edge catches surface runoff; another below the holes catches water that passes through the soil. Three trays receive 500 milliliters of water spread evenly over one minute. The other three receive 500 milliliters spread evenly over ten minutes. Students start a timer as pouring begins and collect both outflows until the timer reaches twenty minutes.

3. For each tray, students measure the volume of runoff and the volume of water collected below. They filter the runoff, dry the trapped soil, and weigh it to estimate surface erosion. Water collected below shows that some water moved through the soil, a subsurface process; it does not prove that the water reached groundwater. Students compare the three results for each pouring speed, rather than choosing one dramatic tray. Greater runoff and more dried soil in the fast-pour group would support part of their prediction. Less drainage in that group would support the other part.

2 ANSWER WITH EVIDENCE

Use the passage

1. What water condition changes between the two groups, and what conditions are kept the same so the comparison is fair?

2. How will students measure surface erosion instead of relying only on runoff volume?

3. How will students measure water moving below the surface? What can that measurement not prove?

4. What pattern across the three trays in each group would support both parts of the prediction?

3 YOUR TURN

Your own words

Design a different investigation using a sloped box of sand over gravel to test how the **amount** of water affects both surface erosion and water movement below the surface. State a prediction, the water amounts, what stays the same, how you will measure each effect, and how you will repeat and compare trials.

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PART 1 · READ AND MARK

Underline the question the class will test, circle the conditions kept the same, and number the two measurements that show water's effects above and below the soil. These marks will help you check whether the investigation can test its prediction. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What water condition changes between the two groups, and what conditions are kept the same so the comparison is fair?	**Pouring speed changes: 500 milliliters is delivered over one minute or ten minutes. The trays, soil mass, packing pressure, slope, water amount, and collection time stay the same.**
2	How will students measure surface erosion instead of relying only on runoff volume?	**They will filter the runoff, dry the trapped soil, and weigh it.**
3	How will students measure water moving below the surface? What can that measurement not prove?	**They will collect and measure water draining through the holes beneath each tray. This does not prove that the water reached groundwater.**
4	What pattern across the three trays in each group would support both parts of the prediction?	**The fast-pour trays would generally have more runoff and more dried soil in that runoff, but less drainage, than the slow-pour trays.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I predict that adding 600 milliliters rather than 200 milliliters will wash away more sand and produce more drainage. I will pour both amounts at 100 milliliters per minute onto identical sloped boxes with equal layers of sand and gravel. For three trials per amount, I will collect runoff and drainage separately for 20 minutes from the start of pouring. I will dry and weigh the sand in the runoff, measure drainage volume, and compare group averages.

Accept testable predictions that differ from the sample. A complete plan changes water amount, controls other conditions, measures both surface erosion and drainage, and repeats each condition.