

Water Shapes Rock

Plan, run, and evaluate a stream-table investigation.

HS-ESS2-5 "Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Clarification Statement: Emphasis is on mechanical and chemical investigations with water and a variety of solid..."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline controls and measurement rules in the protocol. Circle decisions your group must make. Complete the plan, conduct repeated trials, and use your own observations as evidence.

How Does Slope Affect Sediment Transport?

1. Prepare the model

Liquid water flows downhill and can transport loose Earth materials. When flow slows, particles may settle. Investigate how tray slope affects sediment transport by water. Teacher provides a stream tray at least 50 cm long, a catch basin, stable supports, water, measuring jug, stopwatch, ruler, balance, and identical batches of damp sand mixed with fine gravel. Use eye protection, wipe spills, and collect sediment in the basin, not the sink.

With the teacher, choose two safe support heights that give different slopes; record the raised height and tray length. Mark one starting line. Prepare equal-mass batches from one evenly dampened mixture for pilots, six measured trials, and a refinement trial. Record mass/mixture. Keep bed dimensions and packing identical. Keep the same tray, starting position, pour point, water volume and pour duration for every run.

2. Pilot and repeat

1. Place fresh sediment upstream of the start line. Pilot: pour 400 mL over 20 s from a fixed point; adjust settings if needed, then fix them before data collection.
2. Measure from the start line to the farthest visible transported grain, to the nearest 0.5 cm, 30 s after pouring stops. Record 0 if none crosses. Record moving grain sizes and deposit locations.
3. Measure start line to lower tray edge: the downstream limit. Record escaped grains' distances as greater than this limit (censored). Adjust the pilot to prevent escapes.
4. Reset the bed with a fresh identical batch and empty the basin. Run three trials per height, alternating heights. Record actual volume, pour time and deviations.

3. Use evidence and test its limits

Each person records all six trials and writes an individual explanation. Compute each slope's mean and range only when all three measurements are uncensored. Otherwise, report both summaries as undetermined; do not omit censored trials. Compare the means with within-set variation when possible. Use movement and deposits to explain water's transport of Earth materials. Small or inconsistent differences are valid; do not change data to match predictions.

Consider imprecise pouring, uneven packing, or difficulty seeing grains. Choose one improvement, obtain teacher approval, and run one additional trial. Record it separately from the original six. Connect runoff to movement and deposition of rock fragments; this model does not investigate chemical weathering or prove a universal slope rule.

2 ANSWER WITH EVIDENCE _____ Use the passage

- 1** Write your testable question and prediction. Identify the water property or behavior and Earth process being investigated.

- 2** Record your two heights, tray length, and sediment mass/mixture/bed dimensions. List water volume, pour time and pour position as fixed settings.

- 3** Define the measurement origin and downstream limit, timing, units and precision. Why use three trials per height and fresh identical sediment beds?

- 4** Describe your pilot result and any final setup changes. Explain how your plan avoids grains leaving the measured tray. Obtain teacher approval before measured trials.

3 YOUR TURN _____ Your own words

Conduct the approved investigation. Each learner completes all three record stages below. A written plan or supplied sample data does not replace the actual trials.

1. Record six trials

Make a table: Height (cm), Trial, Water (mL), Pour time (s), Distance (cm), and Grain/deposit observations. Record all six runs and deviations. Give each height's mean and range only when all three measurements are uncensored. Otherwise report both summaries as undetermined; do not omit censored trials.

2. Explain and evaluate

Support a claim with both slopes' means/ranges where determined, plus movement/deposition observations. Explain any censored-data limitation. Connect liquid-water runoff to transport and deposition of rock fragments, and describe one uncertainty. A weak or absent difference is acceptable.

3. Refine and test again

Name one measurement or control improvement and why it addresses your uncertainty. Record teacher approval, the extra trial's height, water, time, distance and observations. Compare its quality with the original trials; do not silently merge it into the original data.

PART 1 • READ AND MARK

Underline controls and measurement rules in the protocol. Circle decisions your group must make. Complete the plan, conduct repeated trials, and use your own observations as evidence. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	Write your testable question and prediction. Identify the water property or behavior and Earth process being investigated.	Example: How does support height affect transport distance? I predict a higher slope carries grains farther because gravity drives downhill flow; accept justified alternatives. Liquid water transports Earth materials; settling shows deposition.
2	Record your two heights, tray length, and sediment mass/mixture/bed dimensions. List water volume, pour time and pour position as fixed settings.	Teacher checks two safe distinct heights and one reproducible set of settings. Slope varies; other listed factors stay fixed.
3	Define the measurement origin and downstream limit, timing, units and precision. Why use three trials per height and fresh identical sediment beds?	Measure from start line to farthest visible grain 30 s after pouring, in cm to 0.5 cm; limit is start line to lower edge. Repeat to assess variation; reset to avoid carryover.
4	Describe your pilot result and any final setup changes. Explain how your plan avoids grains leaving the measured tray. Obtain teacher approval before measured trials.	Record real pilot evidence and final settings; use a long enough measurement area and suitable slope/volume. Approval precedes six measured trials.

PART 3 · YOUR TURN (SAMPLE ANSWER)

Evaluate actual work

Example plan: vary support height, hold sediment and water settings constant, and measure downstream distance. Check the group's real records; no universal distances are supplied. A supported explanation uses means/ranges when all measurements are uncensored, plus observed movement/deposits. If any trial exceeds the downstream limit, its slope's mean and range are undetermined from the reported data; keep the trial and explain the limitation.

Example connection: runoff carries loose fragments downhill and deposits them when flow slows. That connects water movement to sediment transport in the rock cycle. A useful refinement targets an observed error, such as a steadier pour; report the extra trial separately and explain whether the change improved measurement quality.

TEACHER ASSESSMENT NOTES

Require the approved plan, pilot, six real trials, valid summaries, individual evidence-based reasoning and one separate refinement trial. Observe safe setup and consistent controls. Accept inconclusive findings when supported. If a distance is censored, that slope's mean and range are undetermined from the reported data; do not accept omission of that trial. This focused mechanical investigation does not cover every water property.