

## Roof Models

**Goal:** Students design and test models to explore how water flows over roofs, on soil, impermeable and permeable surfaces. Students examine how water moves across these different surfaces and explore the impacts of permeable and impermeable surfaces on surface water flow and erosion.

### Objectives

**Knowledge-** Students understand that water moves differently over permeable and impermeable surfaces, the angle of the roof affects the speed of water flow, and that models are used to test systems.

**Skills-** Students build models, observe and record data, and use descriptive language to explain observations.

**Values-** Students realize that humans (in this case, our buildings and associated infrastructure) affect the movement of water in a watershed and that humans can mitigate (lessen) erosion of soil and water movement with catchment systems.

**Grade:** 4th

**Special Safety:** Watch for water splashes on the floor and caution students to walk carefully on the wet surface.

**VA Standards addressed:** Science (2018) 4.1, 4.8; Mathematics (2016) 4.8

### Materials (per group of 2):

- \* Turkey roasting pan
- \* Rectangular Cardboard 'roof' in whole-inch dimensions
- \* Aluminum foil
- \* Rubber bands
- \* Scotch tape
- \* Small plastic containers, or other stable object for elevating model roofs (2, in PLC)
- \* Beaker (300 mL)
- \* Kool- aid or powdered tea or lemonade
- \* 3 oz paper cups (2)
- \* Sponges (2 types, one that is very absorbent & one that is not such as scotch brite), cut up in different sizes, a few per group (if activity takes place inside)

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### Set-up:

1. One set-up per group of 2 to 4.
2. Make rectangular cardboard roofs (use whole inches for dimensions, then cover with a large piece of aluminum foil with lots of overlap.) Prepare these by taping at different angles/slopes.
3. Place on top of two small plastic containers in a turkey roasting pan.
4. Sprinkle with powdered beverage.
5. Place tape and extra supplies in an easily accessible location.



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### Procedure/Instructional Strategy:

1. Ask the classroom teacher for assistance to place students in groups of not more than three.
2. Activate prior knowledge of erosion. Ask students to give examples or provide a definition of erosion.
3. Inquire-
  - a. We often use models to demonstrate/show how our world works. How does water move over a roof? How can you describe this?
  - b. Model the flat roof set-up with the students. Instruct them to follow along on their data sheet. Ask, what do you predict will happen to the water on the roof? In this model, what does the powdered drink mix represent? What do you predict will happen to the drink mix? What is the term/word we use for this process of water wearing away or moving soil? *Erosion*.
  - c. Pour water over the roof model, ask students to observe and share their observations as to what happened to the water that fell on the flat roof.
  - d. Ask: Can water soak into the roof? *No*. Why can't it soak through the roof? The word we use for this is impermeable (like waterproof, water cannot move through). English tie-in: How can we change the word to mean that water CAN move through? (Permeable)
  - e. Inquire: Are all roofs the same shape? What are some other shapes (pitched roofs, can be steep or less of a rise)? Give each pair of students a 'roof', each of a different angle (some will be acute angles and some obtuse). Provide time for groups to explore pouring water over their roof model and make observations. Remind students to record observations on the data sheet.
4. Extending the investigation outdoors:
  - a. Instruct groups to take their 'building' to different surfaces around the schoolyard and to ask: Is this surface permeable or impermeable? What will happen when the water falls off the roof onto this surface?
  - b. Bring the class back together. Ask: How can your group redesign your roof to prevent erosion on the ground? What are some ways that people prevent water from running off the roof onto bare ground?
5. Engineer: Provide time for groups to consider and engineer a solution. Once a group develops a catchment system, they can test it on one surface. The goal is for students to fashion gutters to channel the water. They can make troughs by unrolling the Aluminum foil and explore ways to catch the water that runs off the roof. Suggested questions to stimulate ideas:
  - a. What happens to the water once it is on the ground?
  - b. If the water is channeled in one place, does this still cause erosion?
  - c. How can we prevent erosion? (Rain barrels or some other collection device can hold the water and slowly let it trickle onto the ground so as to not cause a lot of erosion.)
6. Conclusion: Once students have tested their catchment systems and recorded information, bring class together to discuss findings and observations.

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### Foul Weather Plan:

Activity can be done inside; expand on different roof types rather than different surfaces during your discussions.



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	Draw or describe the roof and the surface the 'building' model is on.	Predict: How will water move on the roof and to the ground? (Ex. fast/slow, in a line, spread out, soak in)	Observe: How did the water move? Did it match your prediction?	Observe: Describe the erosion that happened on the surface(s).
Sample Trial 1	The roof is flat  water falls on concrete			
Trial 2				
Trial 3				

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Student Names: \_\_\_\_\_



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