Permeability Field Investigation Student

Objective

- To learn about the concept of permeability, infiltration, and surface water runoff on different surfaces.
- To compare results to permeability data from maps.
- To define parameters of the field test (for higher grades).

Materials for Each Team

- 6-inch PVC pipe 3-in diameter
- 1000 ml-measuring cup
- Stop watch
- Small map of school grounds
- Clear ruler with metric marks
- Red, green, and yellow markers and pencil
- Directions for Permeability Field Test
- Field Observation Sheet
- Container of water for multiple sites (could be 2-liter soda bottle)

Background

In this field inquiry, your class will investigate different land uses or covers on your campus and determine whether they are permeable, semi-permeable, or impermeable. The different areas should include gardens, mulched areas, sport fields, sidewalks, wooded edges, walking paths, and other types of land-use areas on your campus.

- The class will start by *forming hypotheses* about which area under investigation is most permeable and which area is least permeable.
- Then teams will go to the different areas and conduct the permeability field test. The *procedure* for this test is on the next page.
- Afterwards, you will *compile the class results* on a class table or graph and a large map of the campus.
- From these results, you will *draw conclusions* about stormwater runoff on the campus and *make recommendations* about possible areas where rain gardens, conservation gardens, rain barrels, or trees could reduce the amount of stormwater.

Field Test Procedure

Your team will do the following procedure. For consistency each team member will do an assigned task throughout the investigation (Reader, Recorder(s), Holder, Timer, Pourer). Read and *practice* these instructions before you start.

As you complete a test, **mark the test site on your map**. Label each test site according to your team's letter and the number of the test. (If you are team A, your first site will be labeled A1, your second site, A2, and so on.) **Record your observations on the Team Field Observation Sheet**.

1. Fill your cup or bottle with 650 ml of water.
2. Push the cylinder into the ground to the black line on the cylinder. (For areas where the pipe *cannot* be put in the ground, go to Step 3.) Do the following steps:
    - One person applies constant pressure to the top of the container to prevent water from leaking out around the bottom.
    - The Timer starts the stopwatch at the same time the Pourer begins to pour 650 ml of water into the cylinder.
    - *If the water infiltrates before 3 minutes*, the Timer stops the watch at that point. The Data Recorder writes the length of time in seconds on the Team Field Observation Sheet.
    - Otherwise, stop the watch at 3 minutes. If water remains in the cylinder, measure from the rim of the cylinder to the water level (in centimeters). The Data Recorder notes this on the Observation Sheet.
3. If the cylinder cannot be put into the ground, you will pour the water on the surface and *record what happens on your Observation Sheet and map.*
    - Does it pool?
    - Does it flow in a certain direction? Make a red arrow on your map that shows which direction the water flows.

RESULTS: Directions for the Group Map

Each team marks their sites on the large map according to the following:

- If all the water seeped into the ground within **3 minutes**, put a **GREEN dot** on the test site.
- If **some water remained in the cylinder, but greater than 2 cm infiltrated** into the ground, put a **YELLOW dot** on the test site.
- If **less than 2 cm** (or no water) infiltrated into the ground, mark the test site with a **RED Dot, and red arrow** if you tested the direction of water flow.
- Extrapolate the results: If all the test sites in a designated area have the same color of dots, mark the entire area with that color (or stripes of that color).
- Make a map key. Define which colored dots represent *permeable*, *semi-permeable*, *or impermeable.*

TEAM FIELD OBSERVATION SHEET

Weather: Did it rain yesterday? _____

TEST SITE NUMBER (For example, A1, A2, A3…	**TEST SITE DESCRIPTION** (Examples: garden, foot path, playground, parking lot)	**TIME FOR WATER TO INFILTRATE (sec.)** (If the water would not infiltrate, write impermeable.)	**Distance from rim to the water level (cm)** (The amount that infiltrated.)	**OBSERVATIONS** • Note things that could have influenced your results, for instance: Was the ground wet? Did water seep out your cylinder?

EXAMPLE CLASS TABLE

Directions:

Time to infiltrate: If the water did not infiltrate within 180 seconds, write **>180 sec**. If it did not infiltrate at all, write Impermeable.
Averaging: When the water does not infiltrate within 180 seconds, it will take creative thinking to "average" the Time-to-Infiltrate results. Your class can decide the appropriate value to use, or whether to just to consider the average amount of water that infiltrated for that site.
Distance from rim: If the water did not infiltrate into the ground at all, write zero.

	Test Site 1		Test Site 2		Test Site 3		Test Site 4	
	Time to Infiltrate (seconds)	Distance from Rim to Water Level (cm)	Time to Infiltrate (seconds)	Distance from Rim to Water Level (cm)	Time to Infiltrate (seconds)	Distance from Rim to Water Level (cm)	Time to Infiltrate (seconds)	Distance from Rim to Water Level (cm)
Team A								
Team B								
Team C								
Team D								
Team E								
Average								
Is it Permeable or Semi-permeable Or Impermeable?								

	Test Site5		Test Site 6		Test Site 7		Test Site 7	
	Time to Infiltrate (seconds)	Distance from Rim to Water Level (cm)*	Time to Infiltrate (seconds)	Distance from Rim to Water Level (cm)	Time to Infiltrate (seconds)	Distance from Rim to Water Level (cm)	Time to Infiltrate (seconds)	Distance from Rim to Water Level (cm)
Team A								
Team B								
Team C								
Team D								
Team E								
Average Time to Infiltrate								
Is it Permeable or Semi-permeable or Impermeable?								