BRIDGES

Lesson Plan: **Ground Surfaces and Infiltration Activity**

How quickly does water move?

Alignment with STEM Framework

Inventor **Tinkerer** **Investigator** **Designer**

Altruist

Overview

This activity is intended to encourage youth to see the connection between stormwater runoff and infiltration. Youth will apply the concept of infiltration to different types of ground materials; and will then observe how different combinations of soil and vegetation can affect the rate of infiltration. The big idea is how water infiltrates through different types of ground surfaces.

Practice Goals

- ☐ Asking questions and defining problems
- ☐ Developing and using models
- ☐ Planning and Carrying Out Investigations
- ☐ Analyzing and Interpreting Data
- ☐ Constructing Explanations and Designing Solutions
- ☐ Obtaining, Evaluating, and Communicating Information

Content Goals

- ☐ How does ground surface determine infiltration?
- ☐ How does stormwater runoff affect infiltration?
- ☐ How does infiltration rates differ in urban areas and rural areas?

Purpose

The purpose of this lesson is to engage youth with the process of water infiltration, rate of infiltration, and the concept of permeability.

Teacher Background Information

Permeability is the ability of soil to absorb water through its layers. Infiltration is the rate at which water can move through a surface and its layers. Soil water infiltration depends on the texture, structure, and moisture levels (quantity of water contained in a material). The different soil types include sand, silt, and clay. Sand has large grain sizes which make it easy for liquids to pass through. Silt has medium size grains, making it moderately easy for liquids to pass through. Class has tiny grains, this makes it hard for liquids to pass through. Porous materials are materials with openings (pores) in which liquid can pass through. Non-porous materials mean liquid cannot pass through because the chemicals are tightly packed together. It is more common for urban areas to have low infiltration rates because most urban areas have roads and pavements made of non-porous materials.

"Stormwater runoff is a major cause of water pollution in urban areas. When rain falls on our streets and parking lots in cities, the water cannot soak into the ground as it should. Stormwater then drains through gutters and storm sewers, and is then discharged into nearby water bodies. The stormwater runoff carries trash, bacteria, heavy metals, and other pollutants from the urban landscape. Higher flows resulting from heavy rains also can cause erosion and flooding in urban streams, damaging habitat, property, and infrastructure. However, when rain falls in natural, undeveloped areas, the water is absorbed and filtered by soil and plants. But proper soil management prevents the restriction of soil infiltration."

-U.S. EPA

Affinity Goals

I can act like an **Altruist** by considering how poor soil management increases flooding in our community.

I can act like a **Designer** by engineering drainage systems that reduce surface water flooding.

I can act like a **TInkerer** by improving soil permeability, an example could be adding compost to soil which allows for healthy drainage.

I can act like an **Investigator** by analyzing the ways in which various ground surfaces absorb water.

I can act like an **Inventor** by brainstorming tools that can increase infiltration rates in urban areas.

Materials

For the Four Models of Different Surfaces

- [ ] Vegetation - grass with roots intact or moss
- [ ] Soil
- [ ] Gravel/Rocks
- [ ] Sand
- [ ] Clay
- [ ] Cheesecloth
- [ ] Four soda bottles cut in half

Additional materials for lesson:

- [ ] The four models
- [ ] Water
- [ ] Measuring Cup or breaker to pour water
- [ ] Small breaker for measuring infiltrated water
- [ ] Infiltration data collection handout

Time Needed

45 Minutes

Model Preparation

- [ ] Cut the four soda bottles ⅔ down from the top.
- [ ] Turn the bottle over and place the mouth of the bottle in the base to use as a stand and to hold water. Place a single piece of cheesecloth at the bottom of each inverted bottle where the mouth was.
- [ ] Fill bottle 1 with soil only.
- [ ] Fill bottle 2 with soil. Place vegetation on top as if to plant it.
- [ ] Fill bottle 3 with gravel.
- [ ] Fill bottle 4 with clay.

Instructional Sequence

Teacher will:

- [ ] Create four models of different surfaces in advance

Teacher will Ask:

- [ ] What youth think each of the bottles represents
- [ ] If youth can identify surfaces similar to these around their community
- [ ] Youth what they think will happen when water is poured onto each model. Youth will write their predictions down on their data sheet.

Teacher Will:

- [ ] Explain the data collection procedures and carry out the investigation.
- [ ] Select someone to time how long it takes for the water to infiltrate and reach the bottle base.
- [ ] Measure and pour equal amounts of water into each model so that participants can see and time the rate of infiltration. Teacher will select a youth volunteer to pour the filtered water into the measuring cup.

Youth will:

- [ ] Draw a model of the infiltration process on a data sheet. Youth will draw the base in and draw a representation of how much water was filtered into the base. Youth will label materials and note time of infiltration.

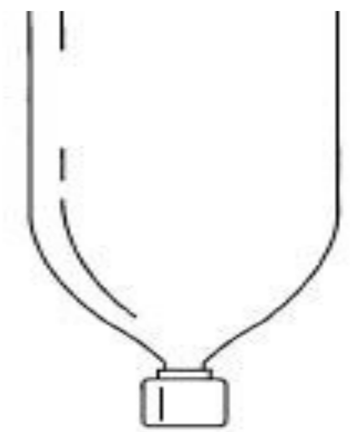
Teacher will:

- [ ] Facilitate discussion of patterns and trends in the data.

Infiltration Activity

Predictions:

Observations:

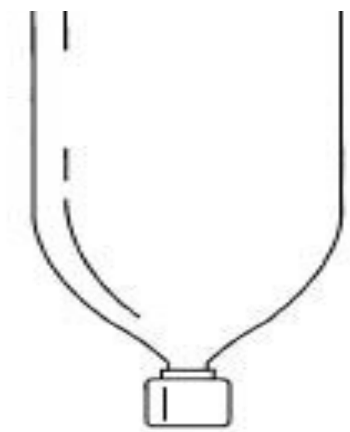


Results:

Observations:

Predictions:

Observations:

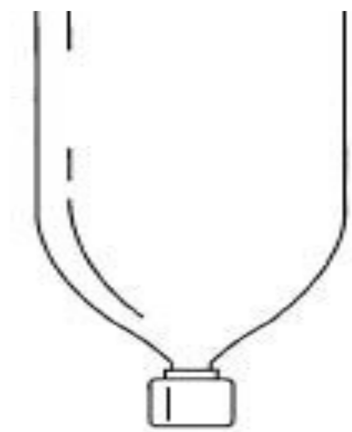


Results:

Observations:

Predictions:

Observations:

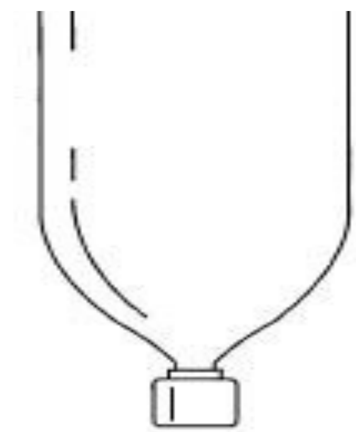


Results:

Observations:

Predictions:

Observations:



Results:

Observations: