

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

## Acid Rain and Soil



### Learner Outcomes:

- Describe mechanisms for the transfer of materials through air, water and soil; and identify factors that may accelerate or retard distribution (e.g., wind speed, soil porosity)

### Key Terms:

Dispersion

Water table

Permeable

Groundwater

Pores

Leachate

**Background Information:** The composition of soil can affect the rate at which a liquid moves through it. For example, sandy soils drain fairly quickly because sand particles are fairly large and the soil is quite porous. Clay soils have very fine hard packed particles that close pores and resist the flow of fluids. In addition, to grain size, different types of compounds in the soil can affect the effects of acid rain, both on the soil and on the ground water into which it drains. Soils containing a higher concentration of lime reduce the effects of acid rain by neutralizing the acid, and slowing the flow of water through the soil. Soils containing a large percentage of organic material are already more acidic and so their ability to neutralize acids is limited.

### Research Question:

What effect does the type of soil have on an acidic solution that passes through it?

### Hypothesis:

This investigation / activity has been adapted from:

Mah K, Martha J, McClelland L, et al. *Science in Action 9*. Toronto, ON: Addison Wesley.

**Materials:**

100 mL graduated cylinder	Hand Lens	Sand
2 x 250 mL beakers	Filter paper	Potting Soil
Plastic funnel	pH meter or pH paper	Peat Moss
Retort stand and ring	Stopwatch	Clay / loam soil
	Vinegar (dil)	

**Procedure:**

1. Set up the ring and retort stand and fold and place a piece of filter paper in a funnel.
2. Observe and record the size and consistency of the grains of sand using a hand lens.
3. Measure out 30 mL of sand and place it into the filter paper in the funnel.
4. Place an empty beaker under the funnel.
5. Measure out 30 mL of vinegar into a second beaker. Measure and record the pH of the vinegar.
6. As you start the stopwatch, pour the vinegar into the sand and time how long it takes for the vinegar to pass through the soil and collect in the beaker. Record your observations.
7. Measure and record the pH of the leachate that you collect in the beaker.
8. Repeat steps 2-7 for the different types of soil (sand, potting soil, peat moss, clay / loam).

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**Observations:**

Sample	Observations	pH of vinegar	pH of leachate	Time to drain
Sand				
Potting soil				
Peat moss				
Clay / loam				

**Analysis:**

1. Which types of soil allowed the liquid to pass through more easily? Explain why.
2. Was your hypothesis correct? Explain why or why not.
3. What was the manipulated variable for this experiment?
4. What was / were the responding variable(s)?

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5. How did we control this experiment to make sure it was a fair test?
  
6. What effect did the soils have on the pH of the leachate? Explain.
  
7. Which soil would be best to reduce the effects of acid rain? Explain.

**Conclusion:**

**Extension:**

1. Research and design an experiment to test what kinds of "environmentally friendly" substances we can add to the soil to help it resist the effects of acid rain.
2. Identify one plant and one animal that are sensitive to the effects of acid rain and research how acid rain impacts these two organisms. Identify where each organism lives and what features in their environments help to buffer the effects of acid rain.
3. Create a poster, information package, or infomercial informing the public of how each and every one of us contributes to the formation of acid rain and offer some suggestions of what we can change to improve the situation.

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