What Are the Characteristics of a Hazardous Substance?
Answer the questions below on a separate piece of paper.

Learning Station 1
Directions:
1. Place the nail into a 10% solution of copper sulfate (10 ml cs/100 ml water).
2. Record your observations after 5 minutes and after 10 minutes.

Questions:
- What happened to the portion of the nail that was submerged in the copper sulfate?
- Why do you think this happened?
- What are the results of corrosion?
- Based on your observations, how would you define corrosion?
- What examples of corrosion do you see in your life?

Learning Station 2
Directions:
1. In a 500 ml beaker, measure out 50 ml of vinegar.
2. Add 1 gram of baking soda to the beaker.
3. Record your observations.

This experiment demonstrates what reactive means. It demonstrates a safe reaction. When we say something is hazardous because it is reactive, it means that a violent reaction can occur, or a toxic gas can be formed as a result of mixing with another substance.

Questions:
- Based on the results of this experiment, how would you define reactive?
- Would it be dangerous for a reactive waste to enter a landfill? Why or why not?

Learning Station 3 (Teacher Demonstration)
Write down the steps involved for each method your teacher uses to light the match. For each method explain why you think the match caught on fire.

Question:
- Based on your observations, how would you define flammable?
Subject
Science, Language Arts

Skills
Carrying out investigations, designing, hypothesizing, providing evidence

Materials
Student information sheet “Leachate and Landfills”  
Per small group: three funnels; three beakers with gradation; dry samples of topsoil, sandy soil, clay soil (NOTE: lumpy clay soil should be avoided); water; food coloring; paper towels or filter paper; graph paper

Time
Two - three class periods

Vocabulary
Percolation, precipitation, groundwater, leachate, watershed

Related NRRA 3R’s of the Common Core Activities
Please see NRRA’s 3R’s of the Common Core additional information and activities on how landfills operate.

Source
Adapted from Bag, Beakers and Barrels: An Action Curriculum Toward Resolving Hazardous Materials Issues

Concept
Soil characteristics influence how substances move in the environment.

Objective
Students will observe how fast water moves through different soil types.

Background See Information Section, pages 121-124. Household hazardous waste (HHW) entering landfills can potentially contaminate water supplies. When precipitation enters landfills, it percolates down through the trash, picking up contaminants, including HHW. This contaminated liquid, called leachate, can enter the surrounding environment. Many factors influence where contaminated water can travel including soil type. Contaminated water moves differently through different soil types. For example, the large pore spaces in sandy soils allow water to move very quickly. Spaces between clay soil particles are extremely small; therefore, the leachate’s movement is slowed down.

Procedures and Activities

Learning About Leachate
- Have students read the student sheet Leachate and Landfills (following page). As a class, brainstorm with students about what things found in landfills contribute to the toxicity of leachate. e.g.: products from our houses containing hazardous substances: oil based paints, automotive products, some cleaning supplies, lead-acid car batteries; waste products from small businesses such as print shops, dry cleaners, film developers.

Pondering Percolation
- Ask students what environmental factors they think influence leachate’s movement (e.g.: soil, geological formations.)
- Discuss with the students the three different soil samples you have collected. Ask students to predict which soil type they think will slow down the water’s movement the most.
- Have student groups conduct the Pondering Percolation experiment. (See the student sheet on the following page for detailed instructions.) This experiment will demonstrate the differences in soil types in terms of leachate movement. (Clay soil is the most effective in blocking leachate.)
Common Core Alignments

GRADE 7

CC.RST.6-8.3
Reading in Science & Technical Subjects:
Key Ideas & Details
CC.SL.7.2
Speaking & Listening:
Comprehension & Collaboration
CC.W.7.2
Writing:
Text Types & Purposes

GRADE 8

CC.RST.6-8.3
Reading in Science & Technical Subjects:
Key Ideas & Details
CC.SL.8.2
Speaking & Listening:
Comprehension & Collaboration
CC.W.8.2
Writing:
Text Types & Purposes

After students complete the experiment, discuss the following questions.

• Which soil type facilitated the water’s movement?
• Which soil type delayed the water’s movement?
• Is there a difference between the first and the last interval? If so, why?
• What soil characteristics influence water’s movement?

Stopping Leachate

• In small groups, have students brainstorm everything they know about landfills and how they operate. What do students know about landfill design and leachate prevention?
• Have students design a landfill that will prevent leachate from reaching the groundwater. The following questions might help the process.
  • How can you use the results of your experiment to help write your plan?
  • What else do you need to consider in trying to prevent leachate from entering the environment?
  • What are your ideas on how to prevent leachate from forming in the first place?

Extensions

• Call your local solid waste department for information about the criteria for siting a landfill. Arrange for a representative to speak to the class. What is the process for deciding where to site a landfill? Have students compare these criteria to their own ideas.
• Discuss how a septic system operates. What types of soils are septic systems usually located in? What might happen if hazardous substances entered a septic system?
### Pondering Percolation

Your group has three different types of soil: topsoil, sandy soil and clay soil. Write a brief description of each type.

<table>
<thead>
<tr>
<th>Descriptions of Soil Types</th>
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</thead>
<tbody>
<tr>
<td>Topsoil</td>
</tr>
<tr>
<td>Sandy Soil</td>
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<tr>
<td>Clay Soil</td>
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</tbody>
</table>

Predict which soil type the leachate will move through most quickly.

**Directions:**

1. Place filter paper in each funnel. Place each funnel in a beaker.
2. On a piece of tape, label each funnel with a soil type.
3. Fill each funnel ¾ full with the corresponding soil type.
4. One soil sample at a time, slowly pour 30 ml of water into each soil sample. Pour the water in the CENTER of the soil.
5. Time how long it takes most of the liquid to move through the soil sample. *Note: You don’t have to wait for every last drop.*
6. Record, on the chart below, how long it takes for the water to seep through the soil.
7. Pour in the next 30 ml the same way. After this has seeped through, pour the remaining 40 ml.
8. Repeat steps 4 - 7 for each soil sample.

**Observations:**

<table>
<thead>
<tr>
<th></th>
<th>Soil 1</th>
<th>Soil 2</th>
<th>Soil 3</th>
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</thead>
<tbody>
<tr>
<td>First 30 ml</td>
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<td></td>
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<tr>
<td>Second 30 ml</td>
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<tr>
<td>Final 30 ml</td>
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