Water Filtration Experiment

* Objectives
  + Students will demonstrate and observe simple water filtration
  + Students will learn the importance of healthy groundwater and soil
* Materials
  + Empty 2-liter bottles, tops removed and placed upside down inside the bottoms (one for each student group)
  + Play sand
  + Finer soil
  + Pebbles/ fish tank gravel
  + Water (pre-mix the “contaminants” into the water, have enough ready for each student/student group: black pepper, leaf litter, sand, soil)
  + Black pepper
  + Leaves/ leaf litter
  + Clear cups/jars (one for each student group)
  + Chart paper/soil profile chart
* Background info
  + Soils act as filters for groundwater sources
    - Groundwater is the supply of water underground held between the spaces in soil, sand, and rock. It moves very slowly through the earth in systems called aquifers
  + If we stop contaminants closer to the top layer of soil, it prevents them from getting into the roots where they could be absorbed by plants
  + You can tell a lot about the health of your groundwater from the health of your soil!
  + Soil filters water chemically and physically
    - Microbes in the soil can destroy dangerous bacteria that could harm groundwater
    - The physical shape and texture of soil can prevent larger particles from seeping into groundwater
  + For some plants, groundwater is their main food source, so it has to be clean for them (phreatophytes); these plants have longer root systems that can reach groundwater

LESSON

* Intro
  + What do we usually grow our plants in? Soil! Soil is extremely important for gardening and for all plants to grow and thrive.
  + Soil has many jobs but one of its most important jobs is to filter surface water
    - Some of the water that falls into the ground from rain, runoff, etc. will eventually find its way into the groundwater
      * Groundwater is the supply of water underground held between the spaces in soil, sand, and rock. It moves slowly through the earth in systems called aquifers.
      * We use groundwater for drinking water and for irrigation
  + Soil has different layers, and these layers have different properties and different jobs.
    - Introduce quick soil profile graphic (see below)
    - Topsoil
      * Best for growing, plants like it
      * Lots of living things
    - Subsoil
      * Not as good for plants
      * Sticky when wet, doesn’t have much space for roots to grow
    - Parent material
      * Rocky, not much lives here
  + Why might it be important to filter the water before it gets into the groundwater? *Through soil filtering we can prevent contaminants from going deeper into the ground and going into the groundwater or being absorbed by the roots of plants*
  + How do you think soil can filter chemicals and substances from water? *Soil filters chemically and physically. Microbes in the soil can destroy dangerous bacteria. The shape and texture of soil can stop larger particles from going deeper.*
  + Do you think the texture/size of soil particles affects what kind of things that soil can filter? Why/why not?
* Activity
  + We said earlier that soils have different layers that do different things and filter different size particles. We are going to make our own filters using layers of different materials to see what filters best and to watch the filtration process as it happens.
  + Step 1:
    - Pair/group students (depending on number)
    - Give each student a 2-liter bottle filter setup
  + Step 2:
    - Introduce “contaminated” water. Explain to students that they will be using some supplies to filter out as much contamination as they can from the water
    - Give each group their sample in a clear cup so that they can observe the contaminants
  + Step 3:
    - Introduce layering materials
      * Play sand
      * Finer soil
      * Pebbles/fish tank gravel
  + Step 4:
    - Pre-filter group discussion:
      * What material do you think should go at the bottom? Middle? Top? Why?
        + Think about what size particles you can catch in each layer of material.
  + Step 5:
    - Give students 3-5 minutes to assemble their filters (can vary). Do NOT pour contaminated water through yet. WAIT until time runs out.
  + Step 6:
    - Compare filters.
    - What did groups do differently? What were your ideas behind your filter design? What do you expect to happen when you pour your sample through?
  + Step7:
    - Pour water sample into the filters and watch what happens
* Closure
  + Discussion:
    - What did you observe?
    - How well did your layering system work out?
    - What could you have changed to make your filter more effective?
  + Recall: Why is it important for soils to filter water? How does it help us?

