

Soil Shenanigans

Grade: 1-2

Time: 1.5hrs

Activity Overview :

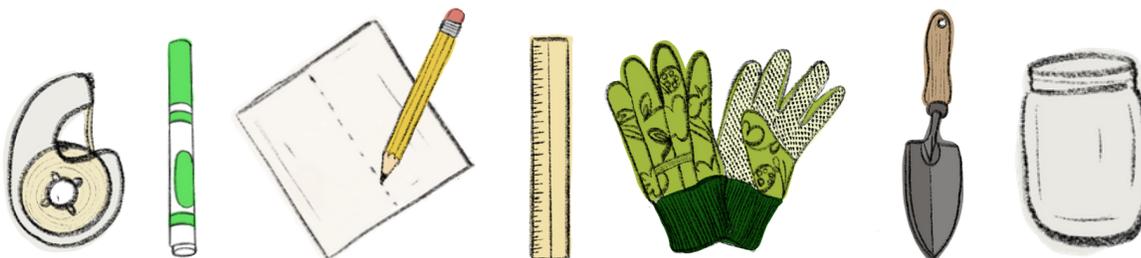
Today we are going to get a little messy as we explore the question, what is soil? For our activity today we are going to go outside and perform some experiments on a sample of soil from our own backyards. By doing this we are going to explore what soil is made up of, what lives in soil, what type of soil is in your backyard, and the importance of soil in our outdoor ecosystems.

Before we begin, think about the following questions:

- What do you think soil is made up of?
- What grows in soil?
- Have you seen any animals or insects in soil before?

Materials:

- Paper (1 piece)
- Markers, pencil crayons, or crayons
- Permanent marker
- Tape
- Trowel, shovel, or metal spoon
- Gardening gloves (optional)
- Clear plastic bottle, clear glass bottle, or clear mason jar with lid (2)
- Water
- Ruler (optional)
- Calculator (optional)

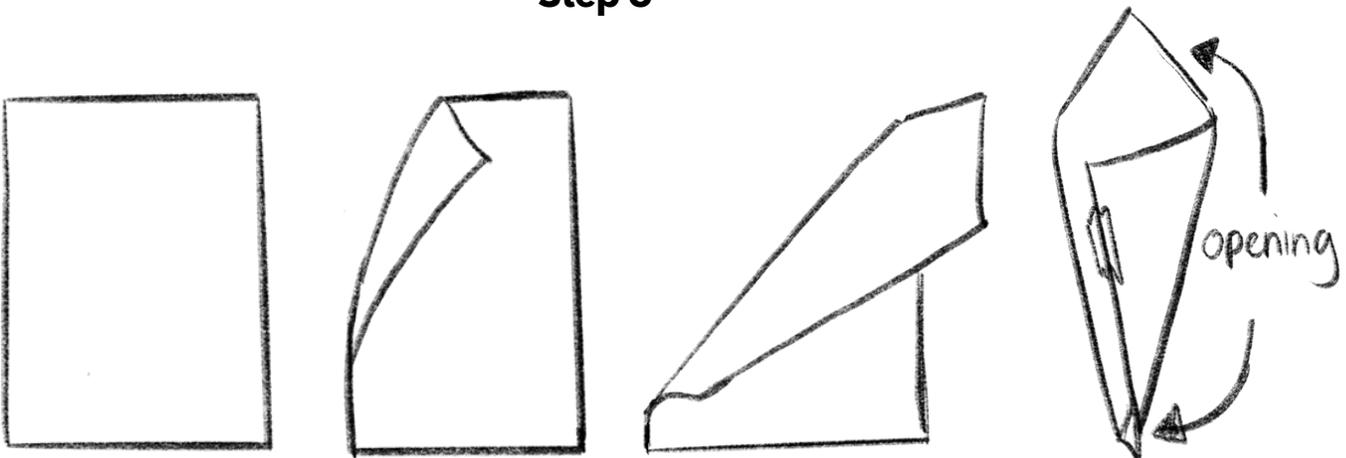


Don't worry if you don't have all these supplies. Experiment with other everyday items and see what you can build!

Activity:

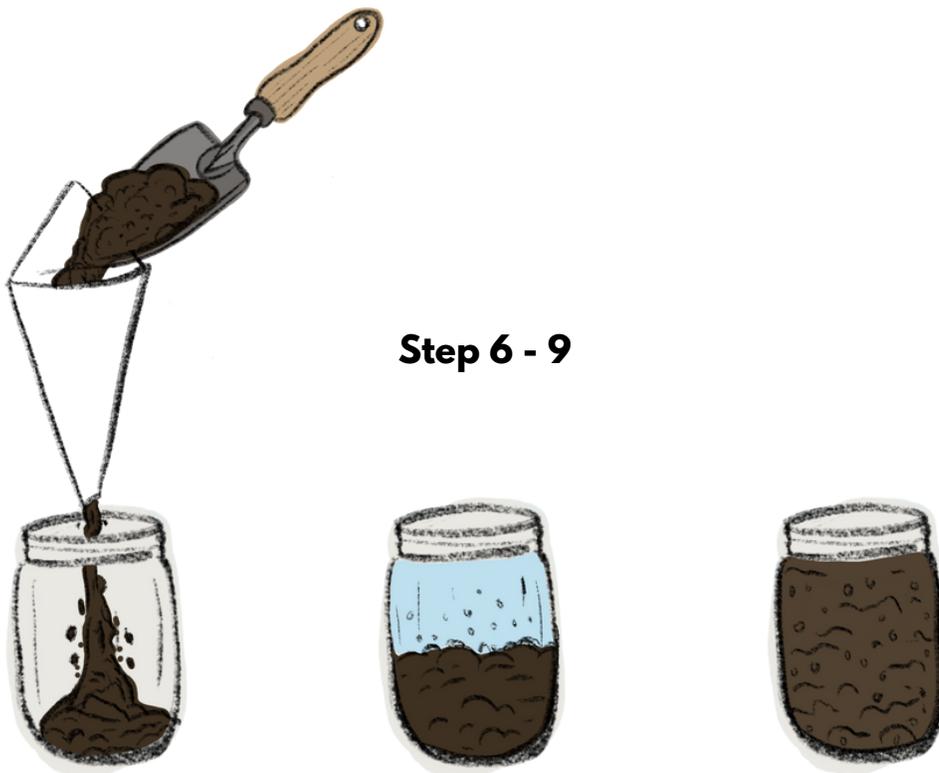
- 1** Before you begin the experiment, fill out the first page of the "Soil Shenanigans Worksheet" on page 10 and 11 to brainstorm what you think soil is. Now that you have brainstormed what you think soil is, let's get the materials ready to start the experiment.
- 2** We will be filling our clear bottles or jars with soil for this experiment, to get the soil in easily we will make a funnel.
- 3** To make the funnel, take a piece of paper and start rolling it up loosely from one corner to the opposite corner to make a cone shape with openings at both ends. Tape the cone together so that your funnel does not unravel.
- 4** Now it's time to get a bit messy! Put on your gardening gloves (if you want to) and take your trowel/shovel/metal spoon, clear bottle or jar, and funnel into the backyard.
- 5** Not all soil is the same, we will be taking two different soil samples to see the different types of soil in our own backyard.
 - Decide where you want to take your two soil samples from
 - You could take one sample from a vegetable garden and the other from an area where only grass grows
 - You could take one sample from the front yard and the other from the backyard
 - You could take one sample from the very top of the soil and the other sample from 30-45 cm deep
 - You can take more than two soil samples if you want to!

Step 3



Activity:

- 6** Now that we have decided where to take our soil sample from, it is time to start digging! Place the paper funnel into the opening of the clear bottle or jar.
- 7** Using your trowel/shovel/metal spoon, dig up some dirt and pour it into the clear bottle using the funnel, break up the soil before pouring it in. Fill up each bottle or jar half-full with soil.
- 8** Take your soil samples inside and then fill the bottles or jars with water until they are almost full.
- 9** Screw the lid onto the bottle or jar securely and shake until the soil and water are thoroughly combined. Place the jars in a safe spot where they will not be touched or knocked over.
- 10** The particles in the soil are going to start settling based on their size, with larger particles and the bottom and smaller particles at the top.
- 11** Let the particles settle for at least two hours, but the best results happen if you let the particles settle overnight.



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After you have let the particles settle you will be able to see what soil is made up of!

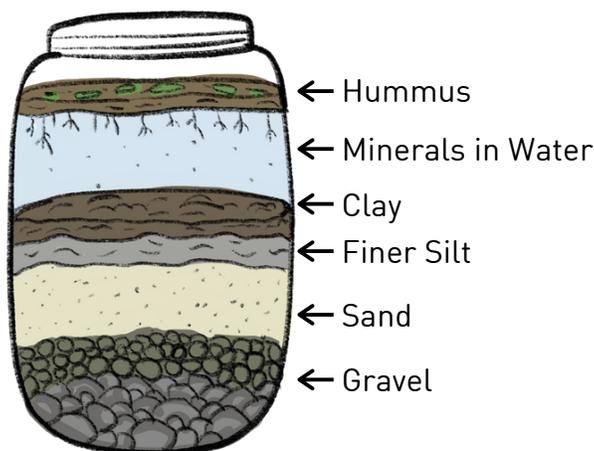
- The bottom layer will contain the largest particles, **gravel**, because they are heaviest and sink to the bottom. The next layer will be **sand** followed by **silt**, then clay. The water will sit on top of the **clay** layer and may be murky due to the **minerals** dissolved in it. Finally, there may be a layer of organic matter called **humus** floating on top of the water.

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There exist three main soil type classifications, **sand, loam, and clay**. The type of soil you have depends on how much **gravel, sand, silt, or clay** is in your soil. On the second page of the "Soil Shenanigans Worksheet" draw out the layers of your soil samples, making sure to draw how large they are relative to one another. When drawing out each layer, make the following observations:

- **Gravel:** the size of the pieces of gravel, the colour
- of the gravel (brown, grey)
- **Sand:** how much smaller the grains of sand are than the pieces of gravel, the colour of the sand (yellow or brown)
- **Silt:** the colour of the silt (more red, brown, or grey)
- **Clay:** the colour of the clay (more red, brown, or grey)
- **Humus:** how thick the layer of humus is floating on the top of the water, if there is any moss, wood chips, or leaves in the humus

Soil Profile



Soil Type Jar Test



0-10% clay
0-10% Silt
80-100% Sand

10-30% clay
30-50% Silt
25-50% Sand

50-100% clay
0-45% Silt
0-45% Sand

- 14** Now let's figure out what soil type you have based on how large the sediment layers are in comparison with each other, the three types of soil we are testing for are [sand](#), [loam](#), and [clay](#). If you want to calculate the soil type more exactly, check out the "Extensions" section!
- **Sand:** If the soil type is sand, the largest layer in your soil sample is gravel and sand. The gravel and sand layers combined will make up more than half of the soil sample.
 - **Loam:** If the soil type is loam, the sand and gravel layers will make up less than half of the soil sample. There will be a similar amount of silt and clay in the sample or there may be slightly more silt than clay.
 - **Clay:** If the soil sample is clay, the largest layer in your soil sample is clay. The layer of clay will make up more than half of the soil sample and there will be similar parts sand, gravel, and silt.
- 15** Label your soil sample diagrams on the "Soil Shenanigans Worksheet" with their soil type.

Engineering and Science Connections:

[Soil](#) is a mixture of organic material, rocks, minerals, and organisms. Soil is essential for life. The purpose of soil is to act as a material for plants to grow in, store and purify water, and is a habitat for organisms such as plants, animals, bacteria, and fungi. Soil is, therefore, an important part of an [ecosystem](#) which is a community of living things which interact with each other.

The layer of soil on Earth is very deep and has different layers. The first layer of soil is called [topsoil](#) (sometimes separated into organic and surface layers). The second layer of soil is called subsoil which usually contains mostly [clay](#) and retains a lot of water, because of this, some plants grow their roots all the way down to this layer. The next layer is called substratum which contains larger particles like [gravel](#) or rocks. Finally, you will reach bedrock which is solid rock.

Engineering and Science Connections:

Topsoil is the darkest layer of soil because it contains the most organic material, it is also where plants grow and where we can find animals and insects living. Examples of animals and insects that live in topsoil include gophers, moles, beetles, ants, and worms.

Topsoil is made up of the materials we identified in our experiment today, **gravel, sand, silt, clay, and humus**. The heavier materials sank to the bottom of your container and the lighter materials were layered on top, with the very light organic material floating on the top of the water.

Gravel is made up of small stones which were weathered away from larger rock. Gravel helps water move through the soil.

Sand is a granular material formed by the erosion of other rocks until it is very fine. Sand is usually yellow or brown in colour and also helps water move through the soil. Plants that do not need a lot of water (like desert plants) grow well in sandy soil. Soil that is classified as sand is 80-100% sand, this type of drains water very well but does not retain it, which is why plants that do not need much water grow well in sandy soil.

Silt is a very fine sand (the grains of silt are even smaller than grains of sand) that becomes slippery when wet. Silt helps retain water in soil, so plants that need a lot of water to grow prefer soil with high percentages of silt.

Clay is a very fine silt (the grains of clay are even smaller than the grains of silt) that is malleable when wet. Clay helps plants retain water at their roots, so plants that require a lot of water grow well in soil with high clay percentages. Soil that is classified as clay is 50-100% clay, this type of soil retains water but does not drain it well, so the roots of some plants may rot due to too much water.

Humus is the organic matter that can be found in soil. Gravel, sand, silt, and clay are **inorganic**, meaning they are made of non-living things. **Organic** materials like humus are made of things that are living or were once living, such as the remains of plants and animals. Humus is important in soil because it contains the nutrients that plants need to grow.

Engineering and Science Connections:

Loam is a very **fertile** type of soil, meaning that many plants grow well in this type of soil. Loam is classified by having roughly equal percentages of sand, silt, and clay which means it holds water and drains it well. Loam can also contain a lot of organic material (humus) which contributes to how fertile it is.

Minerals are inorganic substances that occur in nature and are what make up rocks. Nutrients that plants need can be found in the organic material (humus) found in soil. Plants not only need nutrients to grow, but they also need minerals. Minerals are found in the inorganic substances in soil such as sand, silt, and clay. You may have noticed that the water in your jar was a bit murky even after the soil settled, this is due to the minerals in your soil sample.

Extensions:

Calculating our soil type! If you would like to accurately determine what type of soil you have in your backyard, we can calculate the percentage of sand, silt, and clay in your soil rather than just eyeballing it.

- Measure the total height of your soil sample with your ruler.
- Measure the height of each individual layer of your soil sample (measure the height of the sand and gravel together, then measure the silt layer, and the clay layer).
- To determine the percentage of each material in the soil sample, divide the height of the layer by the total height of the soil sample and multiply by one hundred ex. 3 cm divided by 20 cm is 0.15, 0.15 multiplied by 100 is 15, therefore, that material is 15% of your sample
- Repeat these calculations for each layer to determine the percentage of each material, look at the "Soil Type Jar Test" diagram to determine what type of soil you have based on the percentages.

What grows best in your soil type? If you enjoy gardening, determining your soil type can help you figure out what plants or vegetables grow best in that type of soil. After figuring out which plants grow best in your soil type, map out a plan for your garden this summer (what plants you will plant where).

- **Sand:** carrots, lettuce, tomatoes, radishes, asparagus, watermelon, cucumber, thyme, rosemary, lavender, rose of sharon, eucalyptus.
- **Loam:** peppers, onions, okra, eggplant, spinach, strawberries, blackberries, blueberries, basil, sage, lemon balm, roses.
- **Clay:** echinacea, black-eyed susan, daylily, butterfly weed.

Extensions:

If you find that your soil type is not ideal for the type of plants you want to grow, you can change the soil type by mixing in other types of soil, manure, or fertilizer. If your soil is sandy and you want to make it more like loam, it can be helpful to mix in dark soil from a gardening store, or manure. If one part of your garden has loam while another has sandy soil, you can also mix in the loam from your own garden to improve the sandy soil. If the soil has a high clay content, mixing in sandy soil or gravel can help water travel more efficiently through the soil.

Share your creations!

Don't forget to share your experiments and creations with us! We would love to see what you've made. You can Email us at: esqinfo@uwaterloo.ca or send us a message/tag us on our social media!

Facebook: @uwengoutreach

Twitter: @UWEngOutreach

Instagram: @uwengoutreach

Thanks for exploring, discovering, and learning with us!

3, 2, 1 Done!

3 - Write or draw 3 things you learned from this activity

2 - Write or draw 2 things you found super interesting or cool and want to learn more about

1 - Do you have any questions about the activity? Did something make you wonder...what if? how? or why?

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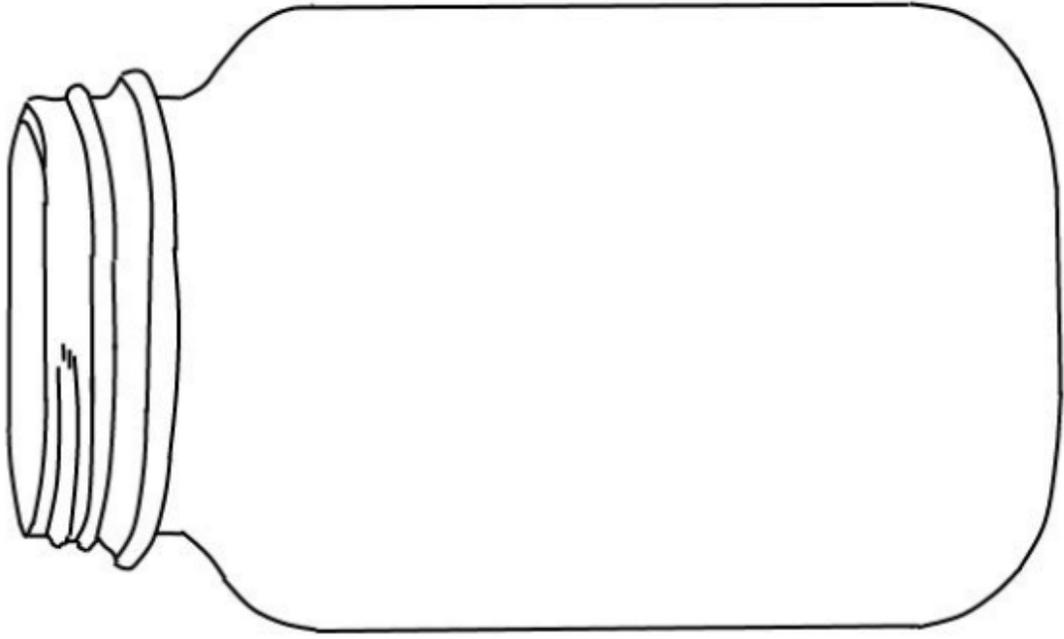
1. Draw what you think soil is made of.

2. Draw what grows in soil (plants).

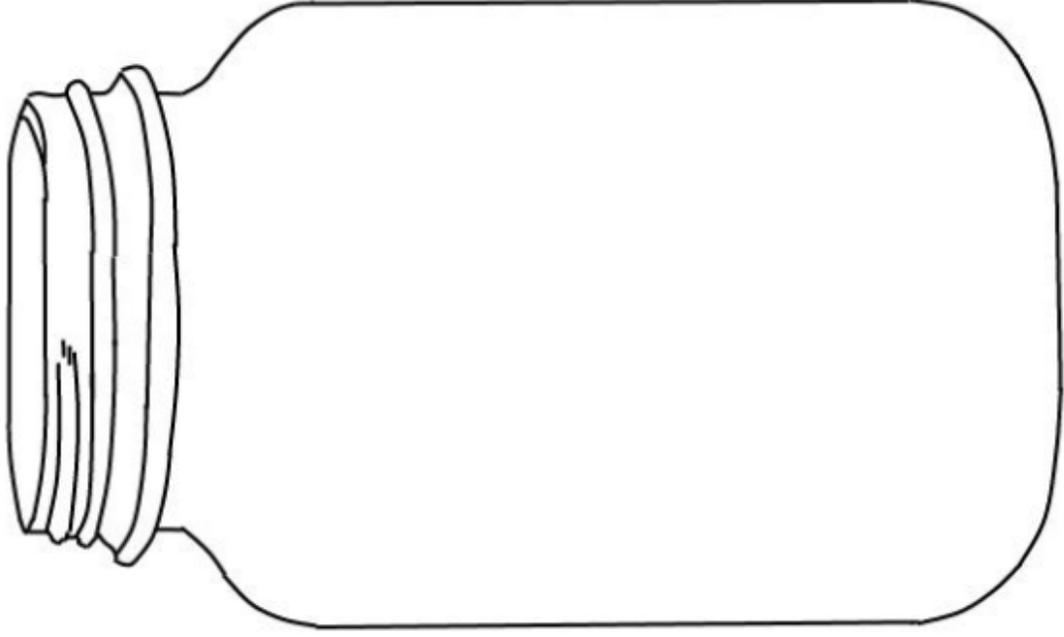
3. Draw what you think lives in soil (animals, insects).

4. Draw your backyard ecosystem.

Soil Shenanigans



Sample 1



Sample 2