

EXPLORING SOIL ECOLOGY

Activity: **The Jam-Jar Experiment**

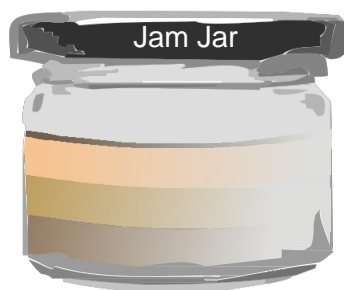
From: <http://www.soil-net.com>



Take a clean, straight-sided jam jar and fill it about a third of the way up with the soil with which you are experimenting. Also have ready another jar of clean water and a stirring stick.



Now add the clear water until the jar of soil is almost full. First just watch the mixture for a while - do you see air bubbles rising? How much air is there in soil? Now stir up the mixture and leave the jar for 2 or 3 hours for the contents to settle out and the water starts to clear.



When the water settles different layers should appear. Sand particles are the biggest and weigh more than silt - so the bottom layer will be the sand part of the soil. Any pebbles will also be at the bottom. Next up is the silt layer. Silt particles are smaller than sand and weigh less so they appear over the sand. If you were able to separate out any clay particles they are the smallest and will be on top. Organic plant materials will be on top.

Time started: _____ Time stopped: _____

Describe what happened:



Teacher Notes

Soil is made up of a mixture of sand, silt, clay particles and rotted plant (organic) material. Different soil types have differing percentages of each. The jam-jar soil experiment helps an understanding of what the proportions of these are for the soil with which you work. You should try this experiment with soils from different areas and compare the results to see how soils vary. Try it also with the soil you get in bags from garden centers for growing seeds and see how that varies from your garden soil.

This activity helps students to begin to understand the mineral constituents of soil, sand, silt, clay as well as organic matter. Adding water to soil in a jar and observing settlement after shaking teaches how different soils possess differing proportions of these 'ingredients'.

Prepare a series of clear-sided jam jars for each group of students. Try and provide a selection of differing soil types - earth from the school grounds and nearby areas for example. Try 'making' soil by mixing potting compost with playground sand to see it separated out again. It is good, if possible, to try samples of other soil types from the area – soils can vary enormously within a short distance. Label jars with the sources.

Once the jars are settled, encourage the students to use a measuring tape to measure the height of the total soil and water (say 10cm), and then the height of each layer (say the silt is 1cm). Then they can work out the percentage of each part of the soil. For silt for example the sum is 10cm divided by 1cm all multiplied by 100 to get the percentage (so $10/1 \times 100 = 10\%$). Ask the students to finish off by drawing a pie chart of the different proportions, and as noted above compare the results with other soils.

When the water has settled out, you should be able to see different layers appearing. Sand particles are the biggest and weigh more than silt - so the bottom layer will be the sand part of the soil. Any pebbles will also be at the bottom. Next up is the silt layer. Silt particles are smaller than sand and weigh less so they appear over the sand. If you were able to separate out any clay particles they are the smallest and will be on top.

If your soil is really thick clay then you may just be left with clay lumps at the bottom, next up you will have the water. This is likely to be discolored. The coloring is likely to be rotted plant (organic) material that is soluble (it's dissolved). Finally, at the top will be floating organic material which isn't fully rotted.

Good class discussion points include: discuss (record) observations, e.g. Air bubbles rising, before stirring, then what happens after stirring.

Students enjoy making their own mixtures of soil up from sand, silt and clay, and other ingredients, then separating them again. Suggest they try at home also as it does take a long time for the soil to settle.

Lesson glossary: structure, texture, mixture, sand, silt, clay, organic, air

Additional Notes

- ☞ Soil is made up of a mixture of Sand, Silt, Clay and rotted plant (Organic) material. Different soil types have differing percentages of each.
- ☞ The Jam Jar experiment helps you to understand what the proportions of these are for the soil you work with.
- ☞ You should try this experiment with soils from different areas and compare the results to see how soils vary.
- ☞ Try it also with the soil you get in bags from garden centers for growing seeds and see how that varies from your garden soil.

Step One

Take a clean, straight-sided jam jar and fill it about a third of the way up with the soil you are experimenting with. Also have ready another jar of clean water and a stirring stick.

[Start off with the jar a third filled with soil.]

Step Two

Now add the clear water until the jar of soil is almost full. Look for air bubbles before stirring - how much air is in soil? [Add water and stir thoroughly.]

Step Three

Now use a stirring stick to stir up the mixture really thoroughly.

Step Four

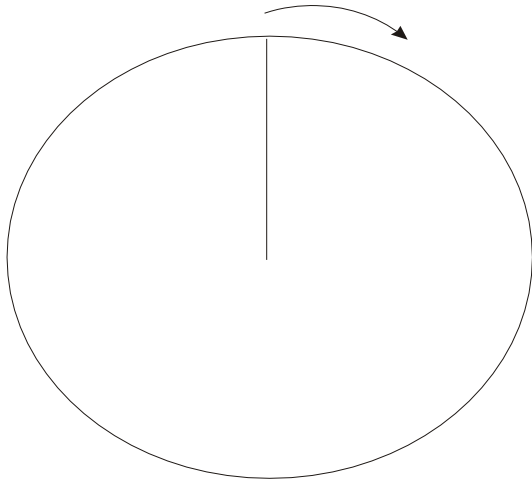
Now leave the jar for 1-2 hours so the contents settle out and the water can start to clear. [Now that the water has settled out, you should be able to see different layers appearing.]

- ☞ Sand particles are the biggest and weigh more than Silt so the bottom layers will be the Sand part of the soil. Any Pebbles will also be at the bottom.
- ☞ Next up is the Silt layer. Silt particles are smaller than Sand and weigh less so they appear over the Sand.
- ☞ If you were able to separate out any Clay particles they are the smallest and will be on the top. If your soil is really thick clay then you may just be left with sticky lumps of Clay at the bottom of the jar.
- ☞ Next up you will have the water. This is likely to be discolored. The coloring is likely to be rotted plant (Organic) material that is soluble (it's dissolved).
- ☞ Finally, at the top will be floating Organic material which isn't fully rotted.

Pie Chart Handout (soil-net.com)

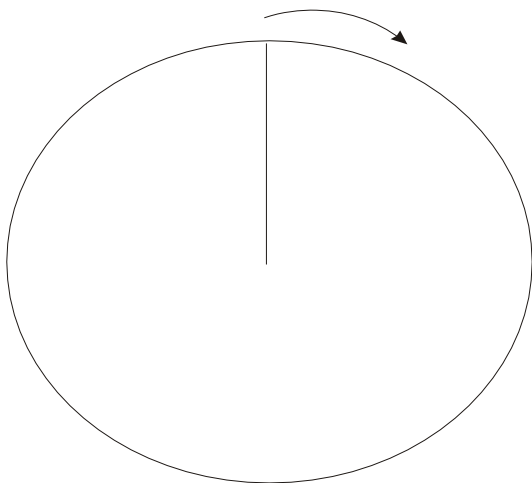
Percentages of the soil parts

What you can do now is use a measuring tape to measure the height of the total soil and water (say 10cm), and then the height of each layer (say the silt is 1cm). Then you can work out the percentage of each part of the soil. For Silt, for example, the sum is 10cm divided by 1cm, all multiplied by 100 to get the percentage (so $10/1 \times 100 = 10\%$). Finish off by drawing a pie chart below of the different proportions, and as noted above compare the results with other soils.



<u>Pie chart color key:</u>	
Sand	<input type="text"/>
Silt	<input type="text"/>
Clay	<input type="text"/>
Pebbles	<input type="text"/>
Water	<input type="text"/>
Floating organic material	<input type="text"/>

Soil Sample: _____



<u>Pie chart color key:</u>	
Sand	<input type="text"/>
Silt	<input type="text"/>
Clay	<input type="text"/>
Pebbles	<input type="text"/>
Water	<input type="text"/>
Floating organic material	<input type="text"/>

Soil Sample: _____