# The Composition of Soil

## Aims

To investigate the composition of soil.

## Apparatus

goggles
bench mat
100cm$^3$ measuring cylinder
evaporating dish
gas jar and lid
spatula

access to:
newspaper
digital balance
soil sample
window sill

**For the second lesson**:
Bunsen burner
pipe-clay triangle
tin lid
tripod

## Methods

1. Spread newspaper over the bench. Put the bench mat on the newspaper, and cover it with a piece of newspaper. Collect your soil sample, and put it on the bench mat.
   Carefully divide the soil into three portions using the spatula.

**Proportion of air in soil**

2. Fill the measuring cylinder with **exactly** 50cm$^3$ of water, and add a small portion of soil.
   Immediately note the new volume, and leave it until the next lesson.

3. In the next lesson, note the final volume of the mixture.

**Proportion of water in soil**

4. Record the mass of the evaporating dish.
   Add a portion of soil and record the total mass of the dish and the soil. Label the dish with your initials, and leave it until the next lesson on the window sill to allow the soil to dry out.

5. In the next lesson, record the mass of the evaporating dish and the dried soil.

**Mineral grain sizes in soil**

6. Fill the gas jar approximately two-thirds full with water, and add the final portion of soil.
   Hold the lid on top, and shake to mix the soil and water. Label the gas jar with your initials, and leave it on the window sill until the next lesson to allow the mixture to settle.

**Proportion of humus in soil** (to be done in the second lesson)

7. Record the mass of a tin lid. Complete step 5 (above).
   Transfer the dried soil from the evaporating dish to the tin lid, and record the total mass.

8. Heat the soil strongly for 3 minutes, allow to cool, then record the total mass again.
   Repeat until the mass is constant.

Results

**Proportion of air in soil**

Calculate the starting volume of soil.

As the air spaces between the mineral grains in the soil fill with water, the total volume of the mixture in the measuring cylinder goes down.
Calculate the volume of air in the soil, and then the percentage of air in the soil sample.

**Proportion of water in soil**

With gentle warming, the water in the soil evaporates. Use your results to calculate the mass of water in the soil, and then the percentage of water in the soil.

**Proportion of humus in soil**

With strong heating, the humus (the remains of dead animals and plants) in the soil is burnt away. Use your results to calculate the mass of humus present in the soil sample. Use this mass, and the original mass of the soil, to calculate the percentage of humus in your original soil sample.

**Mineral grain sizes in soil**

Use your calculations of air, water and humus in the soil to calculate the percentage of minerals in the original soil sample.

Look at the settled contents of the gas jar and make a neat drawing of your results.

Compare your results with the diagram below and estimate the proportions of each grain size in your soil sample.

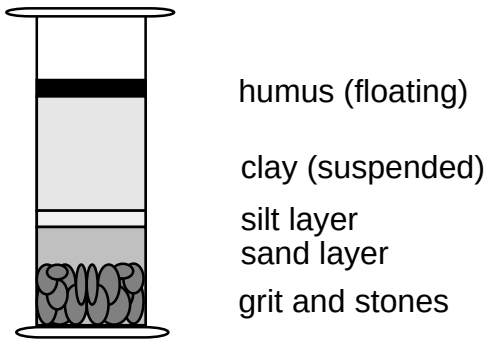


Diagram to show a typical set of results

Analysis

1. Compare the results for your soil sample with others in the class.
   Do the proportions of each component (air, water, humus and minerals) vary?

2. The clay does not settle easily and remains suspended in the water.
   How could you work out the proportion of clay in your sample?

# The Composition of Soil - Technician's Notes

**This is a two-lesson practical.**

Lesson 1

Per group of pupils

1 x 100cm$^3$ measuring cylinder*
1 x evaporating dish*
1 x gas jar and lid*
1 x spatula

access to:
newspaper
digital balance
soil sample

* means needed until lesson 2

Lesson 2

Per group of pupils

1 x pipe-clay triangle
1 x tin lid
1 x tripod

access to:
newspaper
digital balance

large bucket for waste soil