

Lesson 1 Kinds of Soil

Objectives

By the end of this lesson, students will be able to:

- Describe the main components of soil.
- Separate soil using a water shaker.
- Understand that there are different kinds of soil.

Overview

The nature and properties of soil are critical to our survival. All food from terrestrial sources depends on the quality of soil. Crops depend directly on the soil, and terrestrial animals depend on the soil through their food, all of which ultimately derives from plant matter. There are different types of soil, each containing different amounts of materials such as sand, stones, clay, plant material, bones and other minerals. The main message in this lesson is for students to appreciate

the complexity of the soil beneath their feet and to take an interest in soil.



Activity 1

What is in the soil?

Test 1 Separate the soil into different parts on your table.



Does soil have a smell?
Can soil make a sound?



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Stimulus Activity

The stimulus cartoon shows Mary leaving behind muddy footprints. It directs attention towards the ground. What exactly is this mud? Where does it come from? It is soil and water. You could prepare a mixture of water and some soil on a flat surface such as a dinner tray, and invite a student to step into it and then leave a footprint on a sheet of paper. Ask students questions such as: Why do we often have mats by the doorways in houses? (They can help to clean shoes of any dirt and mud.) Why can a footprint be helpful to the police? (A footprint at a crime scene can be used as evidence.)

Lesson 1

Activity 1

For this activity, you will need to collect a large quantity of general soil. (Take a bucket out to the school grounds. If there is time, you could invite students to join you in collecting their soil samples.) Use paper to protect tables or desks. Give each group of students a handful of this soil. Their first test is to spread the soil out, make close observations and collect what they find in the soil. Stones can be placed in a small pile, vegetation in another pile, etc. There may be “foreign” items such as litter, old coins or bottle tops. These materials form another pile. Soil can have a smell if you are close to it — we might describe it as an “earthy” smell or the smell of leaves. Soil itself will not make a sound, but when we walk on soil we can hear our footsteps as we crunch the stones, twigs and leaves.

The second test is to use water in a jar or a bottle. You can provide a third of the volume as soil and two thirds as water so that there will be a visible separation. Each group should shake or stir their soil sample in their container with water. Wait and let the mixture settle. Students will find that stones tend to fall towards the bottom, sandy soil sits above the stones, and plant material floats to the surface. Not all samples will show this clearly. Occasionally stones will settle above smaller particles, so allow students to inspect more than one bottle. This is a science separation technique and can be used to separate mixtures of materials.

Unit 4
Lesson 1

Test 2 Use water to separate the soil into different parts.

1 Put the soil into a bottle of (一瓶) water.

2 Add the lid (盖子) and shake (摇) it.

3

dirty water

stones

plant material

sand

plant material

dirty water

sand

stones

Observe the bottle and the soil. Copy the labels.

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Activity 2

Collect (收集) two kinds of soil. How are they different? How are they the same?

Test 1 Separate the soil into different parts on your table. What can you see? Draw the results.



Test 2 Use water to separate the soil into different parts. What can you see? Draw the results.



Which soil contains (包含) the most (最多的) plant material? Which soil contains the largest (最大的) stones?

Activity 2

This is an extension from Activity 1. The same experimental methods apply to this activity. The task is exploratory and designed to show that different soil types are composed of similar components, but in different ratios. Areas near rivers often have clay soil. Areas near coasts have sandy soil. Areas in woodland have soil rich in vegetation. Areas near mountains have stony soil.

It might be difficult to find a second sample of soil, but a visit to a garden shop should enable you to find some loamy soil. Alternatively you can find some sand, again from a store, and make your own sandy soil mix. If these are not available, then try to find soil samples from two different places near the school. There will be some differences.

Soil differs according to where it is located. To help students with comparing, you might ask questions such as: What colour is the soil? Is it sandy? Is it stony or rocky? Is it loamy? (Loamy soil is good for growing plants.) Which contains more plant and animal matter such as leaves, worms and insects? Encourage students to describe and compare different kinds of soil. Students might be encouraged to bring samples, if convenient.

Lesson 1

Activity 3

This lesson closes with a walking song. The tune is “Three Blind Mice”. You could ask students to suggest some more lines for the song. It would be good to give students the words of this song so that the class could go outside and walk around the school grounds and sing the song. As an extension, you might ask questions such as: If the soil is under our feet, then what is under the soil? (Usually layers of different rocks, perhaps coal or oil, perhaps tunnels, perhaps drains, perhaps bones of dead animals, etc.) This question leads to the “Find Out More!” task below.

Now I Know ...

我在土壤中可以看到石头、沙子和植物。
土壤有不同的种类。

How I Know ...

Learning in this lesson is through observation and practical testing.

Unit 4 Lesson 1

Activity 3

Let's go for a walk. What is under our feet? Sing the song.

Under Our Feet

Walk on the soil, under our feet.
Walk on the soil, under our feet.
With sand and stones and
pieces of wood (木头).
With grass and leaves and
slippery (湿滑的) worms (虫子).
That's the soil, under our feet.
Walk on the soil.

Now I Know ...

I can see stones, sand and plant material in the soil.
There are different kinds of soil.

How I Know ...

- ☒ I separated the soil into different parts.
- ☒ I compared different kinds of soil.
- ☐ I watched a video (录像).



Find Out More!

What is under the soil?



bone



oil



rocks



water



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Find Out More!

The soil we walk upon is called “topsoil”. It is the very top layer, where plants generally concentrate their roots and obtain most of their nutrients. Topsoil consists of sand, stone and organic matter such as plant and animal material. It is a thin layer, usually the top 5 cm to 20 cm. Below the topsoil is another form of soil called “subsoil”. Subsoil is similar to topsoil, but it lacks the organic matter. Below the subsoil are layers of clay or rock. All these materials form part of the earth’s crust. The earth’s crust averages 17 km deep, and is only 70 km deep at its maximum. The radius of the earth itself is about 6000 km, so the crust covers the earth’s surface like the thin skin on an apple.

Students might be aware that digging beneath the soil can reveal many

useful or interesting things. The four photographs show some of these. Water found beneath the ground, called “groundwater”, can be used to irrigate crops. It is an important resource, and must be carefully managed. Some parts of the world, notably California and Texas in the United States, rely heavily on groundwater for agriculture. Oil, of course, is a vital source of energy for industrial societies. Bones, by becoming fossilized, can help scientists to reconstruct the past. Rocks can contain metals and other substances that people use, such as coal or gems. Digging up rocks that contain useful or valuable materials is the basis of mining, one of the world’s oldest and most important industries.

第一课 各种各样的土壤

教学目标

通过本课的学习，学生将能够：

- 描述土壤的主要成分。
- 用水分离土壤。
- 理解土壤有不同种类。

概述

土壤的种类和特性对我们的生存至关重要。所有来源于陆地的食物均依赖于土壤的质量。农作物的生长直接依赖于土壤，陆生动物也依赖于土壤，因为这些动物的食物最终都来源于植物。不同种类的土壤含有的物质（如沙子、石头、黏土、植物、骨骼和其他矿物质）的量不同。本课的主旨是让学生理解他们脚下土壤的复杂性，并培养他们对土壤的兴趣。

导入活动

在导入活动的卡通图片中，玛丽身后留下了泥泞的脚印，这将学生的注意力引向地面。泥究竟是什么？它从何而来？泥就是土壤和水的混合物。教师可以在一个平面（如餐盘）上准备一些水和土壤的混合物，请一名学生踩进去，然后在一张纸上留下脚印。向学生提问：为什么我们经常房子门口铺上垫子？（用来清除鞋上的灰尘和泥土。）为什么脚印可以帮助警察破案？（犯罪现场的脚印可用作证据。）

活动一

在本活动中，教师需要收集大量的普通土壤。（带桶到学校操场收集土壤。如果有时间，教师可以请学生一起收集土壤样本。）用纸张保护桌子或课桌。分给每组学生一把土壤。他们的第一项实验是铺开土壤，仔细观察，将他们在土壤中发现的东西收集起来。可以将石头放成一堆，植物放成另一堆等等。可能还会有一些“外来”物品，如垃圾、旧钱币或瓶盖，这些物品可以放成一堆。凑近土壤就能闻到它的气味，我们可以将之形容为“泥土的”气味或树叶的气味。土壤本身不能发出声音，但是当我们在土壤上行走踩到石头、树枝和树叶时，就能够听到脚步声。

第二项实验要使用盛水的罐子或瓶子。教师可在瓶中加入三分之一的泥土和三分之二的水，以便形成明显的分离现象。每个小组都要摇晃或搅拌盛有土样和水的容器。等待混合物沉降。学生将会发现石头往往沉入底部，砂土在石头上方，植物会漂浮在水面上。并非所有的样本都能清楚地展现这一结果。有时候石头会落于较小颗粒之上，因此要让学生多观察几个瓶子。用水分离物质是一个科学的分离方法，可用于分离多种物质的混合物。

活动二

本活动是活动一的拓展，可以用同样的方法进行实验。这是一个探究式活动，其目的是表明不同种类的土壤具有相似的成分，但这些成分的比例不同。河流附近地区的土壤通常是黏土。海岸附近地区的土壤是砂土。林区的土壤含有丰富的植物。山脉附近地区的土壤含有丰富的石头。

找到第二份土壤样本可能比较困难，但在园艺店应该能找到一些壤土。或者，教师可以从商店找一些沙子，自制砂土。如果这些还难以实现，尝试从学校附近两个不同的地方找土壤样本，两个样本之间应该会有一些差异。

取样的地点不同，土壤的特点也会不同。为了帮助学生进行比较，教师可以提问：土壤是什么颜色的？含沙子多吗？含有小石子还是大岩石？含壤土吗？（壤土适合种植植物。）哪些土壤含有更多的植物和动物，如树叶、蚯蚓、昆虫等？鼓励学生描述和比较不同种类的土壤。如果方便的话，也可以鼓励学生自己带一些土壤样本。

活动三

本课以一首边走边唱的歌曲结束。曲调是“Three Blind Mice”。教师可以让学生再添上几句歌词。把歌词给学生后，可以让他们走出教室，在学校操场上边走边唱。作为拓展，教师可以提问，如：如果我们的脚下是土壤，那土壤下面又是什么？（通常是许多不同的岩石层，可能有煤、石油、隧道、下水道，可能还会有动物骸骨等。）这个问题引出下面的“发现更多！”中的任务。

现在我知道……

我在土壤中可以看到石头、沙子和植物。

土壤有不同的种类。

我是如何知道的……

本课的学习是通过观察和动手实验完成的。

- ☒ 我把土壤分离成不同的组分。
- ☒ 我比较了不同种类的土壤。
- ☐ 我观看了一段录像。

发现更多!

我们踩在脚下的土壤称为“表层土”。表层土在土壤的最表层，植物的根系一般存在于表层土中，并从中吸取所需的大部分养分。表层土由沙子、石头和动植物一类的有机质组成。表层土很薄，一般只有 **5 cm** 到 **20 cm** 的厚度。它下面为“底层土”。底层土与表层土非常相似，但是含有的有机质较少。底层土下面是黏土层或岩石层。所有这些构成了地壳的一部分。地壳的平均厚度为 **17 km**，最厚的地方也只有 **70 km**。而地球半径约为 **6000 km**，因此地壳覆盖在地球表面就像是薄薄的苹果皮覆盖着果肉一样。

学生可能会意识到向下挖掘土壤可以发现很多有用或有趣的事物。比如图中展示的四幅图片。地面下方的水称为“地下水”，可用来灌溉农作物。地下水是一种重要的资源，因此需要严格管理。对世界上的一些地方尤其像美国的加利福尼亚州和德克萨斯州来说，它们的农业十分依赖地下水资源。毋庸置疑，石油是工业社会中必不可少的能源。变成化石的骨头可以帮助科学家重现历史。岩石含有可供人利用的金属和其他物质，比如煤和宝石。挖掘含有有用或者贵重材料的岩石是采矿业的基础，而采矿业也是世界上最古老和最重要的工业之一。

第二课 岩石

教学目标

通过本课的学习，学生将能够：

- 对石头和岩石分类。
- 描述一些石头和岩石的共同特征。
- 理解石头和岩石的多种用途。