SOIL

14

Like air and water, soil too is such an integral part of our lives that we almost take it for granted. We just go on using it without paying much attention to it.

Make a list of the uses of soil. (1)

If the lists of all students in the class are combined, you would see that soil has quite a number of uses.

But is every type of soil suitable for all types of jobs? For example, can every type of soil be used for making pottery? In the same way, you must have heard that for growing certain kinds of crops or plants and trees, a special kind of soil is necessary.

Give some more examples like these to show that different uses require different types of soils. (2)

The suitability of a soil is dependent upon its properties. In this chapter, we shall study soils in order to understand their properties and to understand the differences between various kinds of soils.

Field trip

For our study, we will need to collect soils from different places. Soils will have to be brought from several sites. A list of some places is given below :

farm	banks of a pond
open ground	river bank
garden	forest
roadside	fallow land

You can modify this list to suit your convenience. However, it is necessary to bring soil from several different places.

Collect soil samples on the way to school. In order to do this in a systematic manner. It would be better to decide locations from where

each team would bring the soil sample. This planning should be done one day in advance with the teacher's help. In the morning, leave home a little earlier than usual and go to the designated place and dig up about 250 grams of soil and bring it to school. You will have to carry the collected soil in a plastic bag. Do not forget to write the name of the place from where the sample has been collected on a slip and put it with the soil sample.

Experiment-1 has to be carried out at the site where the soil is collected. So, you must carry the necessary equipment along.

During the course of this study, you should all make at least one field trip together.

During this trip, go to a place where a deep hole has been dug in the earth for constructing a road, bridge, well, or tank or foundation of a building. In these places, you will be able to see different layers of earth several feet deep. You will see different textures of soil in different layers.

Make a picture of such a cross section of earth, in which each layer's depth and size, shape, colour of particles etc. are noted. (3)

There may be a place somewhere nearby where the flow of a canal or river has eroded the soil.

Observe such a section of soil and make a picture like the one you made above. (4)

To the teacher

In this lesson, the field trips and experiments have been organised in a slightly different manner. Each team will bring back soil from different places. You will be expected to decide the team and the site one day in advance. For the collective field trip, choose a site where appropriate observations could be made well ahead of time. Each team should collect soil from one or two locations and make a detailed study of it. Remind the students that Experiment-1 has to be done at the time of collecting the soil sample. For this, they should be given a suitable pipe and a beaker marked at 200 ml.

It will be necessary to begin experiment-6 immediately after bringing back the soil sample. Therefore, tell the students to measure and put 100 grams of soil to dry as soon as they arrive at school. At the end, the differences in the properties of soils should be made clear through group discussion using a collective table.

Before proceeding further, copy the following table in your note book. Note all your observations in this table. (5)

Table-1

No.	Experiment No.	Properties	Observation
1.	Experi-1	Percolation rate(ml/min.)	
2.		Shape of particles	
3.		Colour	
4.	Experi-2	Feeling when you touch it	
5.		Colour	
6.		When you see it through lens	
7.		Living things	
8.		Animal remains	
9.	Experi-4	Soil Types	
10.	Experi-6	Percent moisture content (Gram)	
11.	Experi-7	Ratained Water (ml)	
12.	Experi-8	Acidic/Basic	

Team No. _____ Soil collection site_____

Experiment 1

Percolation rate of water in soil

This experiment has to be done at the time of collecting the soil sample. For this you will need a hollow cylinder or pipe. The main thing is to make sure that each team uses the same kind of pipe, that is, the pipes should all have the same diameter. Some suggestions for obtaining or constructing such a pipe are given below :

1. If possible, get a small tin can (like a pan masala tin) and have the bottom cut off.
2. If available, iron or PVC pipe (approx. diameter 5 cms) cut in 20 cm lengths can be used.
3. Another possibility is to cut off the bottom of an inexpensive plastic glass and ues it as a pipe.

At the place where you collect soil, place the pipe about 2 cms deep in the ground and pour 200 ml water in the pipe. Note the time. When all the water has percolated leaving the pipe empty, note the time again. Be careful not to let the water spill over or run down the sides of the pipe while pouring. If the pipe can not hold 200 ml of water, pour as much as it can hold. Pour the rest as the pipe empties. Calculate the rate of percolation on the basis of the time it

takes for 200 ml water to percolate into the soil, using the following formula :

$$\text{percolation rate (ml/min)} = \frac{\text{amount of water (200 ml)}}{\text{percolation time (min)}}$$

For example, suppose that at a certain place, it takes 20 minutes to percolate 200 ml water, so

$$\text{rate of percolation} = \frac{200 \text{ ml}}{20 \text{ min}} = 10 \text{ ml/min.}$$

Calculate the rate of percolation and enter it in Table 1. (6)

Experiment-2

Examining the soils at school

Have you ever thought about the various properties of soil which can be examined? Let us make a list of these properties.

1. What is the appearance of the soil? Fine, gravelly, or powdery?
2. What is its colour? Black, brown or some other?
3. How does it feel? Firm, soft, crumbly, slimy, or sticky?
4. How does it smell? Is it fragrant, does it stink, or is there no smell at all?
5. Looking through a magnifying glass, do you see anything new in it?
6. Can you see any animals or plants in the soil sample?
7. Is there any decaying animal or plant matter in the sample?

Examine your soil sample for these properties and record your findings in the table. (7)

Did you find any living beings in the soil? If yes, what could be their importance in the soil? (8)

What could be the importance of decaying animal and plant matter in soil? (9)

Are all particles found in a soil identical? (10)

If you have trouble answering the last question, try again after doing Experiment-3.

Experiment-3

Take a little soil. Break the clumps with your hand to powder it. Now take a glass or boiling tube three-quarters filled with water and add half a handful of soil to it. Stir it well with a stick to dissolve the soil. Now let it stand undisturbed for half an hour. Afterwards, observe it and answer the following questions.

Do you see layers of different sized particles in the glass/ boiling tube? (11)

Figure-1

Draw a diagram of these layers marking their approximate heights. (12)

Compare the layers of your soil with other teams. Write down in your own words the differences and similarities. (13)

Now go back and try answering question (10).

During the field trip, you had drawn diagrams of cross sections of earth. Compare those diagrams with the diagram above. (14)

In the above experiment, you saw that soil is composed of particles of different sizes. Soils differ in the proportion of different types of particles. Soils are categorised on the basis of these proportions. If the soil contains a large proportion of big particles, then it is called sandy soil. If the proportion of fine particles is more, then it is called clayey soil. If the amount of fine and large particles is about the same, then it is called loam.

To figure out which soil is which type, let us do an easy experiment.

Experiment-4

Soil Types

Take about 20-25 grams of the soil which you had collected. Remove any pebbles, rocks, grass, etc from it. Now, add water drop by drop and knead the soil. Add just enough water so that a ball can be made from it, but at the same time it should not be sticky. Make a ball about 2.5 cm in diameter with this soil. On a flat surface roll this soil into a 15 cm long cylinder. Make a ring form this cylinder, provided you can bend it without breaking.

The extent to which soil can be shaped indicates its type.

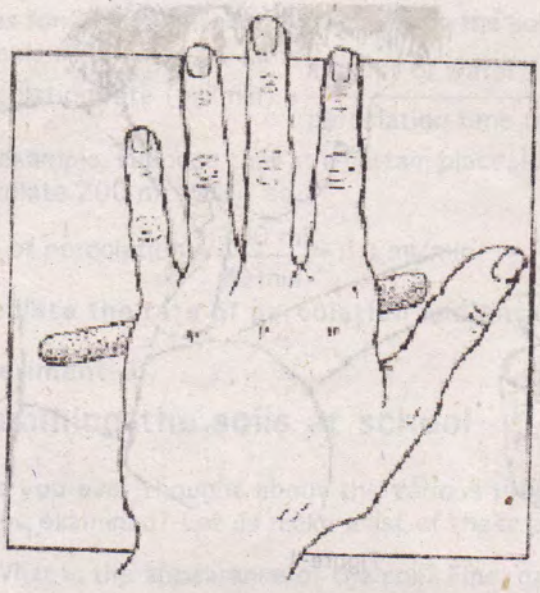
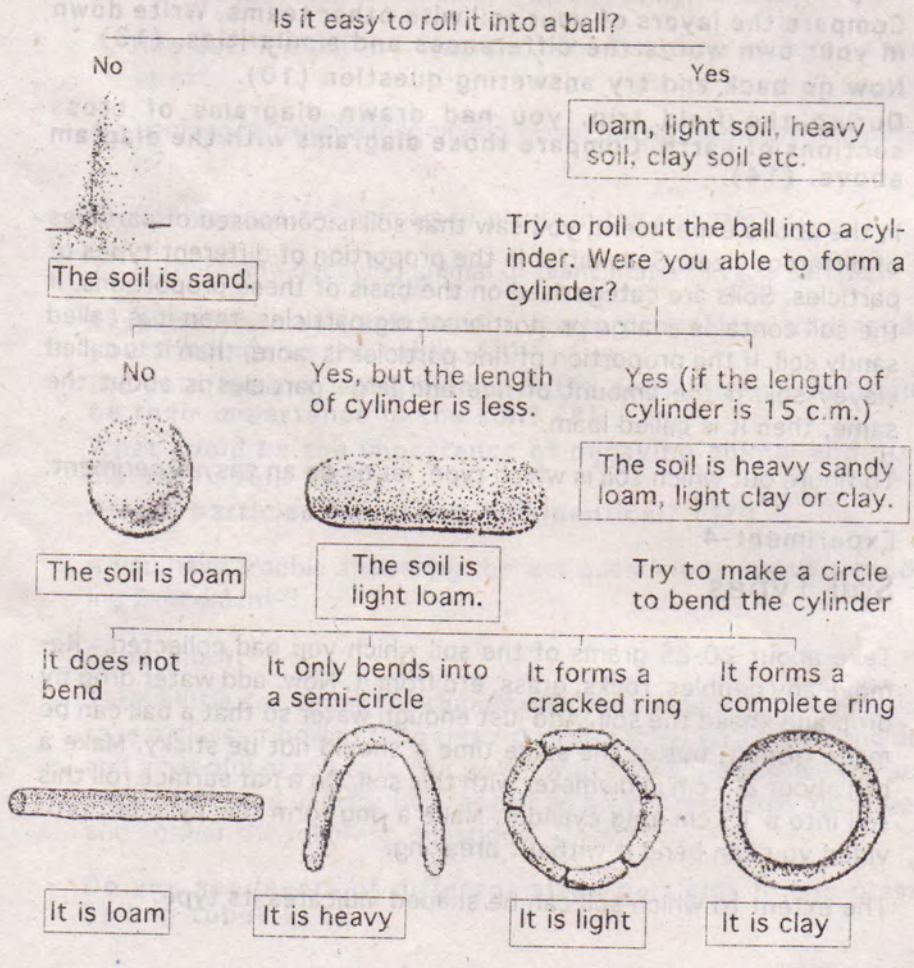


Figure-2

Determine the soil type on basis of the following flow chart.



Write down your conclusions in the table. (15)

Which types of soil would be best to make pots, toys, and statues? (16)

Experiment-5

Moisture in soil

Take a boiling tube. Put two spoonfuls of a soil sample in it. Heat it on a flame.

What happens upon heating? (17)

Do you see water anywhere? If yes, how did you recognise it? (18)

After heating the soil, take it out of the boiling tube.

Compare it with a soil which has not been heated.

Do you see any difference between the two? If yes, what is the difference? Explain in your own words. (19)

Do not attempt experiments 6 and 7 after it has just rained or after irrigation. In which case the observations may be inaccurate. Before you do the experiments, wait for at least 48 hours after rains or irrigation.

Experiment-6

Moisture content of soil

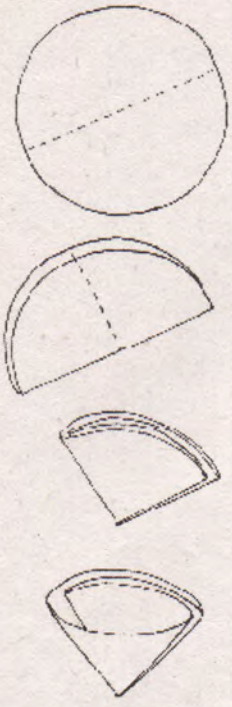
There are several methods to find the moisture content of any soil. One method is given here. Weigh 100 grams of soil. Place it on a newspaper in the sun and allow it to dry for two hours. While drying, the sky must be clear and sunlight strong. This is best done in the afternoon. While it is drying, pound it frequently to make it finer and keep turning it over. Take care that the soil does not fall outside the newspaper. Spilling of soil would distort the results. After drying it, weigh the soil again. From the difference in the weight of the soil before and after drying, we would know the amount of moisture contained in 100 grams of wet soil. This is called **percent moisture content.**

Record the percent moisture content of the soil in Table 1. (20)

Experiment-7

How much water can soil retain

Take a plastic funnel and place a filter paper in it as shown in Figure-3. Weigh 50 grams of dry, powdered soil and pour it into the funnel. Measure a certain amount of water in a measuring cylinder. Then



pour it on the soil, drop by drop.

Do not let all the water fall at one spot. Pour water all over the surface of the soil. Keep adding water until it starts to drip out of the funnel.

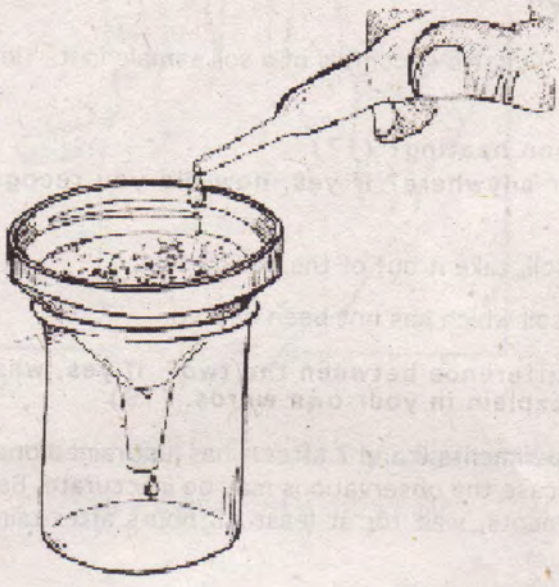


Figure-3

Subtract the amount of water left in the measuring cylinder from the amount you started with and determine how much water the soil retained.

Record your results in the table. (21)

Experiment-8

Soluble substances in soil

Take a beaker and fill half of it with soil. Then pour either rain or distilled water to make the beaker three fourths full. With a twig, stir the soil-water mixture and then leave it standing. After the mixture has been left to stand for a while, decant the water without disturbing the settled soil. Fill half a test tube with it. Heat the water on a burner. When only one fourth of the water is left, answer the questions below.

What colour is this water? (22)

Use litmus paper (red and blue) to find out if the solution is acidic or basic. (23)

Enter results of the litmus test in the table. (24)

Make a collective table on the blackboard in which each team enters its results. Copy this table in your note book. (25)

Collective table

No.	Place of soil	Kind of soil	percolation rate (ml./min)	percentage of quantity of water	Water retained in 50g soil	Acidic or Basic
1.						
2.						
3.						
4.						
5.						
6.						
7.						

Discuss the data in the table and answer the following questions.

Which type of soil has the highest percolation rate? (26)
Which type of soil has the lowest percolation rate? (27)

You must have seen that 8-10 days after rain, the level of water in a well rises.

Which type of soil will allow water to reach a well faster and in greater quantity? (28)

In which type of soil will most of the rain water drain off the surface? (29)

What will be the difference if you plant a crop in a soil with a higher percolation rate compared to one with a lower percolation rate? Discuss with a farmer and write the conclusion in your own words. (30)

Which kind of soil would be most suitable for planting rice - soil with a higher or lower rate of percolation? (31)

Which type of soil retains the highest amount of water? Which retains the least? (32)

Does the soil, which retains most water, have a faster or slower rate of percolation than the other types of soils? (33)

Does the soil which has a high percolation rate retain more water or less than the soils with low percolation rates? (34)

What conclusions can you draw about the relationship between rate of percolation and amount of water retained. (35)

If no water is available for a few days, in which type of soil is a plant most likely to wither - in soil which can retain a large amount of water or in soil which retains little water? (36)

You have just studied some of the properties of soil such as colour, smell, presence of decaying animal and plant matter, soil-type, percolation rate, ability to retain water, acidic-basic, etc. What crops

can be grown in a certain area is dependent on several factors. Among them, the main factor is the properties of the soil.

Discuss these properties of soil and their relationship to crop cultivation with a farmer or an official of the agricultural department.

Write what you learnt in your own words. (37)

A few questions for discussion.

You may have heard about the Tawa Dam in Hoshangabad district. This is a big irrigation project. While this dam has increased agricultural production, it has created some new problems also. For example, in some villages, the area near canals has become waterlogged and the soil is eroding. In some places, there is a drainage problem in the fields. You must have also heard that in our State, more such dams are being built, such as the Narmada Sagar etc. Some people are of the opinion that these dams too may create similar problems.

The experiments which you have performed in this chapter will help you to understand these problems from a scientific point of view.

Discuss in your class and with others and find out which are the experiments that help understand the scientific basis of these problems. Write your comments on the relationship between the properties of soil and these problems. (38)

NEW WORDS:

percolation
retention
loam
project