2 A third *leaf* was taken, and the leaf was left uncovered.
3 We took the three *leaves* and we put the three leaves into heated methylated spirit.
4 The leaves lost their *chlorophyll*, and the chlorophyll dissolved in the spirit.
5 The iodine touched the *starch*, and the starch turned blue.
6 We put each leaf onto a *saucer* and we poured a little iodine into the saucer.
7 Sunlight reaches the *leaf*, and the leaf makes starch.
8 When sunlight reaches the leaves they form *starch*, and starch turns blue with iodine.
9 Iodine was poured onto the totally covered *leaf*, and the leaf remained unchanged.
10 The leaf needs *sunlight*, and without sunlight starch cannot be formed.
11 In the leaves there is a green *substance* and the green substance is known as chlorophyll.
12 The green substance is known as *chlorophyll*, and chlorophyll assists the leaves to form starch with the aid of sunlight.

Exercise 4 Rewrite this passage, using another word in place of each word or phrase italicised:

We *put* the *partly* covered and the *completely* covered leaves in heated methylated spirit, *and* the one which had not been covered at all. After *a few* minutes, the green substance had dissolved in the spirit. When we poured a little iodine onto each leaf, the one which was *not covered* turned blue; the *partly* covered one turned blue only where it had not been covered. The *completely* covered leaf *stayed the same*. From this was learned that leaves *make* starch with the *help* of chlorophyll and sunlight.

Exercise 5 Answer these questions without referring to the Texts:

1 What was the difference in the way the two leaves were covered with brown paper?
2 Where were the three leaves placed after some days?
3 What could be seen after some minutes?
4 Where was each leaf placed next?
5 Which leaf turned blue all over?
6 Which leaf remained unchanged?
7 When is starch formed in a leaf?
8 What is the green substance in leaves known as?
9 Can leaves form starch during the hours of darkness?

Exercise 6 Questions for further discussion:

1 What things that we eat contain starch?
2 Does chlorophyll dissolve in water? How do you know?

Vocabulary
potato

Exercise 7 Suggestions for further activities:

1 Cut a potato in half and drop a very little fresh iodine onto it. Observe the colour change. Why is this?
2 Carry out the experiment described in this Unit. (Heat the methylated spirit by setting it in a pan of very hot water, not over a flame, as this is dangerous.)

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Exercise 1 Find the way in which the words and phrases italicised in Text A are expressed in Text B:

1 Here is
2 partly
3 a few
4 and another one
5 made some methylated spirit hot
6 Or, using different words, we can say
7 which had not been covered
8 which had been completely covered
9 stayed the same
10 Why was this?
11 makes starch, and starch
12 cannot make
13 so
14 without
15 helps
16 the help

Making opposites

Opposites, or negatives, of many words are made by putting UN- in front of them. Some other words use IN-, IM- or AB-:

a uncovered, unobserved, unchanged, undeveloped; undissolved, unfinished, unheated, unconverted; unaffected, unevaporated, untreated

b incompleted, invisible, invariable

c impossible

d abnormal

Exercise 2 Contract (shorten) the relative clauses given below, as in example (b). (Remember that they are parts of incomplete sentences.)

(1a) the leaves *which had been covered* . . .
(1b) the *covered* leaves . . .
(2a) a leaf *which is not covered* . . .
(2b) an *uncovered* leaf . . .

1 the leaf which had been partially covered . . .
2 a leaf which had been totally covered . . .
3 a plant which had not developed . . .
4 chlorophyll which has not been dissolved . . .
5 the leaf which had been affected . . .
6 the methylated spirit which had been heated . . .
7 the experiment which had been finished . . .
8 the experiment which has been partially completed . . .
9 the change which had not been observed . . .
10 the gas which has not expanded . . .
11 the water vapour which had not been condensed . . .

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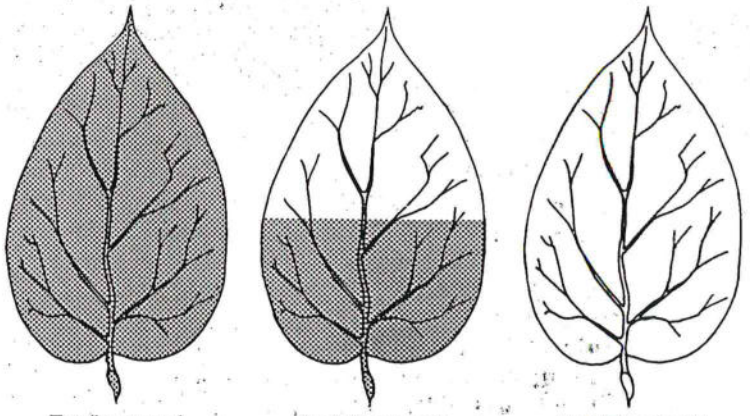


Three bean leaves

12 the liquid which is not converted . . .
13 the gas which has expanded . . .
14 growth which is not normal . . .
15 roots which are not developed . . .
16 water which has not been filtered . . .
17 latex which has been treated . . .
18 grass which has been twisted . . .
19 conditions which are not variable . . .
20 water which is not chlorinated . . .
21 an experiment which is not possible . . .
22 pressures which are not changed . . .
23 a rate which has not been determined . . .
24 a change which is not noticeable . . .
25 a reason which has not been explained . . .

Exercise 3 Read or rewrite these sentences, using WHICH to avoid repeating the nouns italicised:

(a) We took a leaf *and covered the leaf* with brown paper.
(b) We took a leaf *which we covered* with brown paper.

1 We took another *leaf* and we partially covered the leaf with brown paper.

Unit 13 One Function of Leaves

Vocabulary

description
methylated spirit
saucer
separate
starch
tincture of iodine

A

Here is the description of a simple experiment with leaves:

First we completely covered one leaf of a bean plant with brown paper, and *partly* covered another. After *a few* days, we cut these two leaves *and another one* which had not been covered at all. Then we *made some methylated spirit *hot*, and placed the three leaves in it.

After *a few* minutes, we saw that the leaves were colourless, but the methylated spirit was green. *Or, using different words, we can say* the green substance in the leaves had dissolved in the spirit.

Next we placed each leaf on a separate saucer and poured a little tincture of iodine onto each. The leaf *which had not been covered* turned blue, the partly covered leaf turned blue only where it had not been covered, and the leaf *which had been completely covered/stayed the same. Why was this?*

When sunlight reaches the leaf, it *makes starch, and starch* turns blue with iodine. If sunlight does not reach the leaf, it *cannot make* starch; *so* iodine does not turn it blue. Or, using different words, we can say that leaves cannot make starch *without* sunlight. The green substance, which is known as chlorophyll, *helps* the leaves to make it with *the help* of sunlight.

B

The description of a simple experiment with leaves (1)is given as follows:

First one leaf of a bean plant was completely covered, and another (2)partially covered with brown paper. After (3)some days, these two leaves, (4)together with another which had not been covered at all, were cut and placed in (5)heated* methylated spirit.

After (3)some minutes, the leaves could be seen to be colourless, but the methylated spirit could be seen to be green. (6)In other words, the green substance in the leaves had dissolved in the spirit.

Next, each leaf was placed on a separate saucer, and a little tincture of iodine was poured onto each. The (7)uncovered leaf turned blue, the (2)partially covered leaf turned blue only where it had not been covered, and the (8)totally covered leaf (9)remained unchanged. (10)What was the reason for this?

When sunlight reaches the leaf, (11)starch, which turns blue with iodine, is formed. If sunlight does not reach the leaf, starch cannot (12)be formed; (13)consequently iodine does not turn it blue. (6)In other words, leaves (12)cannot form starch (14)in the absence of sunlight. The green substance, which is known as chlorophyll, (15)assists the leaves to (12)form it with (16)the aid of sunlight.

* Great care must be taken when heating methylated spirit.

Passive using a perfect infinitive

Exercise 2a Without agent:

(a) We could see that *the red ink had crept* up the stem. (active)
(b) *The red ink* could be seen *to have crept* up the stem. (passive)

Read and rewrite these sentences in the passive as in example (b). (The subjects of the passive sentences are italicised):

1 We observed that *the colour of the flowers* had changed.
2 We observed that the *red ink* had passed up the central tubes only.
3 We proved that *the water* had passed up to the flowers.

Exercise 2b With agent:

(a) We noticed that the stem *had passed up* the red ink slowly. (active)
(b) *The red ink* was noticed *to have been passed up* slowly *by the stem*. (passive)

Read and rewrite these sentences in the passive as in example (b). (The subjects of the passive sentences are italicised):

1 We observed that the roots had taken up *only a little of the water available.*
2 We observed that the roots had left behind *most of the water available.*
3 We noticed that the whole stem had not passed up *the red ink.*
4 We proved that the roots had taken up *water together with the other substances dissolved in it.*

Exercise 3 Describe the experiment using passive forms. Notice which passive sentences will require an agent. (The subjects of the passive sentences are italicised):

First we placed *some flowering stems* in red ink. After some time we saw that *the red ink* had crept up the stems, and that it had changed *the colour of the flowers.*

Then we cut *a stem* transversally and examined *it* under a magnifying glass. The whole stem had not taken up *the red ink*, but we could see that *certain central tubes* were red.

It was proved in this way that the roots had taken up *water, together with the other substances dissolved in it*, and that central tubes in the stem had passed *it* up to the flowers.

Exercise 4 Answer these questions without referring to the Texts:

1 How is water obtained from the soil by the plant?
2 What happens to the water in the soil which the plant does not use?
3 How was the stem cut, transversally or lengthways?

4 What was used to examine the stem?
5 Which part of the stem was seen to be red?
6 If a substance is dissolved in water, will the roots of a plant take it up, or will they leave it behind?

Exercise 5 Questions for further discussion:

1 How could blue carnations be obtained?
2 When is the best/worst time to water the garden? Why?
3 If a plant is left without water, it dies. Why?
4 Why is it useful for farmers to know that roots take up any substance which is dissolved in the water in the soil?

Vocabulary
carnation

Exercise 6 Suggestions for further activities:

1 Place some freshly-cut flowering stems into red ink, and some others into blue ink. (White or pale-coloured flowers are best.) Observe the change in the colour of the flowers after 10–15 minutes.
2 Put two saucers marked A and B side by side on a window-sill. Put some cotton-wool on each saucer, and place a few bean seeds on top. Water saucer A with ordinary water, and saucer B with an equal quantity of distilled water only. Observe and compare the growth of the bean seeds over the next 2–3 weeks. Why do the bean seeds watered with distilled water only grow less healthily and eventually die?
3 Place a medium-sized carrot upright in a jar or bottle of green or blue ink and leave it overnight. Then cut the carrot transversally at about 2cm from the top. Cut the rest of the carrot in half lengthways. Is the carrot all the same colour inside? Draw two diagrams to show where the ink has passed.

Unit 12 One Function of Roots

Vocabulary
function ink stem width

A

Plants *need* water, but they cannot use it unless it *is there* in the soil. They *get* the water from the soil *by using* their roots. The roots take up the water and pass it up the stem to the leaves and flowers. The plant uses only a little of the water *which is there* in the soil; most of *the rest* evaporates into the air *round about*.

We placed some *stems with flowers on* in red ink. After some time we could see that the red ink had *moved very slowly* up the stems and changed the colour of the flowers.

We cut a stem *across its width* and *looked at it carefully* under a *glass which made it look bigger*. We could see that the whole stem was not red, but only *some tubes in the middle*. *Or we can say*, the roots take up water *and/anything else which is dissolved in it*, and pass it up the *middle* of the stem to the leaves and flowers.

B

Water is (1)required by plants, but it cannot be used unless it is (2)available in the soil. The water is (3)obtained from the soil (4)by means of the roots, and passed up the stem to the leaves and flowers. Only a little of the water (5)available in the soil is used by the plant; most of (6)the remainder evaporates into the (7)surrounding air.

Some (8)flowering stems were placed in red ink. After some time, the red ink could be seen to have (9)crept up the stems and changed the colour of the flowers.

A stem was cut (10)transversally and (11)examined under a (12)magnifying glass. It could be seen that only (13)certain central tubes were red, not the whole stem. (14)In other words, water, (15)together with (16)other substances dissolved in it, is taken up by the roots and passed up the (17)centre of the stem to the leaves and flowers.

Exercise 1 Find the way in which the words and phrases italicised in Text A are expressed in Text B:

1 need
2 there to be used
3 get
4 by using
5 which is there
6 the rest
7 round about
8 stems with flowers on
9 moved very slowly
10 across its width
11 looked at (it) carefully
12 glass which made it look bigger
13 some tubes in the middle
14 Or we can say
15 and
16 anything else which is dissolved in it
17 middle

3 How was the stem cut, transversally or lengthways?

8 It doesn't matter which system of measuring is used, the boiling point of water is the same in the same conditions.
9 It doesn't matter how heavy it is, if the object displaces a greater weight of water, it will float.

Exercise 4 Answer these questions with one word each:

1 In which direction does the root grow?
2 In which direction does the shoot grow?
3 How does the shoot emerge from the seed-leaves?

Exercise 5 Answer these questions without referring to the Texts:

1 How can bean seeds be made to start growing more quickly?
2 What is known as the seed-coat?
3 Does the seed-coat split before or after the root emerges?
4 Which grows upwards, the shoot or the root?
5 What happens to the shoot as the root grows downwards?
6 What happens to the seed-leaves as the leaves open on the shoot?
7 If it is grown in the dark, is the growth of a bean seed normal or not?
8 In what ways is the growth different in the dark?
9 Why does the shoot remain white instead of turning green?
10 Does a green plant grown in the dark die immediately or eventually?

Exercise 6 Read or rewrite this passage, using another word for each word or phrase italicised:

Some bean seeds were *put* onto damp cotton-wool and certain changes were *watched and noticed* after *a few* days. The changes would *happen* sooner if the seeds were first *left in water*. First a *very small* root and then a shoot *came out*. A little later, side roots appeared on the *most important and largest* root, while the shoot *grew longer* and turned green. *It doesn't make any difference which* way the seed is planted, the root *always* grows downwards, and the shoot *always* grows upwards. The seed-leaves *dry up* and, *in the end*, disappear. If a bean seed is grown in the dark, *growth* begins *as usual*, but *in the absence of* light, the plant cannot *stay alive* for long.

Exercise 7 Questions for further discussion:

1 Why are roots white when shoots and leaves are green?
2 If a healthy green plant were placed in the dark, what would happen and when?
3 Which way would a plant grow if you planted the seed upside down in the soil?

4 Have you noticed which way the leaves face in a plant grown on a window sill?

Vocabulary
window-sill

Exercise 8 Suggestions for further activities:

1 Plant some bean seeds on damp cotton-wool and place on a window-sill. Do not let the cotton-wool dry out. Keep a record of their growth during the next 2–3 weeks. Which way do the leaves face?
2 Plant 10–15 bean seeds on damp cotton-wool and keep them covered with an upturned box. Observe their growth. How many of them grew?
3 Plant some bean seeds on damp cotton-wool and place on a window-sill. Keep them covered with an upturned box into which a small hole has been cut. Observe their growth. Which way do the leaves face?
4 Put a healthily growing bean seed into a dark place and leave it there. Observe what happens and when.
5 Push three toothpicks (or matchsticks) into a small onion and place in a jar of water, so that the sticks rest on the rim, and the bottom of the onion is in the water. Place on a window-sill and notice what happens during the next week to ten days.

Exercise 1 Find the way in which the words and phrases italicised in Text A are expressed in Text B:

1 in a few days
2 make (them) soft
3 leaving (them) for a time in water
4 start to happen
5 outside
6 A little later
7 comes out
8 slowly
9 grows longer
10 most important and largest
11 It doesn't make any difference which
12 always
13 dry up
14 in the end
15 it begins to grow
16 in the usual way
17 shows
18 stay alive
19 without it

Exercise 2 Describe the growth of the bean seed using passive forms. (The subjects of the passive sentences are italicised):

First we placed *some bean seeds* on damp cotton-wool, and after some days we observed *the following changes*. (If you soak *the seeds* first, the changes will take place sooner.)

We observed that first *the root* emerged, after it split *the seed-coat*. Then we observed that *a small shoot* emerged backwards and it gradually lengthened and turned green. Later we saw that *side roots* appeared on the main root. Then we observed that *the seed-leaves* shrivelled and disappeared, as the leaves opened on the shoot.

We also grew *a bean seed* in the dark. We saw that *growth* began normally, but the shoot did not turn green and the plant eventually died.

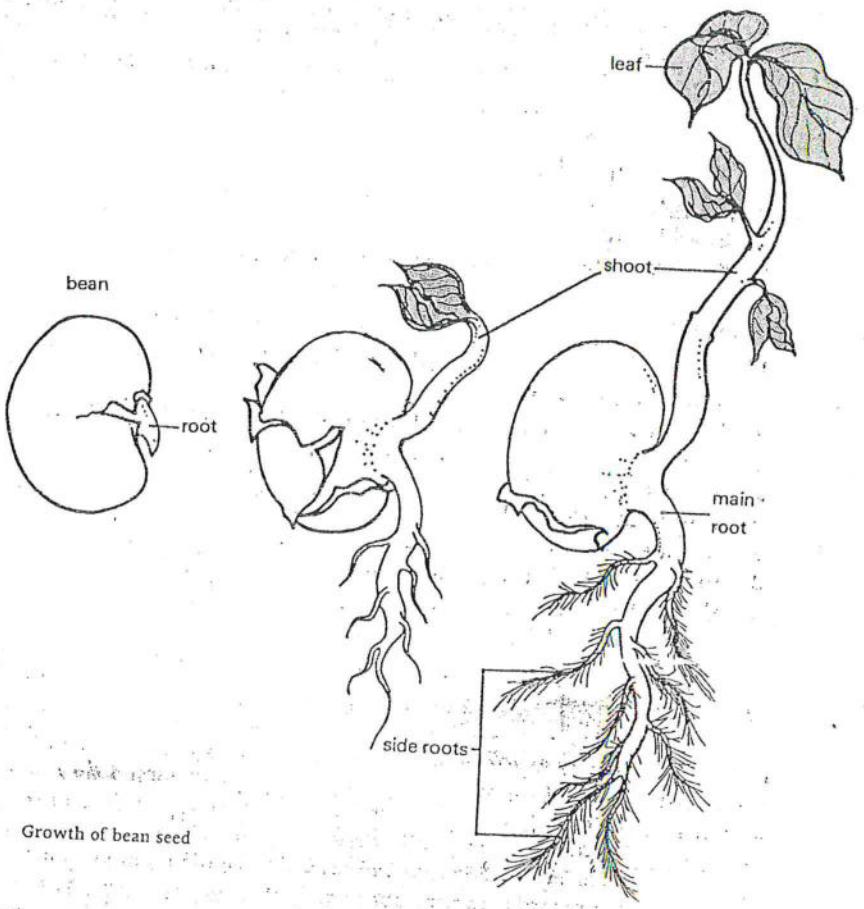
This proves that green plants need *light* to make them green, and that they cannot survive long without it.

Exercise 3 Here are two ways of expressing the same idea:

(1a) *It doesn't make any difference which* way a seed is planted . . .
(1b) *Whichever* way a seed is planted . . .
(2a) *It doesn't matter how* little light there is, a seed begins to grow normally.
(2b) *However* little light there is, a seed begins to grow normally.

Rewrite these sentences as in examples (b):

1 It doesn't matter how much water is given, a green plant will not survive long in the dark.
2 It doesn't matter how dark it is, a bean seed will start growing normally.



Growth of bean seed

3 It doesn't matter from where the shoot emerges, it will always grow upwards.
4 It doesn't matter from which side the root emerges, it invariably grows downwards.
5 It doesn't matter how high the temperature at which a liquid solidifies, it is still said to freeze at that temperature.
6 It doesn't matter how little heat there is, some evaporation will always take place.
7 It doesn't matter how many millions of droplets there are in a cloud, it won't rain unless they become heavy enough to fall.

t 11 The Growth of Seeds

Vocabulary

bean	to disappear	root	skin
cotton-wool	leaf	seed	soil
damp	leaves (pl.)	a shoot	to split

A

If you place some bean seeds on damp cotton-wool, *in a few days* you will see that they have begun to change. If you *make them soft* by *leaving them for a time in water* first, the changes will *start to happen* sooner.

The *outside* skin of the bean seed, known as the seed-coat, splits, and a small root begins to grow downwards. *A little later* a tiny shoot *comes out* backwards from between the seed-leaves, and begins to grow upwards. The shoot *slowly/grows longer* and turns green while the root grows downwards. Side roots begin to appear on the *most important and largest* root.

It doesn't make any difference which way you plant the bean seed on the cotton-wool or in the soil; the root *always* grows downwards while the shoot grows upwards. As the leaves open on the shoot, the seed-leaves begin to *dry up*, and, *in the end*, they disappear.

If you grow a bean seed in the dark, *it begins to grow/in the usual way*, but the shoot does not turn green and, in the end, the plant dies. This *shows* that green plants need light to make them green, and that they cannot *stay alive* for long *without it*.

B

If some bean seeds are placed on damp cotton-wool, (1)after some days they will be seen to change. If they are first (2)softened by (3)soaking in water, the changes will (4)take place sooner.

The (5)external skin of the bean seed, known as the seed-coat, splits, and a small root begins to grow downwards. (6)After some time a tiny shoot (7)emerges backwards from between the seed-leaves, and begins to grow upwards. The shoot (8)gradually (9)lengthens and turns green while the root grows downwards. Side roots begin to appear on the (10)main root.

(11)Whichever way the bean seed is planted on the cotton-wool or in the soil, the root (12)invariably grows downwards while the shoot grows upwards. As the leaves open on the shoot, the seed-leaves begin to (13)shrivel, and (14)finally they disappear.

If a bean seed is grown in the dark, (15)growth begins (16)normally, but the shoot does not turn green and the plant (14)finally dies. This (17)proves that light is needed by green plants to make them green, and that they cannot (18)survive for long (19)in its absence.