

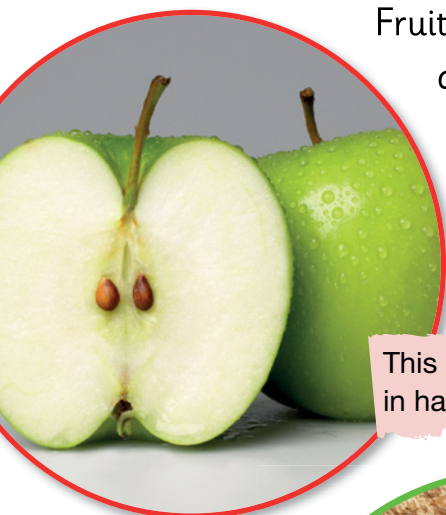
1 Investigating plant growth

1.1 Seeds

Seeds and fruits

Have you ever swallowed a **seed** when you were eating an apple or an orange? We find seeds inside fruits.

Fruits and seeds can be different sizes and shapes.



This apple has been cut in half to show the seeds.



An avocado pear has one large seed.



Bean seeds are found inside a pod.



A poppy's fruit contains the seeds.

What's inside a seed?

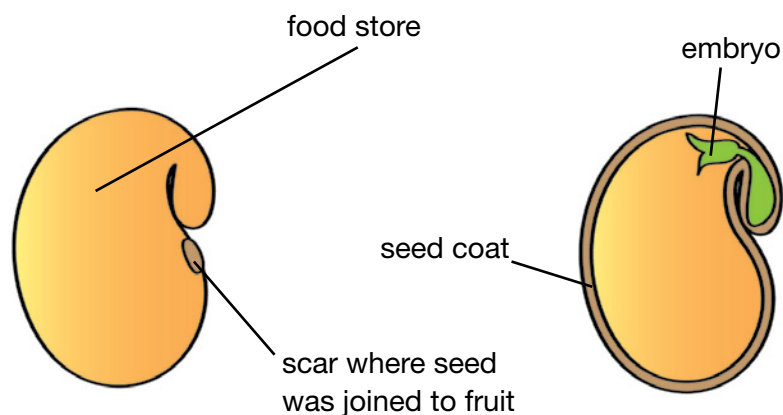
Are seeds alive? Seeds might look dead, but they are not. Seeds grow into new plants. There is a tiny plant inside the seed that starts to grow when it has all the things that it needs. The tiny plant inside the seed is called an **embryo**. The seed also has a food store.

Words to learn

seed embryo
 seed coat



Here is a bean seed with its parts labelled.



Activity 1.1

Draw and label a seed

Look carefully at the seed with the hand lens.

Find the **seed coat** and the scar where the seed was joined to the fruit.

Make a neat drawing of the outside of the seed. Label your drawing.

Use your fingernails to pull off the outer covering of the seed.

Pull the two halves of the seed apart.

Find the embryo inside the seed.

Find the seed's food store.

Draw and label the inside parts of the seed.

You will need:

a large fresh seed • a hand lens

Questions

- 1 Why does the seed need a food store?
- 2 Why does the seed need a seed coat?
- 3 What do you think the seed needs to make it start to grow?

What you have learnt

- 🌀 Seeds are found in fruits.
- 🌀 The embryo inside a seed grows into a new plant.
- 🌀 Seeds are covered by a seed coat.
- 🌀 Seeds contain a food store.

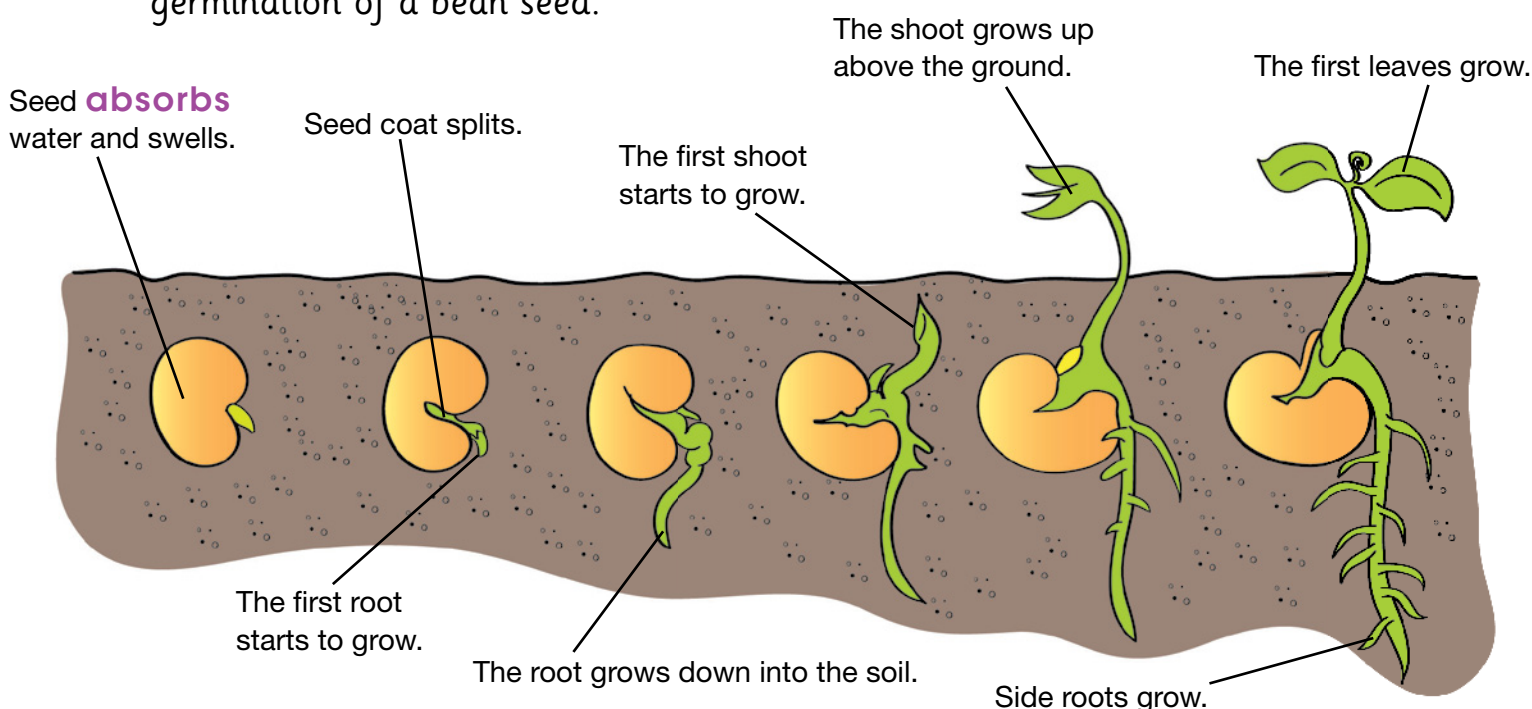
Talk about it!

What is the biggest seed in the world?

1.2 How seeds grow

Germination

If a seed is given the right conditions, and the embryo is alive, it will grow. When a seed starts to grow, we say it germinates. This process is called **germination**. The seed uses its food store to give it the energy to grow. The seed **shrivels** and becomes small after germination. Here are the stages in germination of a bean seed.



A lotus plant growing in water.

Seeds can live without germinating for years until the conditions become suitable. The oldest seed known to germinate was a 1300-year-old lotus seed found at the bottom of a lake in China.

Activity 1.2

You will need:
 a bean seed • a saucer of water

Observe a seed

Soak the bean seed in water overnight. Predict how the seed will change overnight.

Observe the seed the next day and write down any changes that you see.

How did the seed change overnight? Was your prediction correct? Explain why the changes happen.

Where do you think the water entered the seed?

Give a reason for your answer.



Questions

- 1 Why do seeds need to absorb water?
- 2 a Which part of the new bean plant grows first?
 b Suggest a reason why this part grows downwards.
- 3 In which direction does the first shoot grow and why?
- 4 Why do you think the new leaves start to grow above the ground?
- 5 Why do you think the seed shrivels and becomes small after germination?

What you have learnt

- Seeds start to germinate if the conditions are right and the embryo is alive.
- The food store gives seeds the energy they need for germination.
- Seeds absorb water to start germination.
- The new root grows downwards first, followed by the new shoot which grows upwards.

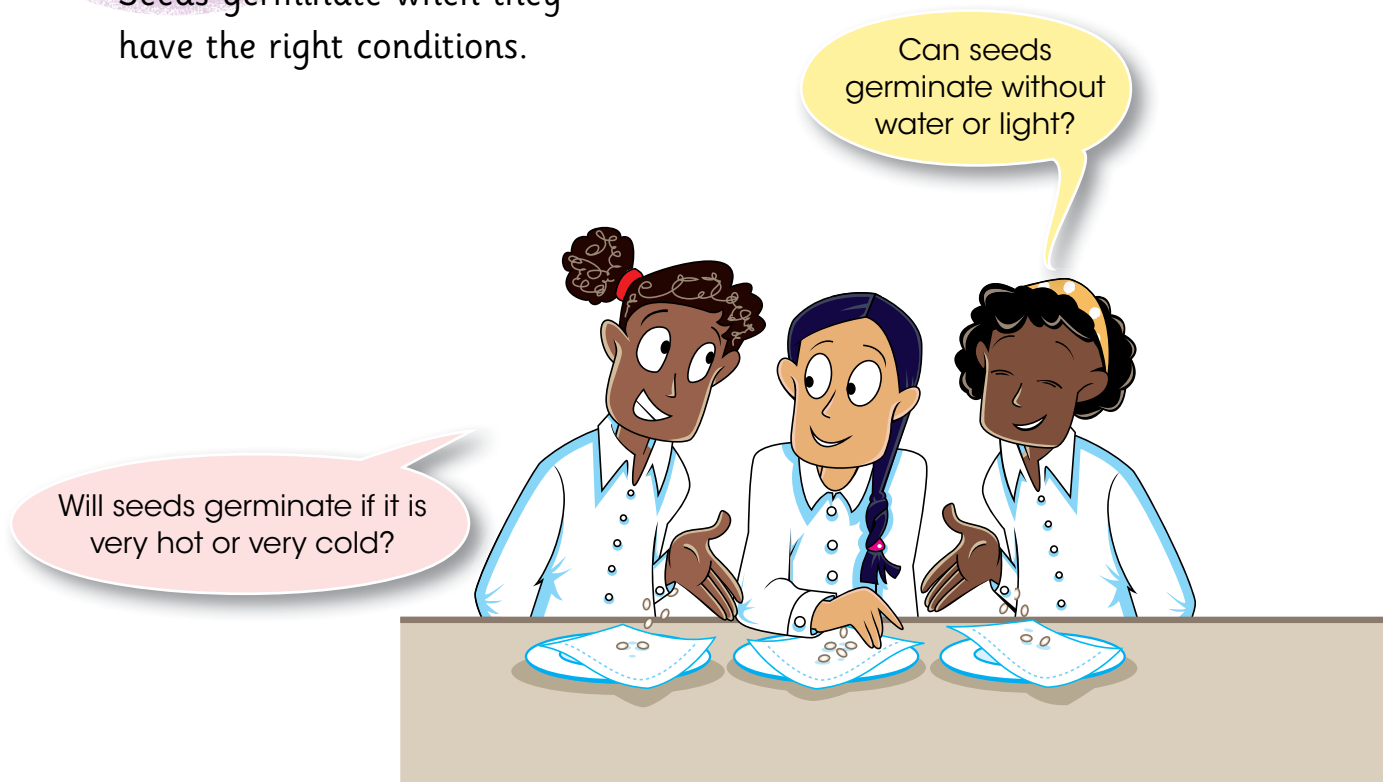
Talk about it!

Can new plants only grow from seeds?

1.3 Investigating germination

What do germinating seeds need?

Seeds germinate when they have the right conditions.



Activity 1.3a

Do seeds need air to germinate?

Place 10 seeds on a moist paper towel on each saucer.

Cover both saucers with moist paper towels. Place one saucer in each bag. Use the straw to suck all the air out of one bag. Quickly close it with a bag tie. Close the other bag, leaving air inside it. Leave both bags in a warm place for two days, then remove the seeds from the bags and observe them.

Which seeds germinated?

Suggest a reason for this.

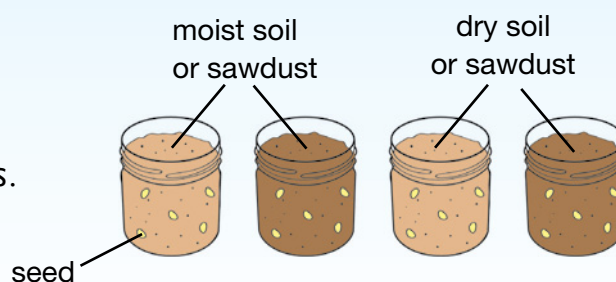
You will need:

20 small seeds • four paper towels • some water
 two saucers • two small plastic bags • two bag ties
 a drinking straw

Activity 1.3b

Investigate conditions needed for germination

Place five seeds against the glass in each jar.
 Moisten the soil in two jars.



You will need:

20 seeds • four glass jars filled with soil or sawdust • water • a measuring cup

Place one jar of dry soil and one jar of moist soil in a warm place.
 Place one jar of dry soil and one jar of moist soil in a cold place.
 Check the moist soil every day to make sure it does not dry out.
 Observe the seeds every two days for eight days.
 Draw a table to record your observations.

Questions

- 1 How can you make sure that this is a fair test?
- 2 **a** What differences did you observe between the jars?
b Suggest reason for these differences.
c Why would your results be better if you used 40 seeds instead of 20?
- 3 Does the investigation show whether seeds need air for germination?
 Explain your answer.
- 4 Write a conclusion about the best conditions for seed germination.
- 5 **a** Do you think seeds need light for germination? Make a prediction.
b Plan an investigation to test your prediction.

What you have learnt

- Seeds germinate when they have right conditions.
- Seeds need water, warmth and air to germinate.
- Seeds do not need light to germinate.

Talk about it!

Why do most seeds germinate in spring?

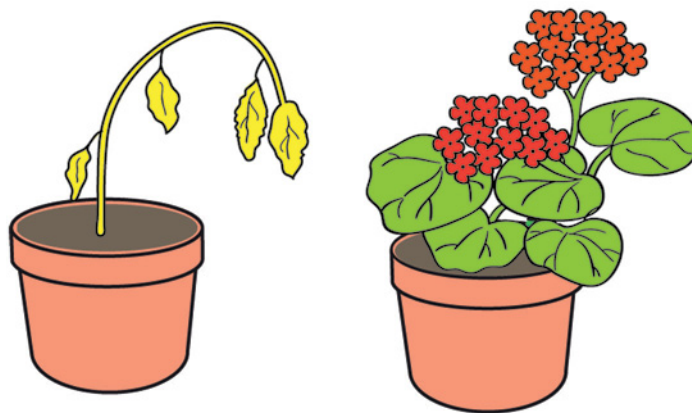
1.4 What do plants need to grow?

Word to learn
factors



Plants need certain things from the environment to make them grow. We call these things **factors**.

Without these factors, plants will not grow well, or they might even die. Look at these pictures. Which plant is healthy and growing well?



Plants need water, warmth, light and air

Plants need water so that they can have strong stems and firm leaves. They also use water to transport substances such as food to all parts of the plant.

Most plants grow best when they get warmth. Most grow better if it is not too hot or too cold.

Plants make their own food. They need light energy for this. A plant that does not get light energy grows long, thin stems, becomes weak and dies.

Plants are living things. Living things need air. Plants without air will die.



Plants need light energy to grow.

Light energy is a factor that helps plants to grow. Plants need the energy in sunlight to make food in their leaves. Plants always grow towards the source of light energy.

Activity 1.4

Draw a bar chart of plant growth

Ashok and his friends grew some plants in pots.
Ashok put his plant in a sunny place and watered it twice a week.
Marco put his plant in a shady place and watered it twice a week.
Leo put his plant in sunny place but forgot to water it.
Tariq kept his plant under bed and watered it twice a week.
After two weeks they measured how much their plants had grown.



Name	How the plants looked	Growth of plants in cm
Ashok	green and healthy	25
Marco	lighter green and quite healthy	18
Leo	dry and brown	6
Tariq	thin and weak	14

Draw a bar chart of the results.

Questions

- 1 Whose plant grew the best?
- 2 Whose plant grew the worst?
- 3 Why did Leo’s plant look dry and brown?
- 4 Why was Marco’s plant smaller than Ashok’s?
- 5 Explain why Tariq’s plant was thin and weak.
- 6 a Predict the height of a plant placed in a greenhouse and watered.
Explain your prediction.
b Draw another bar on your chart
to show your prediction.

What you have learnt

- Plants need factors from the environment to make them grow.
- The factors plants need are light energy, air, water and warmth.

Talk about it!

Do plants need soil for growth?

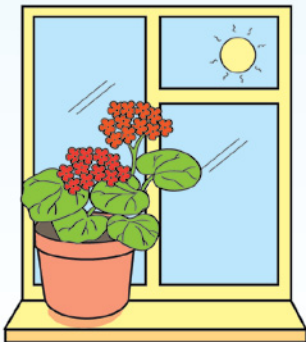
1.5 Plants and light

Activity 1.5

Investigating the effect of light on plant growth

Measure and record the height of the two plants.
Water both plants with the same amount of water.
Look at the pictures to see what to do.
Predict how well you think the two plants will grow. Write down your prediction.

You will need:
two similar pot plants • a dark cupboard
some water • a measuring cylinder • a ruler



Plant A



Plant B

Observe the plants every four days for three weeks. Water both plants with the same amount of water each time you observe them.
Draw a table to record the height and appearance each time you observe them.

	Date:		Date:		Date:		Date:		Date:	
	Plant A	Plant B	Plant A	Plant B	Plant A	Plant B	Plant A	Plant B	Plant A	Plant B
Height in cm										
Number of leaves										
Colour of stem and leaves										
General appearance										

Decide what type of graph is best to show your results.
Draw a graph of the plants' growth in height.
Draw the plants at the end of the investigation. Label your drawings.

Questions

- 1
 - a Which plant grew the best?
 - b Do your results support your prediction?
 - c Name two ways in which you measured plant growth.
 - d How else could you tell which plant grew better?
- 2
 - a Why did you keep one plant in the dark?
 - b Which factor or factors caused the changes you observed?
 - c Is this investigation a fair test? Explain why or why not.
- 3
 - a Write a conclusion for the investigation.
 - b Do you think you have enough data to form a conclusion? Say why or why not.
 - c Suggest a way to improve your results without doing the investigation again.
- 4 If you repeated the investigation with a different type of plant, would you get the same results? Say why or why not.

Challenge

Design a fair test to show that plants need air to make them grow.

What you have learnt

- ☞ Plants need light energy to grow well.
- ☞ Plants need light energy to make food in their leaves.

Talk about it!

Why do some plants that live in very shady places grow big?

1 Check your progress

1 Copy the two columns of words.

Match the words in column A with their meanings in column B.

Column A

1	seed
2	embryo
3	seed coat
4	germinate
5	environment

Column B

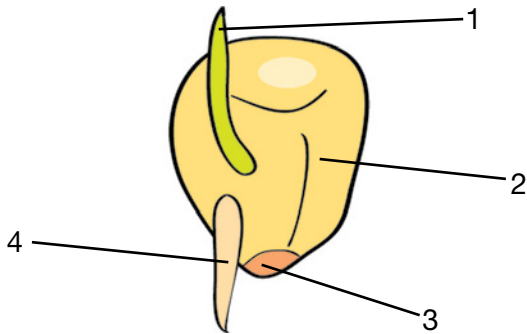
A	the outer cover that protects the seed
B	when a seed start to grow
C	everything around us
D	part of a plant that can grow into a new plant
E	part of a seed that grows into a new plant

2 Copy and complete these sentences.
Use the words in the box to help you.

food store factor air shoot root swells warmth up
down absorbs

When a seed starts to germinate it _____ water and _____ .
The seed gets energy from its _____ .
The _____ is the first part of the new plant that starts to grow.
It grows _____ . The _____ grows next.
It grows _____ .
Seeds need water, _____ and _____ to germinate.
Light is a _____ that plants need so that they can grow.

3 Here is a picture of a germinating seed. Write down the names of parts 1 to 4.



4 Dembe’s class germinated seeds under different conditions. These are their results.

Conditions	Number of seeds germinated
warm, light	10
warm, dark	15
cold, light	5
cold, dark	7

- a Which conditions are best for germination?
- b Do seeds need light for germination? Use the results to explain your answer.
- c Did the seeds get water or not? How do you know this?
- d Dembe must draw a graph of the results. What type of graph should he draw and why?

5 Each plant in the picture is missing one of the factors it needs for growth.

- a Identify the missing factor for each plant.
- b Name one other factor that plants need for growth.
- c Explain why the factor missing in A is important for plant growth.

