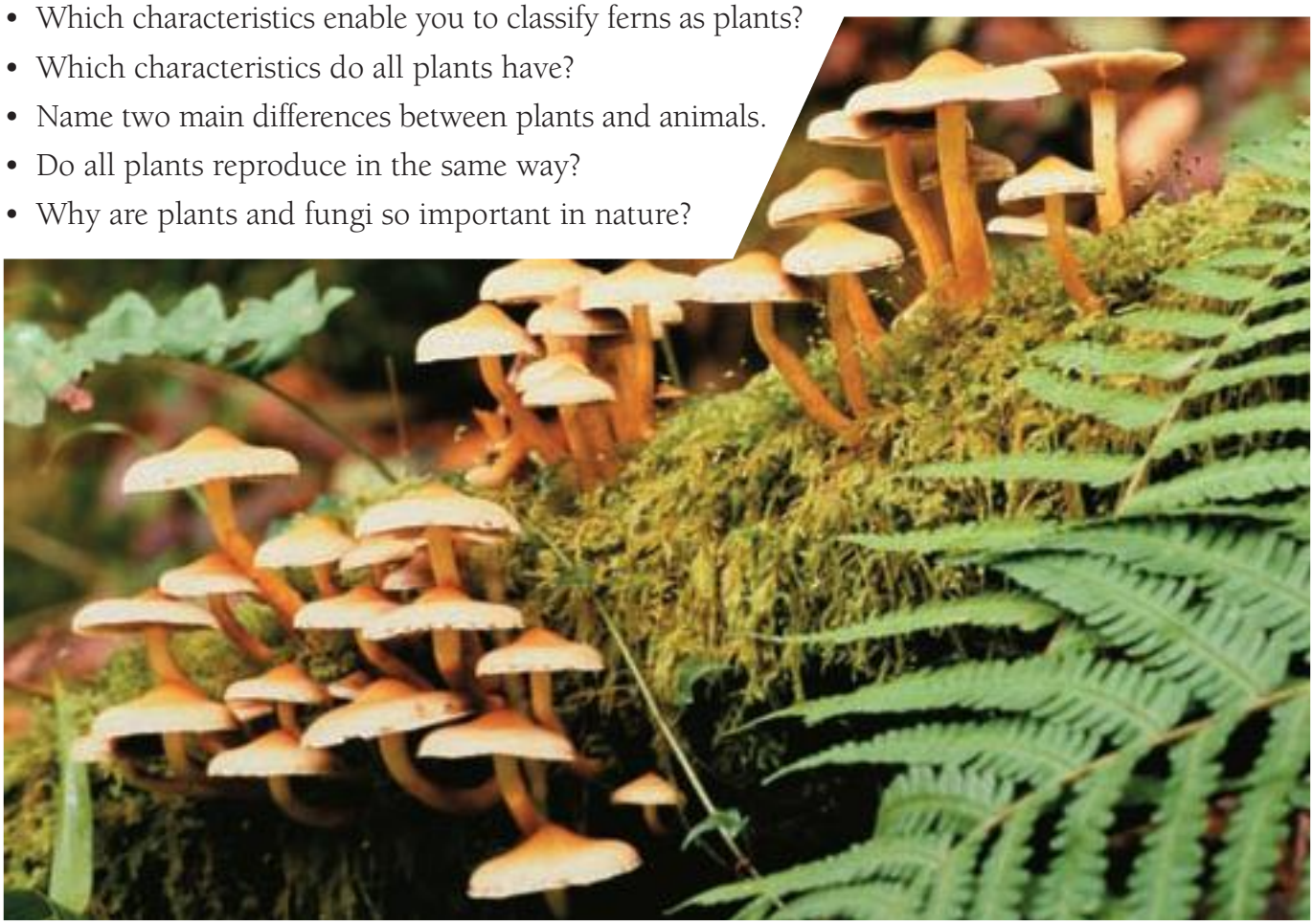
UNIT 6

The plant and fungi kingdoms

What do you remember?

- Which characteristics enable you to classify ferns as plants?
- Which characteristics do all plants have?
- Name two main differences between plants and animals.
- Do all plants reproduce in the same way?
- Why are plants and fungi so important in nature?



Content objectives

In this unit, you will ...

- Identify the main characteristics of the plant and fungi kingdoms
- Recognise plant and fungi organs, shape and functions
- Discover how plants and fungi obtain nutrition and reproduce
- Learn how to make a classification

Key language

Comparing

Ferns are bigger than mosses.
Conifers are the largest group of gymnosperms.

Describing a process

When minerals dissolve in water, raw sap is produced.

Making generalisations

Most gymnosperms are evergreens.
Many angiosperms are deciduous.

1. What living things make up the plant kingdom?

The plant kingdom is made up of multicellular, eukaryotic, autotrophic living things. They cannot move about.

All plants:

- have **roots**, **stems** and **leaves**. These vary according to the species.
- are **multicellular**: made up of many cells which form tissues.
- have **eukaryotic** cells. These cells have a nucleus and organelles surrounded by membranes. They are surrounded by a **cellulose wall**. They have chloroplasts which contain **chlorophyll**. Chlorophyll is necessary for **photosynthesis**.
- are **autotrophic** beings: they can make their own food through photosynthesis.
- **live attached to the soil**. However, they are able to make some movements. For example, they grow towards light.

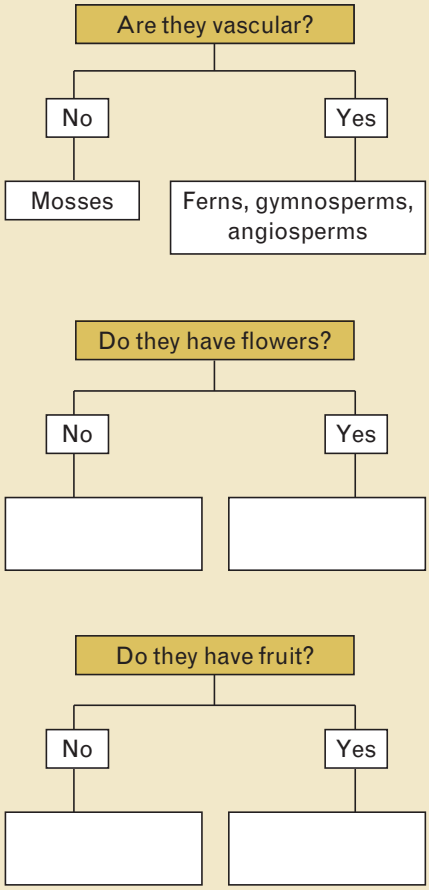
How are plants classified?

Plants are classified in two groups: non-flowering and flowering.

- **Non-flowering plants** are simple plants without flowers or seeds.
  - **Mosses.** They are small, and **non-vascular**: they have no conductor vessels.
  - **Ferns.** They are bigger than mosses. They are **vascular**: they have conductor vessels to distribute water and nutrients.
- **Flowering plants** are more complex, with flowers and seeds.
  - **Gymnosperms.** They have seeds inside a false fruit, like a pinecone.
  - **Angiosperms.** They have seeds inside a real fruit.

Activity

1. Classify the plants as in the example.



Mosses

Ferns

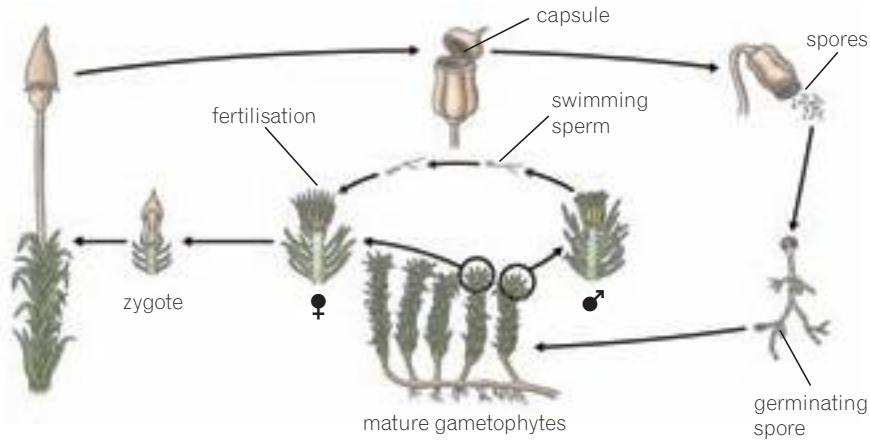
Gymnosperms: pine

Angiosperms: roses

2. What are non-flowering plants like?

Mosses and **ferns** are non-flowering plants:

- They reproduce by spores. The mature spores are dispersed by the wind. The spores germinate and produce new mosses or ferns.
- They grow in damp, shady places. They need a lot of water in order to reproduce.

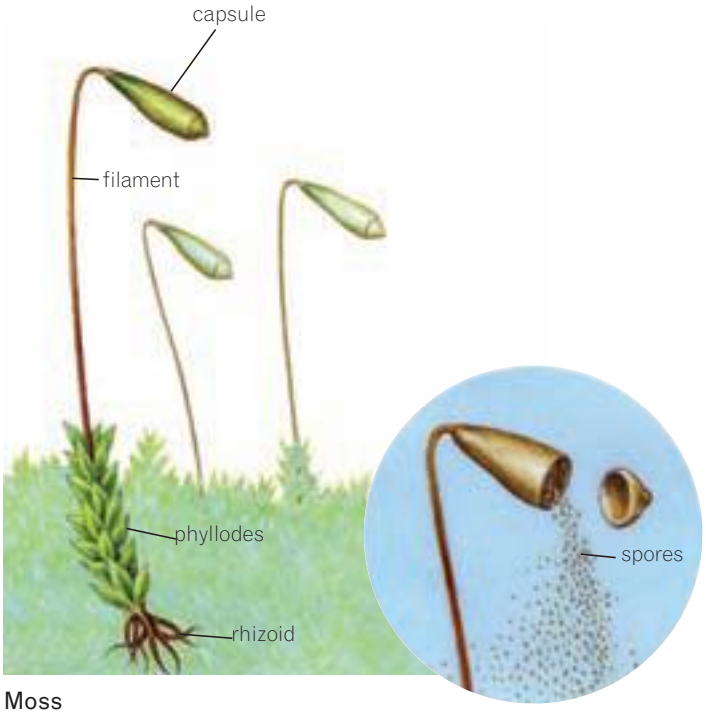


Life cycle of a moss

Mosses

The main characteristics are:

- very small, **non-vascular** plants.
- no **true roots**, **stems** or **leaves**. They fix themselves to the ground by **rhizoids**.
- Instead of leaves, they have small laminas called **phyllodes**.
- Mosses produce **spores** inside **capsules** at the end of filaments.

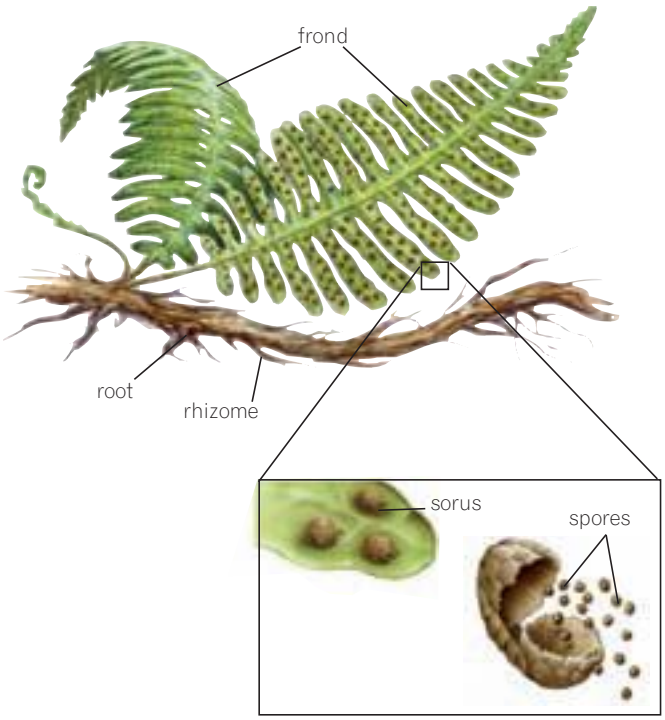


Moss

Ferns

The main characteristics are:

- **vascular** plants. They can be very large.
- have **roots**, **stems** and **leaves**. The stem, called a **rhizome**, grows horizontally in the round.
- The leaves are large, and are called **fronds**.
- ferns develop clusters of spores called **sorus** (plural: **sori**) on the underside of the fronds.



Fern

3. What are flowering plants like?

There are two main groups: **gymnosperms** and **angiosperms**.
Both grow **seeds** in order to reproduce.

Gymnosperms

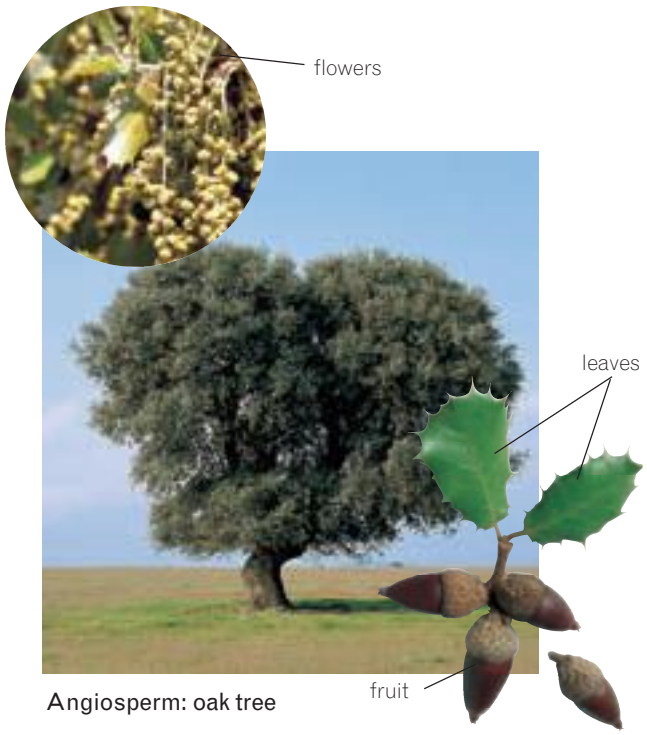
- Most are **evergreens,** like pine trees and sequoias. They have leaves all year. The leaves are normally shaped like needles.
- The **seeds** are not protected by a fruit.
- They have **small**, **insignificant flowers**. These group together into **inflorescences** or **cones**. These cones are male and female.

Angiosperms

- Many are **deciduous**, for example, oak trees. They lose their leaves in winter.
- The **seeds** are enclosed by a **fruit**. The fruit protects the seeds. It also enables them to be dispersed more easily.
- They have **brightly coloured flowers**. The flowers attract animals and facilitate polinisation.

Gymnosperm: pine tree

The female cones, called pinecones, contain the seeds, called pine nuts



Angiosperm: oak tree

Activities

2. Which characteristics differentiate gymnosperms and angiosperms?

3. Research the plants where you live. Classify them into the four main groups in a chart. Describe their reproduction, and identify them as vascular or non-vascular, with cones or with fruits.

Did you know that...?

The largest flower belongs to the species *Rafflesia arnoldii*. One flower can reach a diameter of 1 m and weigh up to 11 kg.

4. What functions do leaves, stems and roots have?

Plants have three main organs: **leaves**, **stems** and **roots**.

Leaves

Photosynthesis takes place in leaves. The leaves take in and expel gases from the atmosphere. They eliminate excess water in the form of water vapour. This process is called **transpiration**.

The main part of a leaf is called the **blade**. A leaf has a **topside** and an **underside**. A **petiole** joins the leaf to the stem. Gases and water vapour enter the leaf and are expelled through small pores. These pores, **stomata**, are found on the underside of the leaf.

Stems

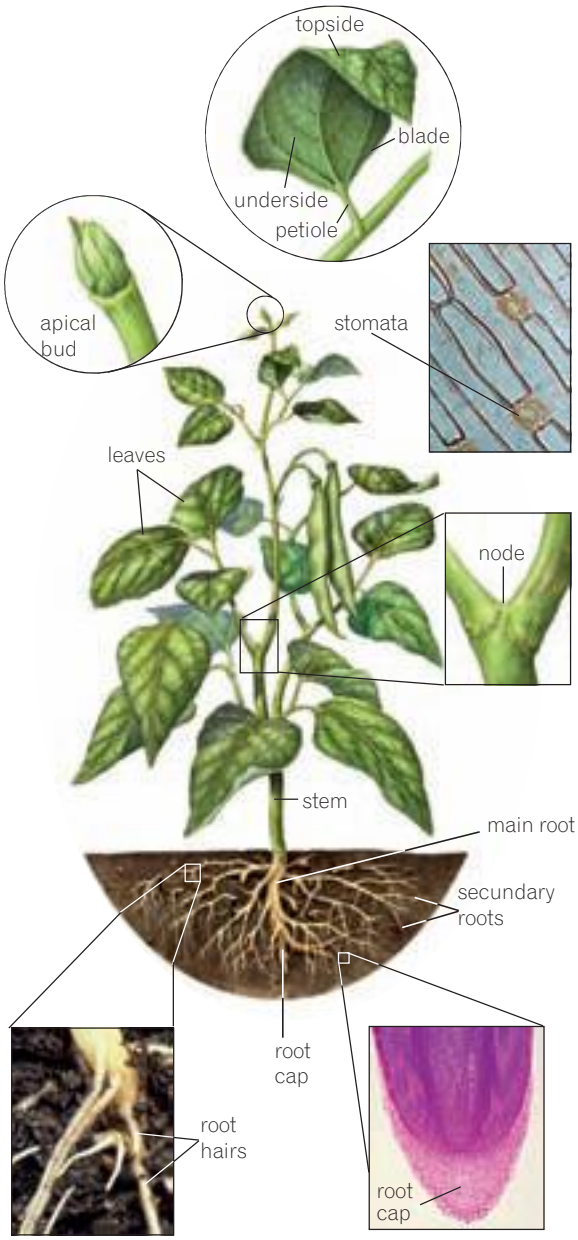
Plant stems are usually above ground. The stem keeps the plant upright and supports it. It also carries substances to other parts of the plant. Some stems, for example, the potato, accumulate reserves of water and food.

Leaves and branches are joined to the stem at **nodes**. The part of the stem between the nodes is called the **internode**. Stems grow upwards from the **apical bud**. Lateral branches grow out of **axilliary buds** along the stem.

Roots

Plant roots have two functions: to fix the plant to the ground, and absorb water and minerals. Some roots, for example, carrots and beetroots, accumulate food reserves.

The root surface is covered with many tiny hairs which absorb the water and minerals. Each root ends in a **root cap**.



Venus flytrap

Did you know that...?

When the Venus Flytrap plant detects an insect, its leaves close quickly to trap the insect inside.

Activities

4. Where do vegetables come from? Make a poster showing the vegetables you eat. Classify them as: *leaf, stem, root, rhizome,* etc.
5. Draw a plant. Label the main parts.

Hands on

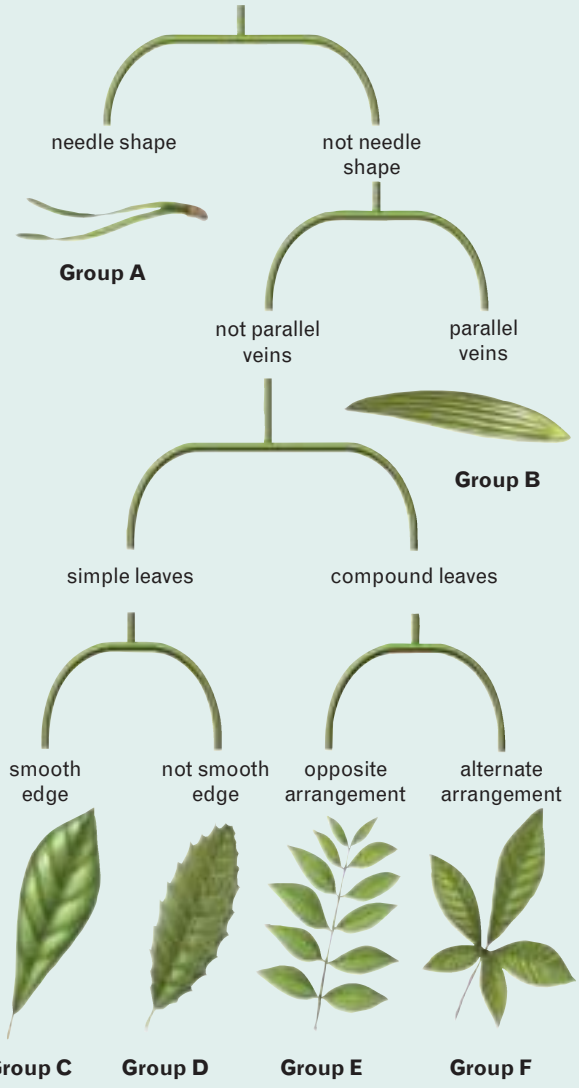
Observation and classification of leaves

What is a classification system?

A classification system is an organised way of grouping objects into similar categories. Scientists use criteria (rules) to sort the objects into categories.
Each category in the classification is labelled. An effective system has multiple levels of increasing detail.

Creating a leaf classification system

There are an enormous variety of shapes and sizes of leaves in the plant kingdom.
In pairs or groups, use these steps to create your own classification system.



1. Collect samples.

Collect as many different samples of leaves as possible. Remember, pine needles are leaves!

2. Establish criteria for classifying the samples.

a. Separate the leaf samples into two different groups. You must use discriminating and objective criteria so everybody will decide the two different groups, without personal opinions. Look at the diagram to help you.

b. Now choose new criteria to separate these groups into two more groups.

c. Repeat this process again with the new groups, until all the leaf samples in a particular group have similar characteristics.

3. Create a key to explain the classification.

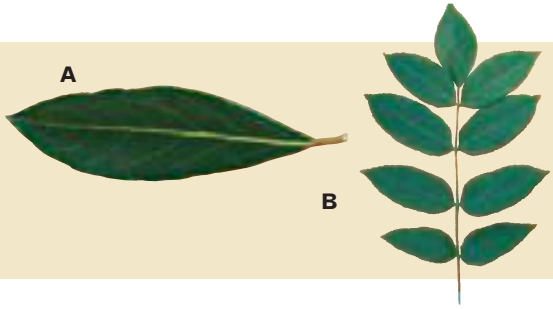
a. Write down your selection criteria. For example: Group A: *leaves shaped like needles*. The key can then be used to classify new leaf samples.

b. Test your classification system and key. Ask a classmate to add a new leaf sample to a group. If this is done correctly, you know your classification works.

Activities

6. Using your key, classify leaves A and B, into groups.

7. How might you change your criteria for classification if you were sorting leaves for a Maths class?



5. How do plants reproduce?

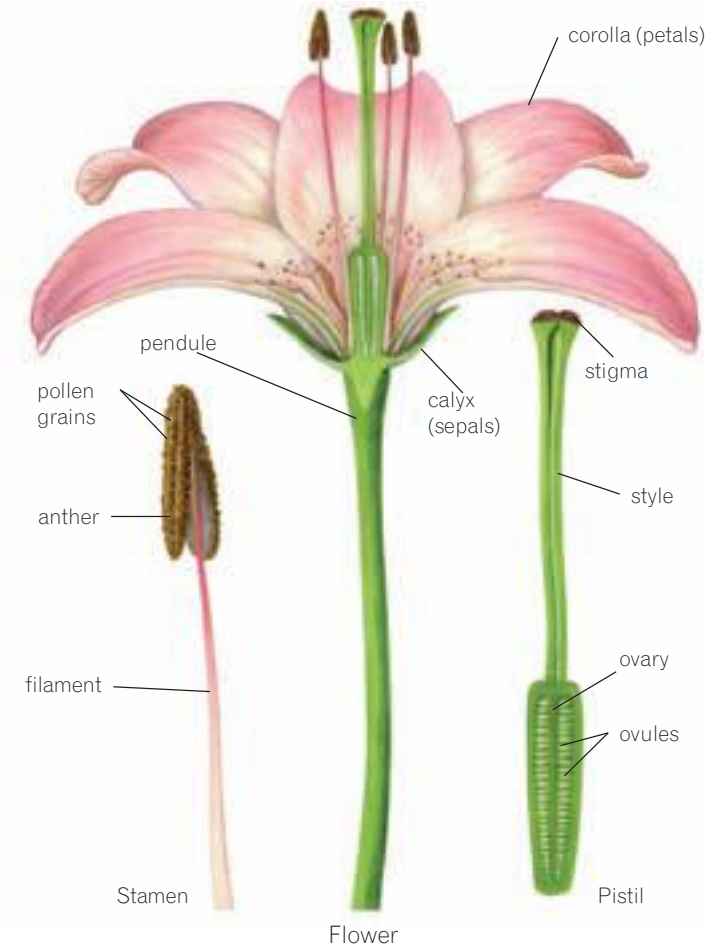
- **Asexual reproduction.** Only one plant is involved. When you take a cutting of a geranium and replant it, asexual reproduction takes place.
- **Sexual reproduction.** Sexual cells from two different plants join together to produce a new plant. Flowering plants have sexual reproduction.

Geraniums reproduce asexually from cuttings of stems with leaves

Main parts of a flower

Flowers are the reproductive organs of angiosperms and gymnosperms. Flowers have two parts: the reproductive part and the protective part.

- Reproductive parts: the **stamen** (male reproductive part) and the **pistil** (female part).
  The **ovules** are found inside the ovary. During reproduction, the ovules come into contact with the **pollen** which is produced in the stamen.
- Protective parts: the **petals**, which make up the **corolla**, and the **sepals**, which make up the **calyx**.



Flower

Did you know that...?

"Bee" orchids (genus *Ophrys*) have flowers which resemble female bees. When a male insect lands on the flower, the pollen rubs on to it, and the insect flies off.

Activities

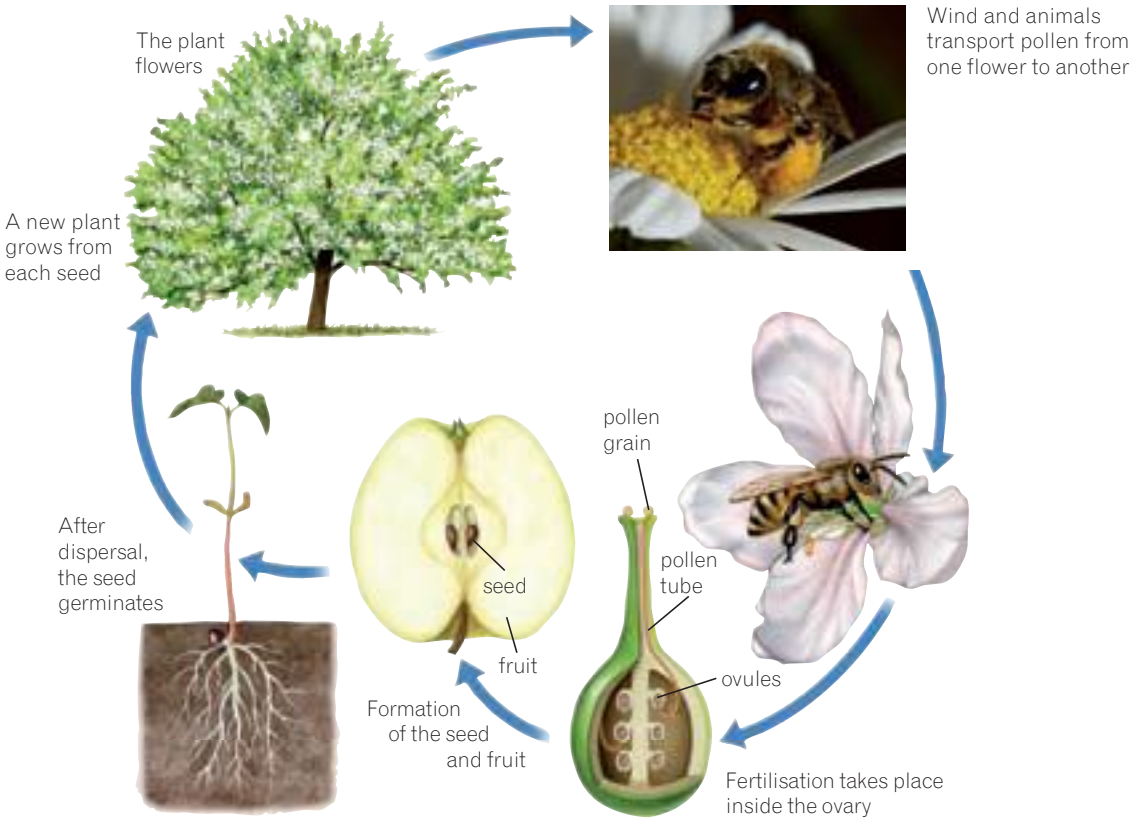
8. Study the flower diagram on this page. Identify the reproductive and protective parts of the flower.
9. Research ways that pollen can be carried from flower to flower. Make a list, and give an example of a plant to illustrate each one.

The reproductive stages

Plant reproduction has the following stages: pollination, fertilisation, formation of fruit and seeds, dispersal and germination.

1. **Pollination.** Pollen from one flower's anther reaches another flower's stigma.
2. **Fertilisation.** Pollen reaches the stigma, penetrates it, and fertilises the ovules inside the ovary.
3. **Fruit and seed formation.** The fertilised flower is transformed. The corolla and the calyx dry up. The ovary changes into the fruit. The ovules are transformed into seeds inside the fruit.
4. **Dispersal.** The ripe fruit falls off the plant or releases the seeds.
5. **Germination.** The seeds fall on the ground and germinate. A small root and shoot grow.

Life cycle of a plant



6. Can plants react?

Plants receive information from the environment, and react to it. There are two types of reaction:

- **Permanent reactions.** These reactions relate to growth. For example, if you place a plant horizontally, the stem will grow and curve towards the light. The roots will grow down into the soil.
- **Temporary reactions.** The plant returns to its initial position when the change stops. For example, some carnivorous plants close their leaves when an insect lands on them.

Activities

10. Describe the reproductive stages of a plant. Refer to the drawing and text.

In stage 1, pollination …
Where does (fruit and seed formation) take place?

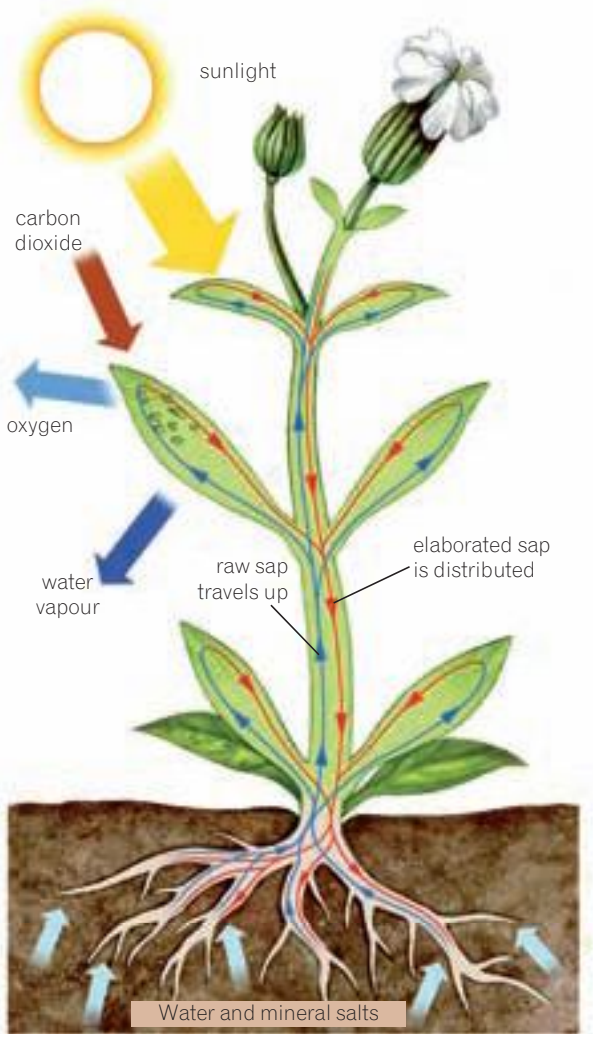
11. Study the plants around you. Find examples of permanent reactions.

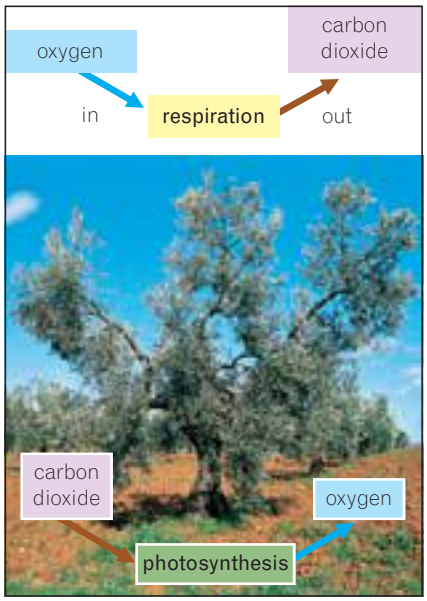
7. What is plant nutrition?

Plants are **autotrophic**: they produce their own food. They use their leaves, stems and roots to carry out these processes:

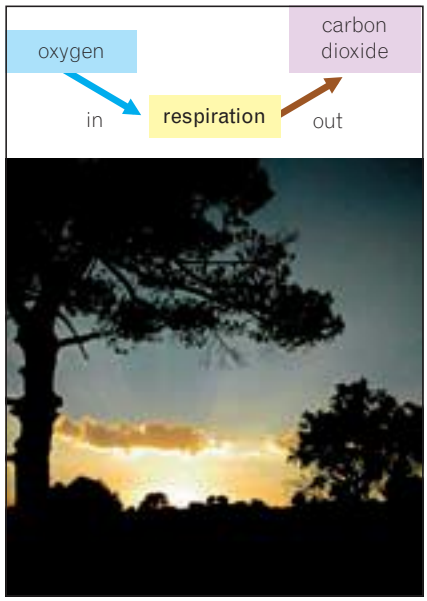
- **Absorption.** Plants absorb water and mineral salts from the soil through their roots. When mineral salts dissolve in the water, **raw sap** is produced.
- **Transportation.** The raw sap travels up the conductor vessels from the roots to the stem and leaves.
- **Transpiration.** Excess water is expelled through the stomata as water vapour. As a result, raw sap goes up into the leaves.
- **Photosynthesis.** Raw sap is transformed in the **leaves** into **elaborated sap**: a mixture of water and organic substances. It contains sugars. Sunlight provides the energy needed for this process. During photosynthesis, the plant absorbs carbon dioxide through its leaves. The leaves then expel oxygen through the stomata.

  Finally, the elaborated sap is distributed throughout the plant cells by the conductor vessels.
- **Respiration.** Plants breathe. During respiration, plant leaves take in oxygen from the air and release carbon dioxide.





Daytime: respiration and photosynthesis take place simultaneously. Plants breathe AND carry out photosynthesis.



Nighttime: plants breathe but do NOT carry out photosynthesis.

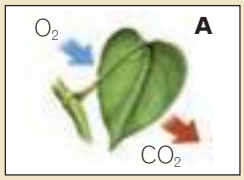
Activities

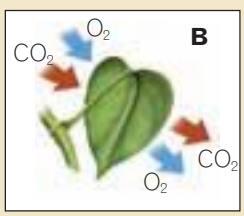
12. Draw a diagram of a plant. Indicate the phases of nutrition for each part.

13. Observe these drawings.

a. What does each drawing represent? Day or night?

b. Do plants breathe and carry out photosynthesis all day? Explain your answers.



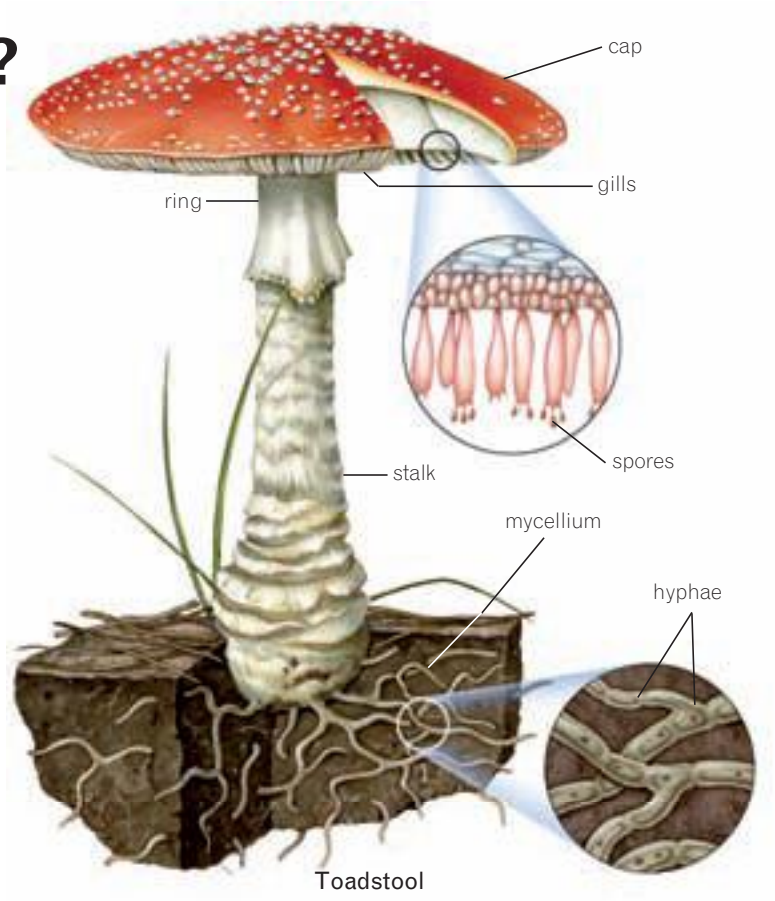


8. What are fungi like?

Fungi generally grow in the soil in dark, damp places.

The main characteristics of all fungi are:

- They can be **unicellular** or **multicellular**. However, multicellular fungi do not produce different types of tissues.
- The cells are **eukaryotic**. They have a true nucleus and a rigid cell wall. They are similar to plants, but have no cellulose.
- They are **heterotrophic**: they do not produce their own food. There are two types: **saprotrophs** and **parasites**.
  - **Saprotrophs** break down food from dead, organic materials.
  - **Parasites** feed on other living beings. They cause diseases in plants and human beings.
- The body is made up of **hyphae** which are microscopic filaments. The hyphae group together to form the **mycelium**, which grows underground.
- Fungi reproduce by **spores**. When the spores are dispersed, they form new hyphae which grow into new fungi.



Toadstool

Activities

14. Compare fungi and plants. How are they different? How are they the same?

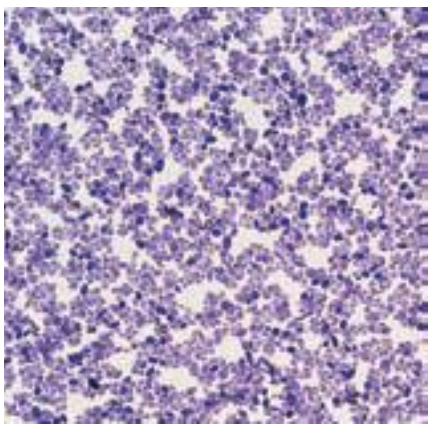
15. Talk about fungi:

Which fungi are... ...edible? ...useful? ...parasites? ...multi-cellular? ...poisonous?

16. Research mushrooms and toadstools. Make a poster.

Three groups of fungi

Fungi can be classified into three main groups.


Yeasts. Some are parasites. Others are useful. Yeast is useful for making bread, beer, wine.


Moulds. Multicellular. Some are parasites. Others feed on organic matter and decompose it: bread mould, fruit mould.


Mushrooms. Multicellular. Some are edible. Others are poisonous.

Activities

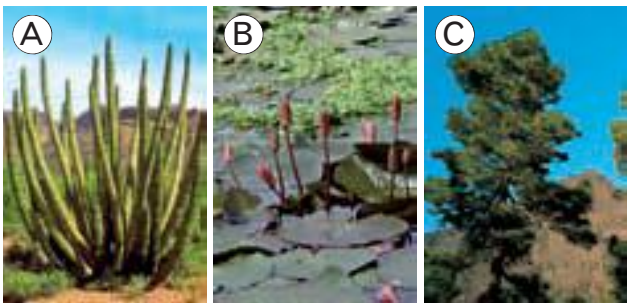
17. Can a plant move around? And make movements? Explain your answer, giving examples.

18. Study the photos and answer.

a. What environments do plants live in?

b. How do they carry out nutrition?

c. Are plants unicellular or multicellular?



19. Plants are autotrophic organisms.

Can photosynthesis take place in a plant root? Why or why not?

20. Which part of the plant is each of these foods?

a. cauliflower b. lettuce c. carrot

d. green bean e. artichoke f. red pepper

21. Imagine the stem from a white carnation is left in a glass of red ink.

a. After some time, the carnation petals turn red. Why does this happen?

b. What mechanism allows the liquid to travel up the stem?

22. If a flowerpot is placed in a window, the stem grows in the direction of the light. Is this reaction temporary or permanent?

23. Cacti have very small leaves, like thorns.
What advantage does this have for the plant? What characteristics of cacti allow them to survive in the desert?

24. Put the stages of plant nutrition in order.

a. Carbon dioxide enters through the stomata.

b. The raw sap travels from the root to the leaves.

c. Oxygen is released and elaborated sap is formed.

d. The roots absorb water and mineral salts, and raw sap is formed.

e. Elaborated sap is transported to all parts.

f. Photosynthesis takes place in the cells of the green parts of the plant.

25. Copy and label the flower diagram.

26. Compare mosses and ferns. Complete the chart.

	Size	Vascular or non-vascular?	Roots, stems, leaves?	Reproduction
Mosses				
Ferns				

27. Describe the life cycle of a moss.

28. Why do you think male pine cones are located on the far ends of the branches?

29. Paper is made with cellulose. To obtain the cellulose from trees, they are cut down.

a. How could more trees be saved?

b. How can you recycle paper?

c. How else can you save and reuse paper?

30. Look at the tree trunk. There are pairs of rings. The light area corresponds to springtime, when the tree grows most. The dark corresponds to autumn, when it grows less. To find out a tree's age, count each pair of light and dark rings.

How old is this tree ?

What should you know? 6

PLANTS

Plants are multicellular, autotrophic living things.
They live fixed to the soil, but can make some movements.

Functions

- **Nutrition.** There are five stages: absorption of nutrients, transportation, transpiration, photosynthesis and respiration.
- **Interaction with environment.** Plants can respond to changes.
- **Reproduction.** Asexual (only one plant is involved) and sexual (two different plants are involved).

Non-flowering plants

- **Mosses.** They are small, non-vascular plants. They have no true roots stems or leaves.
- **Ferns.** They are vascular plants. They have roots, stems and leaves called fronds.

Flowering Plants

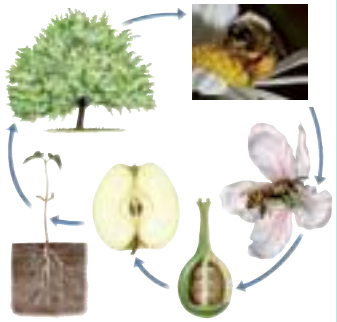
- **Gymnosperms.** They have seeds, but no fruit. They have small, insignificant flowers.
- **Angiosperms.** The seeds are protected by a fruit. They have colourful flowers.

Leaves. They carry out photosynthesis. Gases are exchanged and transpiration takes place through the leaf stomata.

Stems. They keep the plant upright and support the plant structure.

Roots. They fix the plant in the soil, and absorb water and mineral salts.

Flowers. They contain the reproductive system. The main parts are the corolla, calyx, stamen and pistil.



FUNGI

Fungi can be unicellular or multicellular. They have eukaryotic cells. They are heterotrophic. Fungi are made up of hyphae, which group together to form the mycelium. Fungi are classified into:

- **Yeasts.** *Unicellular*. They are used to make bread, wine, beer…
- **Moulds.** *Multicellular*. They grow on food products.
- **Mushrooms and toadstools.** *Multicellular*. Some are edible, others are poisonous.

Projects

INVESTIGATE: How is bread made? How was penicillin discovered? What sort of fungi are involved?

WEB TASK: Where can you find the tallest tree in the world?