

UNIT 3



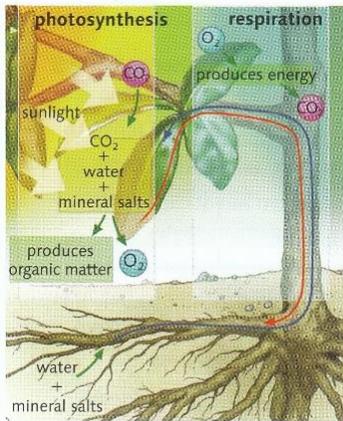
THE PLANT KINGDOM



1. THE PLANT KINGDOM

Plants are multicellular organisms made up of eukaryotic cells, with a rigid cell wall made of cellulose. They make their own food through **photosynthesis**: they are autotrophs. Photosynthesis takes place in the **chloroplasts** of some plants cells, where chlorophyll absorbs solar energy (from sunlight). Plants use this energy to transform water and mineral salts from the soil, and carbon dioxide from the air, into organic matter. Oxygen is also released during photosynthesis.

Most plants are green (because of the chlorophyll) and are adapted to living on land. They are usually attached to the ground through roots.



Photosynthesis and respiration in plants

Plants also respire, like any other living being. Respiration takes place in every plant cell: organic matter and oxygen is consumed and carbon dioxide and energy are released. Plants use this energy to carry out their vital functions. Plants respire all the time, whether it is dark or light. They photosynthesise only when they are in the light.

The water and mineral salts that plants absorb from the soil through the roots form **xylem sap**. It then goes up to the leaves, where it is transformed into **phloem sap**. This is a mixture of the organic matter produced during photosynthesis dissolved in water. From the leaves, the phloem sap is distributed to the whole plant. In most plants sap is transported by the **vascular conduits**.

1.1. Classification of plants

Plants are classified according to their type of reproduction. Plants are divided into **non-flowering** seedless plants and **flowering** plants, with seeds. Non-flowering plants include more primitive plants such as liverworts, mosses, horsetails and ferns, which reproduce by spores. Flowering plants are also called **spermatophytes**: they use seeds to reproduce.

Liverworts and mosses (**Bryophytes**) are considered non-vascular plants because they don't have a true vascular system. Horsetails and ferns (**Pteridophytes**) and Spermatophytes are considered vascular plants because they have well developed woody vascular conduits.

2. GENERAL STRUCTURE OF PLANTS (SPERMATOPHYTES)

Plants are complex living things with developed tissues and organs. Organs in plants are specific parts with specific functions. Even though not all plants have true organs, such as Bryophytes, most plants have three main differentiated organs: the **root**, the **stem** and the

leaves.

2.1. Roots

Roots grow in the opposite direction of the stem and are usually underground. They attach the plant to the ground and have very thin **absorbent root hairs** that collect the water and mineral salts from the soil to form xylem sap. There is a **main root**, which has several **secondary roots**.

2.2. The stem

The stem is usually visible above the ground. It supports the leaves and flowers and contains conducting tissues that transport sap between different parts of the plant. There are different types of stems: **herbaceous**, **woody** or **underground stems**.

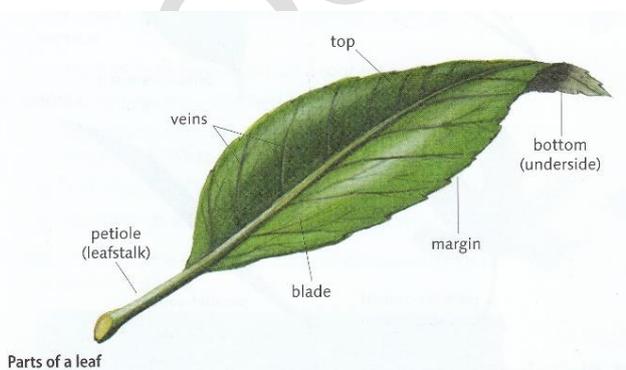
2.3. Leaves

Leaves are usually flat and green and grow out from the trunk or the branches.

Parts of the leaf:

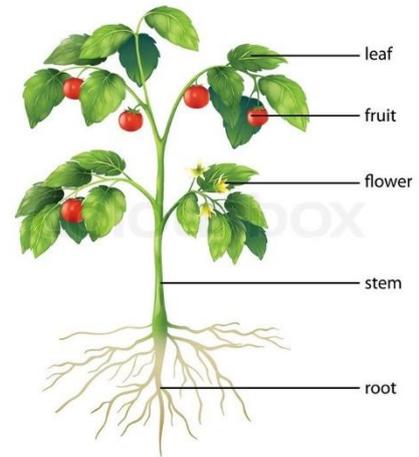
- The **blade** is the flat wide part of the leaf. It contains the **veins** (conduits which transport sap).
- The top and the bottom are the upper side and the **underside** parts.
- The underside contains little pores called stomata.
- The **petiole** (leafstalk) joins the leaf to the stem or branches.

Leaves are where photosynthesis takes place (thanks to the chlorophyll inside the chloroplasts). Gases from the air can go into and out of the plant through small pores on the underside of leaves called **stomata**. Besides gas exchange, laves can also regulate the amount of water inside the plant through the process called **transpiration** (evaporation of water vapour) through stomata.



Parts of a leaf

Flowering Plant (Angiosperm) Anatomy



Leaves can be classified according to two main criteria: vein structure and blade shape or the margin of the leaf.

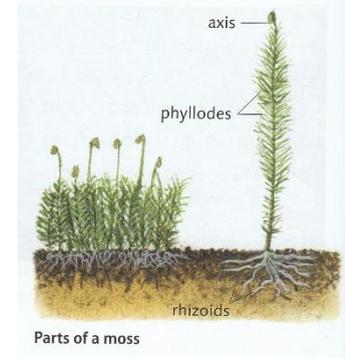
3. NON-FLOWERING PLANTS

This group includes plants with no flowers that reproduce by means of **spores**, like Bryophytes and Pteridophytes. They use to live in very humid and shady places.

3.1. Mosses and liverworts (Bryophytes)

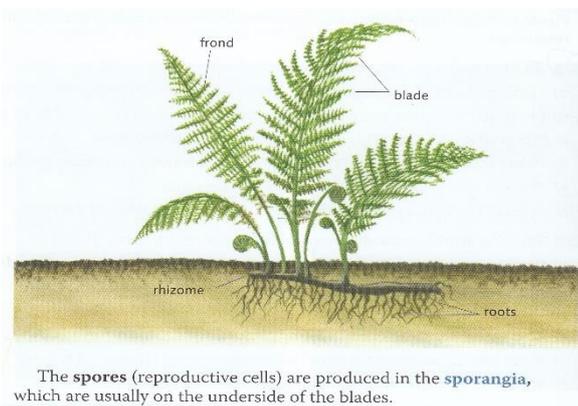
These are the most primitive plants on Earth. Bryophytes don't have true tissues and organs, they absorb water and mineral salts through their whole surface.

Mosses have three main parts: an **axis** (similar to a stem), **phyllodes** (similar to leaves) and **rhizoids** (similar to roots).



3.2. Ferns and horsetails (Pteridophytes)

This second group of plants have already developed roots, stems and leaves. They also have woody vascular conduits, but they still don't produce flowers or seeds for reproduction.



The **rhizome** (stem) of ferns is under the ground, **fronds** (large leaves) come out of the rhizome. The **roots** are on the lower part of the rhizome and have absorbent hairs on them.

The reproductive cells, **spores**, are produced inside the sporangia that are grouped in **sori**, on the underside of the fronds.

Horsetails have rhizomes too and all Pteridophytes need to live in humid places.

4. FLOWERING PLANTS

Flowering plants are **spermatophytes**: they use seeds to reproduce. The seeds are produced by specialized structures called **flowers**.

Flowering plants are classified into **gymnosperms** and **angiosperms** according to the type of flowers they have.

4.1. Gymnosperms

Gymnosperms have the following characteristics:

- They are all **woody** plants; most are trees, although some are shrubs.
- They are **perennial** (evergreen plants): they don't lose their leaves in winter. Many of these species have leaves shaped like needles (the pine tree) or like scales (the cypress tree).

- They have unisexual simple flowers, without sepals or petals, called **cones**. Male cones are usually grouped in **inflorescences**.
- Seeds are formed inside female cones, but no fruit is formed. Their naked seeds are exposed to the environment.

Ginkgoes, cycads and conifers are gymnosperms. Conifers are the largest and most well-known group of gymnosperms. They include pine and fir trees, cedars, cypresses or junipers. Mature female cones in conifers are called **pine cones**, which contain the pine seeds, pinions.

4.2. Angiosperms

In this group of plants, the seeds are formed inside a **fruit**. Angiosperms can be woody or herbaceous plants and have developed colourful and complex flowers.

Angiosperms flowers can have up to four types of organs:

- **Sepals** are leaves located below the petals. They are usually small and green. Collectively, the sepals are called the **calyx**: The **calyx** protects the internal parts of the flower.
- **Petals** are the coloured leaves that attract insects. Collectively the petals are called the **corolla**.
- **Carpels (pistils)** are the **female** reproductive organs of a plant. A carpel includes the **stigma**, the **style** and the **ovary**. Inside the ovary are the **ovules**, which contain the female gametes.
- **Stamens** are the **male** reproductive organs of the flower. They have a **filament** with an **anther** at the end: the anther produces the **pollen grains** (with the male gametes inside). Stamens are protected by the corolla.

A **complete flower** is a flower that has all four types of organs, but not all flowers are complete:

- **Male** flowers only have stamens, but no pistils.
- **Female** flowers only have pistils, but no stamens.
- A **hermaphrodite** flower is a flower that has both stamens and pistils.

A group of flowers on the same stem is called an **inflorescence**.

■ Fruit and seeds

Angiosperms produce **fruit**: structures that come from the flower's ovary and that contain one or several **seeds**. Fruit can be **fleshy**, such as the tomato, or **dry**, such as nuts.

Fruits **disperse** seeds so that they can **germinate**: develop and produce a new young plant. For germination to take place the seeds must be dispersed: they must land on suitable ground, at a distance from the mother plant and have enough space, light and nutrients available to grow.