Lesson 1 Plants- Living Things

Have you ever considered where your food comes from? Fruits and vegetables come from plants, but what about meat, fats, dairy products and junk food?

Meat comes from animals (mainly cattle, sheep and poultry) as do dairy products and some fats. These animals eat plants. Junk foods are mainly made up of fat, sugar and flour. Lipids (fats and oils) come from animals or plants (eg. canola oil), while sugar and flour come from plants.

So you can see that plants are essential for our lives. They transform the Sun's energy into a form of energy able to fuel our bodies. The more we know about the structure of plants and their functions, the more we can improve on plant health, growth and yields.

Plants are organisms. You, your pets, the plants around your house and your friends are all made up of cells. Cells are the smallest units of life. All living things are made up of cells and all cells come from other cells. You came from your mother's and father's cells. You are a living thing. All living things are called organisms. Plants are organisms too, autotrophic organisms. Plants are autotrophic organisms. An autotroph is a 'self–feeder' it makes its own food by a process called photosynthesis.

Plants contain a green chemical called chlorophyll that is needed for photosynthesis to occur. Chlorophyll is stored in parts of a plant cell called chloroplasts. The chloroplasts use energy from sunlight to make food using water (from the soil) and carbon dioxide (from the air).

How do we know that plants are actually living?

- There are 7 signs that something is living. Have you ever heard of the acronym **MRS.GREN?**

M=Movement

R=Reproduction

S=Sensitivity

G= Growth

R=Respiration

E=Excretion

N=Nutrition

So let's see if plants are definitely alive using this acronym **MRS.GREN.**

		Yes	No
M=Movement	Do plants move?	☐	☐
R= Reproduction	Do plants reproduce?	☐	☐
S=Sensitivity	Are plants sensitive?	☐	☐
G=Growth	Do plants grow?	☐	☐
R-Respiration	Do plants use energy?	☐	☐
E=Excretion	Do plants get rid of waste?	☐	☐
N=Nutrition	What do plants need to grow?	☐	☐

Yes, hopefully you were correct and ticked all boxes yes. Therefore, plants are in fact living things.

Go to the send in exercises and complete **exercise 1.1**

CELLS alive! - Plant Cell Worksheet

https://www.cellsalive.com/swf/cell_model.swf

Go to the website above and complete this activity. You must fill in the name and function of the different parts of a plant cell **(send in exercises 1.2**) some of these parts you may not have heard of before.

Specialised plant cells

Like animals, plants are multicellular organisms. Plants have specialised cells of different shapes and sizes, but they do not have as many different types of cells as animals.

Each type of cell is specialised to carry out a different function within the plant.

Specialised plant cells

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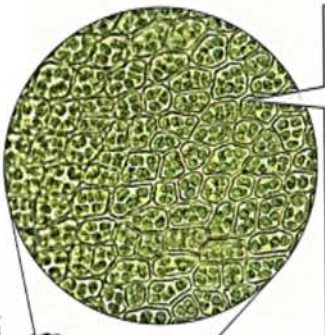
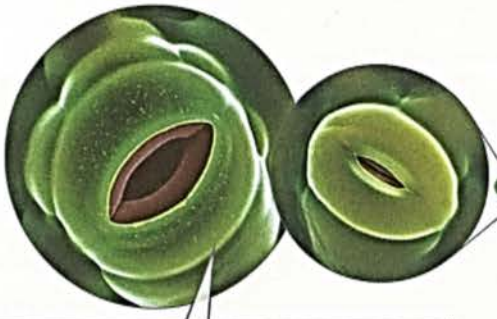
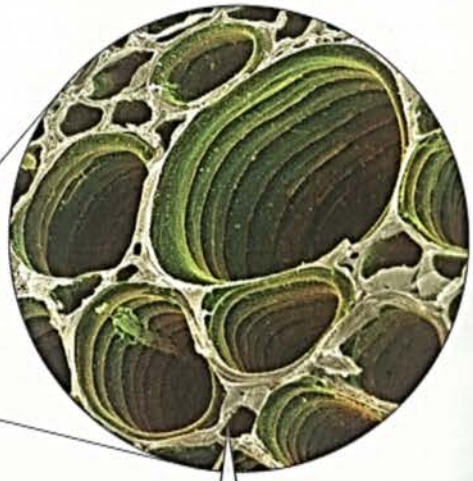
Each type of cell is specialised to carry out a different function within the plant. Figure 2.3.8 shows some plant cells that have different functions.



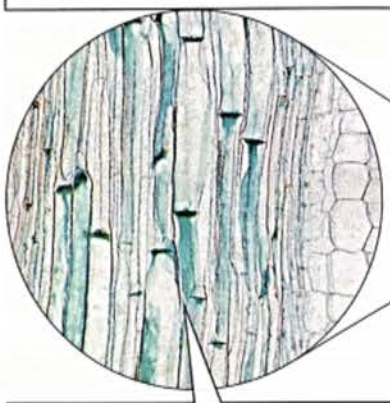
Photosynthetic cells
Cells near the surface of the green parts of stems and leaves have large numbers of chloroplasts. In the chloroplasts is a green chemical called **chlorophyll**. This chemical traps the Sun's energy, which the plant then uses in photosynthesis. Plant cells that are not exposed to sunlight, such as those in the roots, do not contain chloroplasts and are not green.



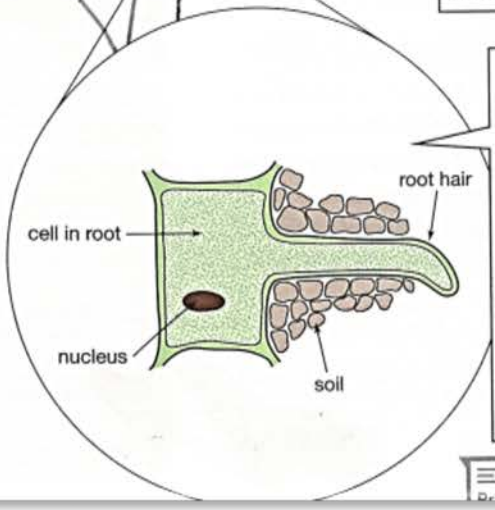
Guard cells
Guard cells are found on the leaves and stems of plants. Guard cells work in pairs to open and close very tiny pores (or holes) in the leaves called **stomata**. Gases needed by the plant enter through open stomata. Unwanted gases leave the same way. Guard cells close the stomata when plants need to reduce water loss.



Structural cells
The cell walls act as the skeleton of plants. When plants grow, they become bigger and heavier. Then their skeleton needs to get stronger. The cell walls of many cell types, especially the water-conducting cells in the plant stem, become thicker and stronger, providing more support. The wood of tree trunks is mostly cells with walls that are so thick that the cell has died. The living part of a tree trunk is just inside the bark.



Conducting cells
Plants take in water from the soil through their roots. The water is needed in the leaves for photosynthesis. This means that water has to be transported from the roots to the leaves. Plants make their food in the leaves but the cells of the roots and stems need food if they are going to stay alive. This means the food has to be transported from the leaves to the roots and stems. Inside the plant are cells that are specialised for transporting water and food. These conducting cells are long thin tubes like drinking straws.



Root hairs
Plants cannot move around to get water from where it is available. This means they need an efficient way of taking in water where they are growing. Water comes into plants from the soil through the surface of their cells. The more surface they have in contact with the soil, the more water they will be able to take in. Some of the cells on the outer surface of roots have extensions called **root hairs**. These root hairs increase the surface area of the root by a large amount.

Figure 2.3.8 Different plant cells have different jobs to do.

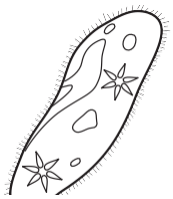
Go to the send in exercises and complete exercise 1.3

Types of organisms

1. Unicellular organisms

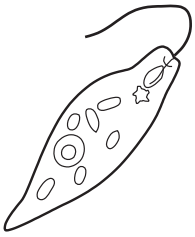
Some organisms are **unicellular**. This means that they are only made up of one cell. The single cell exchanges gases with its environment, feeds and gets rid of wastes as a single cell.

Here are some examples of unicellular organisms.

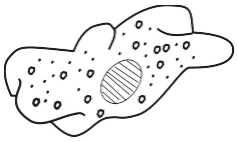


paramecium

d Diatom



euglena



amoeba

1. Microscopic unicellular organisms.

a. diatom – **microscopic** single celled **photosynthetic algae**, living in groups or colonies
b. amoeba – single celled organism which moves by **pseudopodia** to gain food

   https://www.youtube.com/watch?v=7pR7TNzJ_pA
c. euglena – single celled photosynthetic algae

   https://wn.com/euglena_motion
d. paramecium – microscopic single celled organism that moves with **cilia** to find food

   https://www.youtube.com/watch?v=pvOz4V699gk

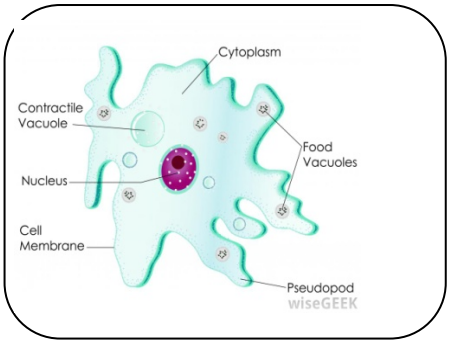
2. Multicellular organisms

A **multicellular** organism is made up of different kinds of specialised cells; each kind of cell has a particular role or function that benefits the organism. Each cell in a multicellular organism is dependent on other cells for its survival.

You are a multicellular organism. Do you think all your cells are identical? Does a cell in your tongue do the same thing as a bone cell in your leg? Do all your cells do the same things?

You have specialised cells in your lungs which absorb oxygen and release carbon dioxide. Other cells in your stomach assist in the digestion of food. Cells in your kidneys filter out wastes. Cells in your heart work together to pump blood around your body. Cells in your bones help you to stand up straight and move around.

As you can see, your body is made up of many different cells and each kind has a different role. Most plants are multicellular organism's t



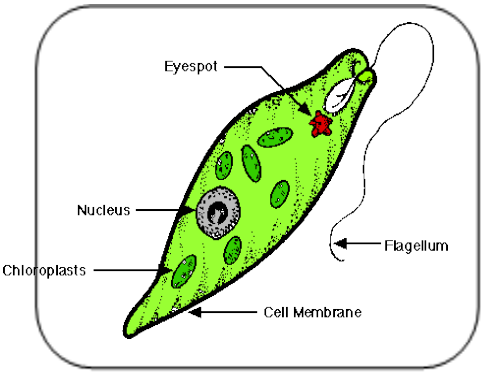
Amoebas have projections called pseudopods. What are they used for?

_____

Do you think amoebas are a type of animal cell or plant cell?
Explain your answer.

_____

_____



Euglena are not plant cells even though they contain chloroplasts.
Why do you think this is?

_____

What is the function of the eyespot?

_____

1 Define a unicellular organism and give an example.

_____

_____

2 Define a multicellular organism and give an example.

_____

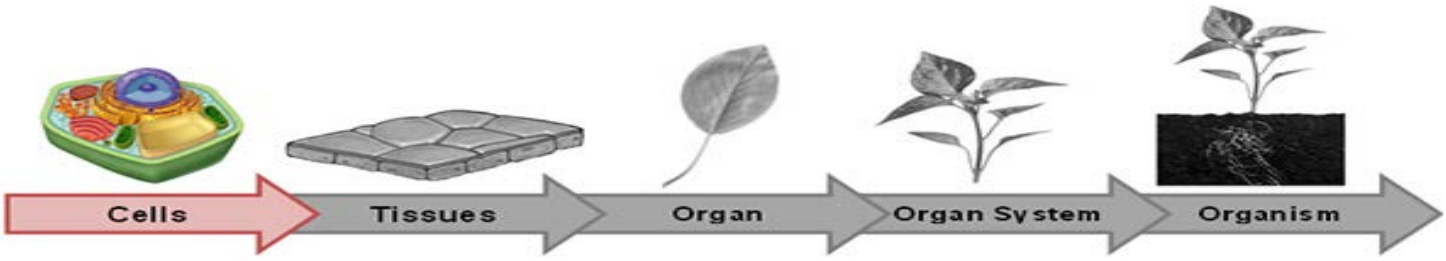
_____

Lesson 2

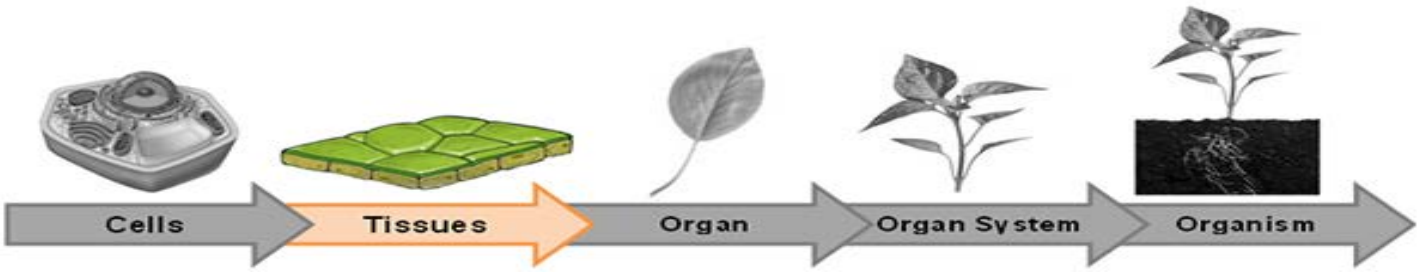
Plant cells, tissues, organs and systems

Although flowering plants are simpler than animals, they have tissues and organs too. These tissues and organs enable the plants to carry out essential functions such as photosynthesis, transport and reproduction. For example, many plants use flowers to reproduce and so flowers are their reproductive organ. jf

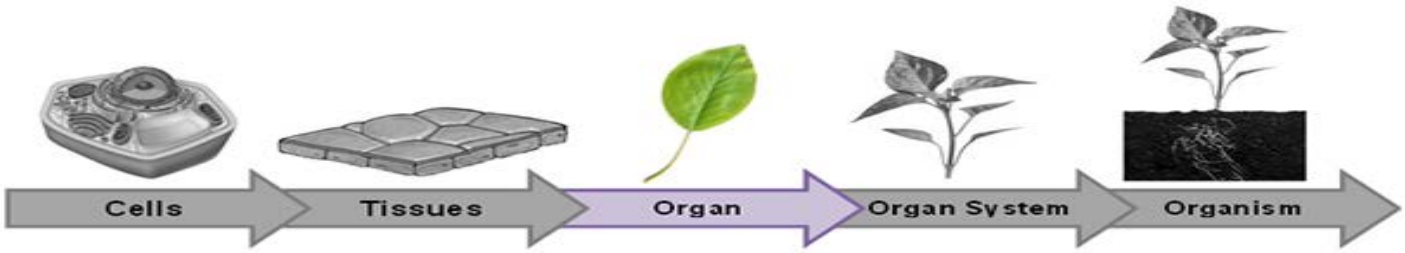
Cell-> Tissue ->Organ ->System -> Group of systems ->Organism



Plants are eukaryotic cells that have a cell wall and chloroplasts. A plant cells grow and mature, they become specialized to do specific jobs within the plant. For example, guard cells are located in the epidermis of leaves and control the opening and closing of the stomata. Phloem cells are found in the vascular tissue and carry nutrients throughout the plant. Xylem cells are also found in the vascular tissue and carry water throughout the plant.



Plants have three types of tissue: **dermal, vascular and ground tissue.** These three tissue can be found throughout the plant.



There are four types of organs found in plants: roots, stems, leaves and reproductive structures. The image below shows the main functions of plant organs.

Reproductive structures

- Function to make more plants
- Include flowers, fruit, cones and seeds

Leaves- the primary site of photosynthesis

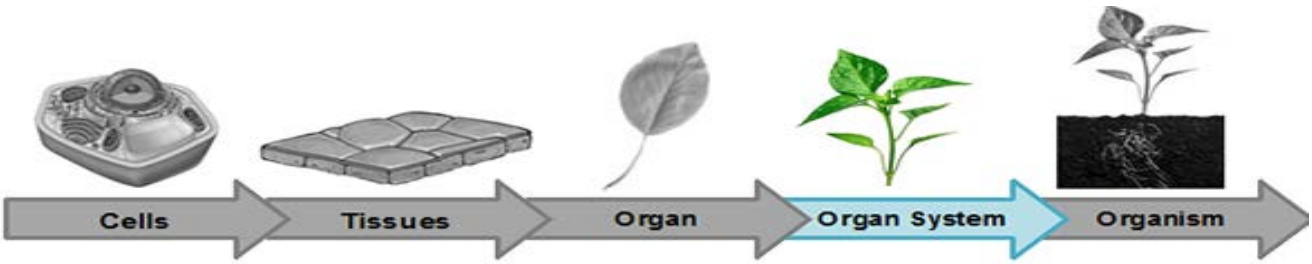
Stems

- Support and elevate the leaves
- Transport water and nutrients between root and shoots
- Store water and nutrients

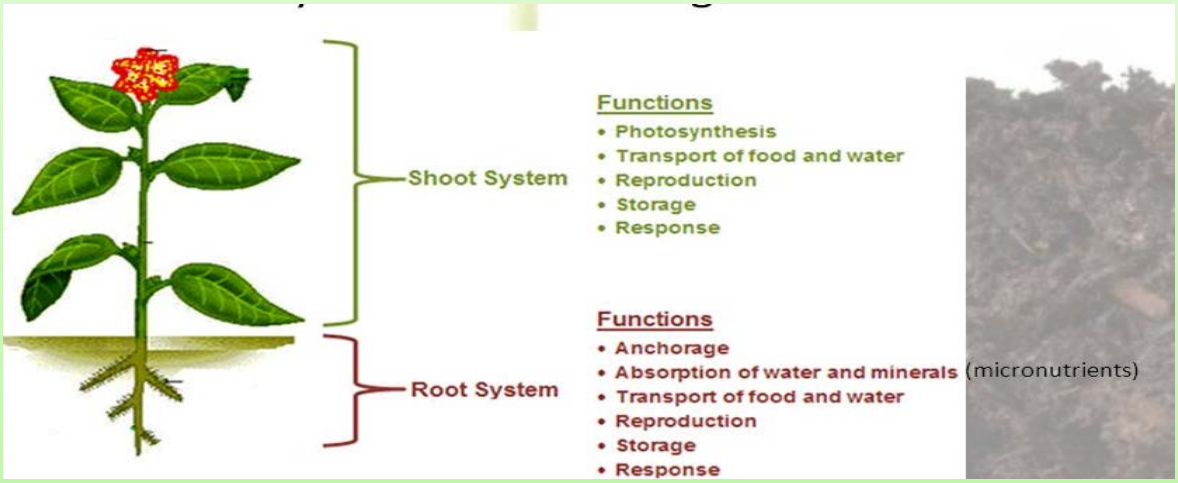
Roots

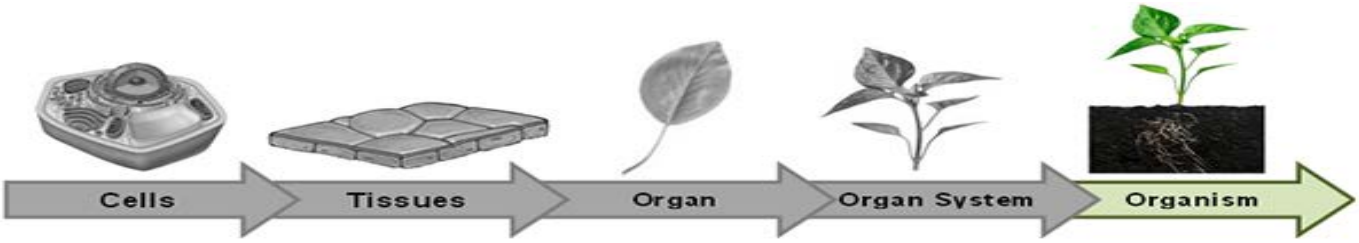
- Anchors the plant
- Absorb minerals and water
- Store nutrients

Not all plant have all of these organs, and some plants have modified versions of these organs. For example, cacti have modified leaves called spines, and potatoes are modified stems called tubers.



Plants have two organ systems, the shot system and the root system. The shoot system is above the ground. The shoot system includes organs such as leaves, stems, flowers and fruits. The roots system is below the ground. The root system includes the roots and modified stem structures such as rhizomes and tubers. Each plant system has special functions. The picture below identifies the function of the shoot and roots systems of plants.





Plants are found all over the Earth. They are found on land, in freshwater, and in the ocean. Plants have the following three features that distinguish them from other living organisms.

- Plants have chlorophyll, a green pigment necessary for photosynthesis.
- Their cell walls are made sturdy by a material called cellulose.
- They are fixed in one place(they don't move)

Go to the send in exercises and complete exercise 2.1

Lesson 3

Photosynthesis

Unlike animals, plants have no mechanism, to eat food. They have no digestive systems and cannot go hunting or move about grazing on other organisms. That requires them to make their own food, glucose. They do this in a process called photosynthesis. Yet, the production of glucose is useless unless the chemical energy contained in it can be released. This is the role of another chemical reaction, respiration. Although very different in detail, photosynthesis and respiration are effectively opposites of each other.

Click on this interactive to help with your understanding of photosynthesis.

http://www.harcourtschool.com/activity/science_up_close/311/deploy/interface.swf

What do plants need to survive?

Glucose ($C_6H_{12}O_6$) is a type of sugar. It provides all the energy that animals and plants need. Animals get their glucose by digesting food, whereas plants make their own glucose by a set of chemical reactions known as photosynthesis.

Photosynthesis combines carbon dioxide (CO_2), drawn from the air) and water (H_2O, drawn from their roots) to make glucose and oxygen gas (O_2, which is released back into the atmosphere). The energy that powers the process comes from sunlight. This means that photosynthesis can occur only during daytime.

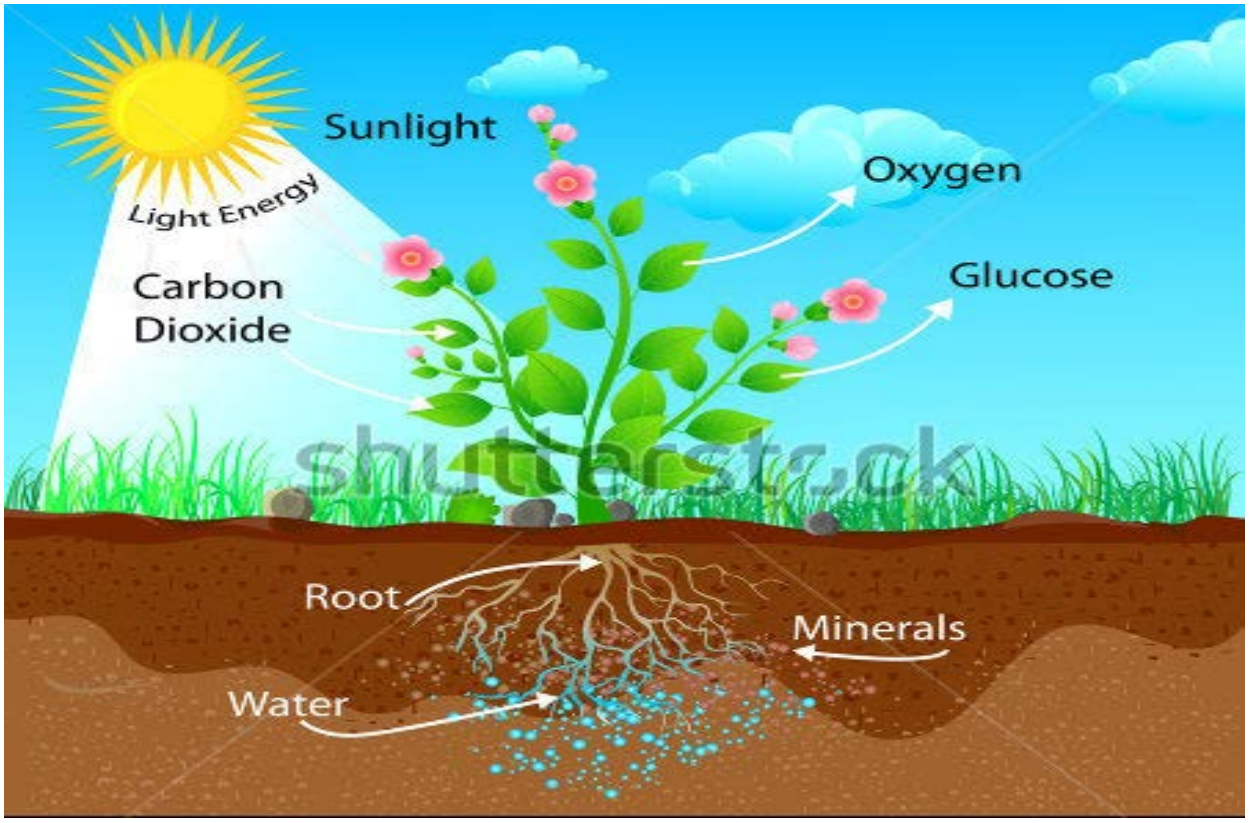
Photosynthesis is a series of reactions, but can summarised by the word equation below.

carbon dioxide + water $\xrightarrow[\text{chlorophyll}]{\text{light energy}}$ glucose + oxygen

Chemists write this as a balanced chemical equation:

Light energy (from the sun)

$6CO_2 + 6H_2O$ ----------→ $C_6H_{12}O_6 + 6O_2$



A plant draws in the required carbon dioxide from the air around it and draws up the water it needs through the roots. The oxygen

produced in photosynthesis is released back into the air. The other product, glucose, is a type of sugar that acts as food for the plant.

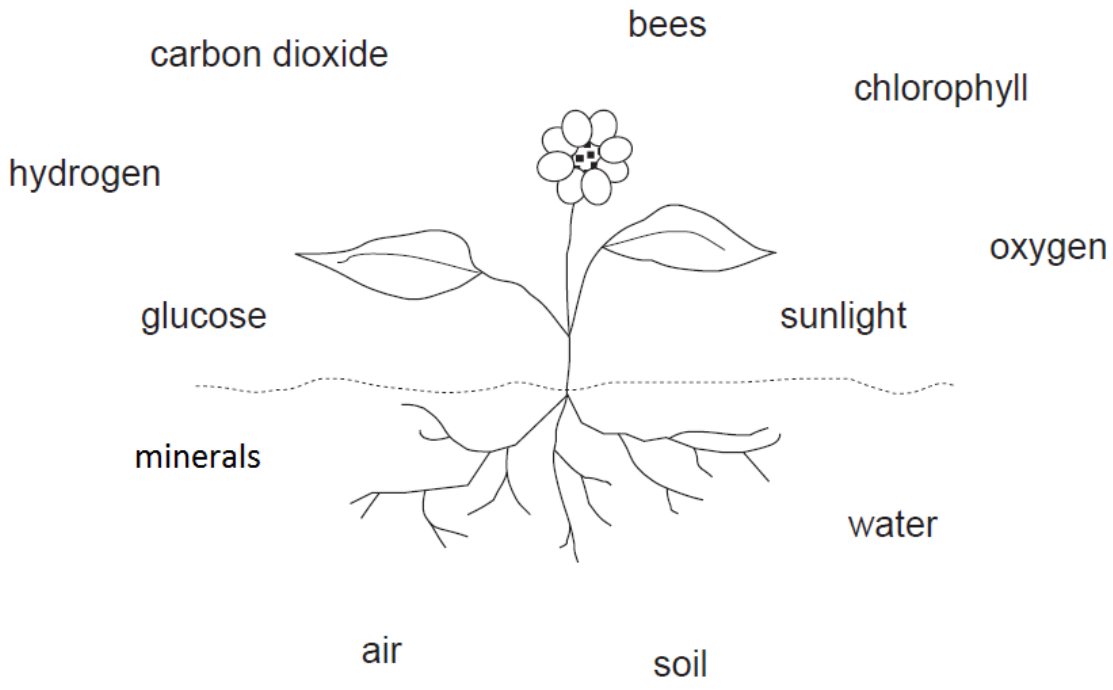
https://www.youtube.com/watch?v=eo5XndJaz-Y

Activity: Inputs and outputs of photosynthesis

Look at the diagram below and recall what you know about photosynthesis, then:

• circle the things that a plant needs for photosynthesis

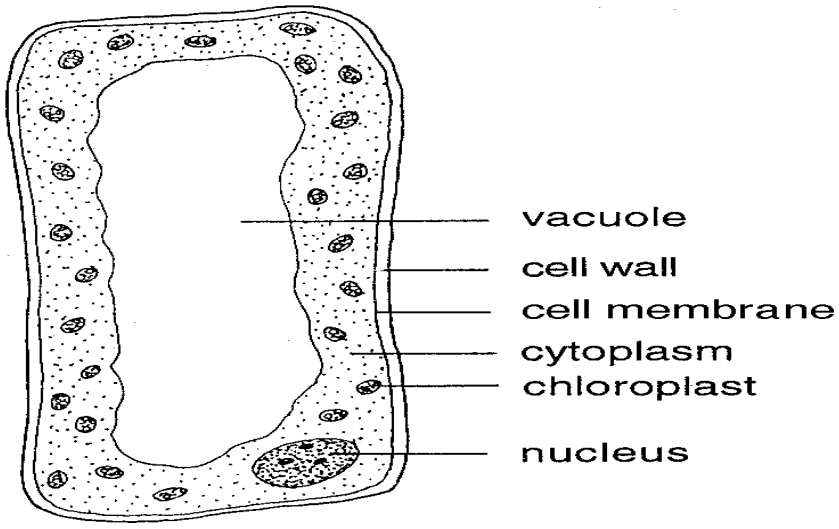
• put a rectangle around the substances that a plant produces during photosynthesis



Check and mark your answers with the suggested answers

Photosynthesis and respiration in plants occur inside their cells.

The diagram below shows the inside of a **typical plant cell that carries out photosynthesis.**



A typical plant cell that carries out photosynthesis

The structures in the cell called chloroplasts contain the **green pigment** called **chlorophyll**. Only those plant cells with chlorophyll carry out photosynthesis.

All plant cells, however, carry out respiration.

Activity

1. Write a word equation that summarises photosynthesis.

_____

2. Write a word equation that summarises cellular respiration.

_____

3. Complete the following sentences.

Photosynthesis occurs in plant cells that contain the green pigment, called _____. _____ occurs in all living cells to release _____ for growth and reproduction.

Check and mark your answers

What is photosynthesis?

What plants absorb (take in):

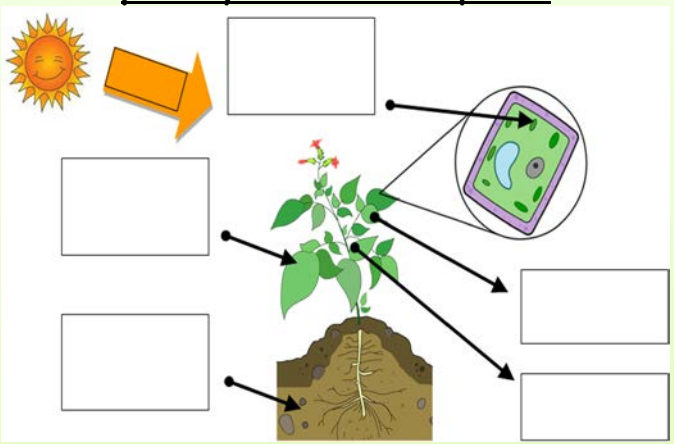
What plants give-off:

Where does photosynthesis happen?

In which plants?

Where in the cell?

Fill in the diagram to show how photosynthesis takes place:



Key Learning Question:

Why is photosynthesis important?

Extension

Why would cutting down lots of trees be a problem?

Why do we need photosynthesis?

Why do plants need it?

Why do animals need it?

Write down the steps in photosynthesis:

Lesson 4

Multicellular plants

Some plants are made of a single cell. Other plants are made of many cells created by cells dividing (**cell division**). These plants are called **multicellular plants**.

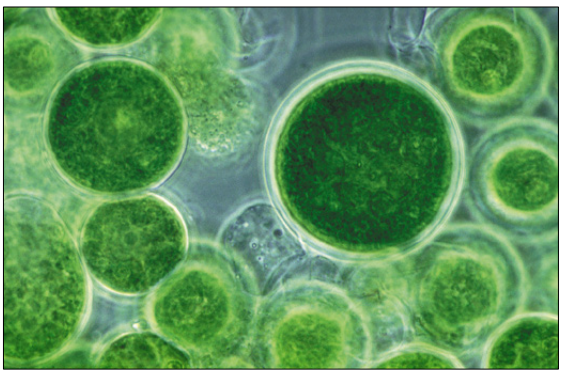


Figure 6 single celled, microscopic algae

Figure 7 multicellular plants- large kelp

In multicellular plants **cell division**:

- allows **growth** and **repair**
- creates different types of cells to form **different structures**

Different structures work together to move substances throughout the plant.

Types of multicellular plants

All multicellular plants can be divided into two large groups:

- vascular plants (those with internal tube structures)
- non-vascular plants (without internal tube structures)

Non-vascular plants

Non-vascular plants are simple plants with:

- Simple structures.
- They do not have strong tubes inside them for carrying water and food around the plant.
  They reproduce by releasing spores.
- These are hardy cells that can grow to produce new identical plants.
- An example of a non-vascular plant is a moss plant.

WITH NO VASCULAR TISSUES, MOSSES THRIVE IN AREAS HIGH IN MOISTURE.

MOSSES REPRODUCE WITH SPORES THAT MATURE IN CAPSULES.

Vascular plants

These plants have:

- **strong tubes in their structures** for carrying water and food around the plant.
- Examples are ferns, conifers and flowering plants (scientific name *Angiosperms*).
- There are many different types of flowering plants including trees, grasses and crops.

Figure 9 Examples of angiosperms (flowering plants)

Go to the send in pages to complete exercise 4.1

Activity

1. Explain why cell division is important for multicellular plants.

_____

_____

2. State the scientific name for flowering plants.

_____

Check and mark your answers

Now think back over the main points of the lesson then read the following summary.

Summary of Lesson 1

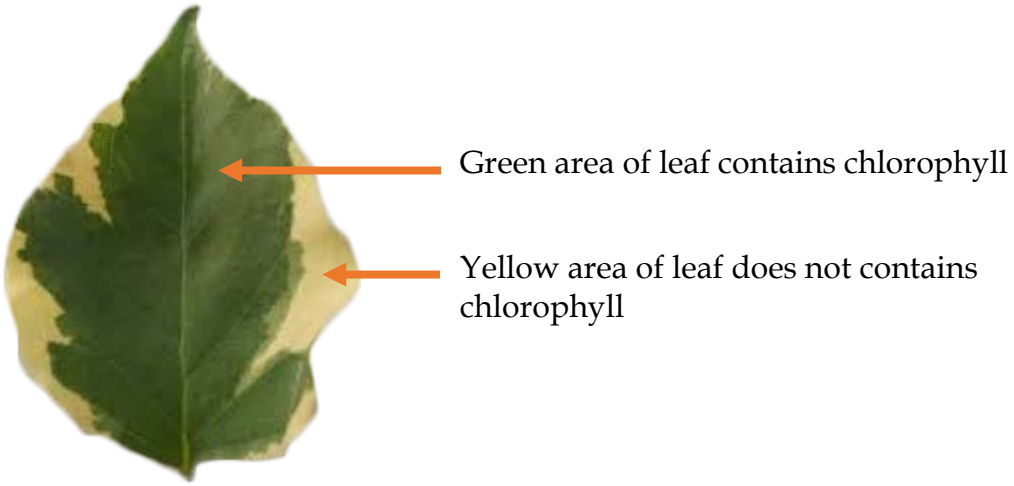
- All plant substances are made by photosynthesis reactions using light energy.
- All living cells use respiration reactions to get the chemical energy they need.
- Plants can be divided and classified into groups depending on their structures.

Complete the Send-in exercises for Lesson 1

Is chlorophyll is necessary for photosynthesis?

A group of students carried out an experiment to find out if chlorophyll was necessary to make food in the leaf.

They used a multi-colored leaf for their experiment. This leaf is special because part of the leaf was yellow and the rest was green. The yellow areas contained no chlorophyll.



Multi-coloured leaf

The students carried out a test with iodine to determine which parts of the leaf contained starch. Remember, leaves store food made in photosynthesis in the form of starch.

The leaf was boiled in water for 5 minutes to stop all chemical reactions and make the leaf cells more permeable to iodine.

It was then transferred into a boiling tube containing methylated spirits (alcohol). This boiling tube was placed in hot water bath for 10 minutes. The purpose of placing the leaf in warm alcohol is to remove the chlorophyll in the leaf and to make the colour change of iodine test more visible.

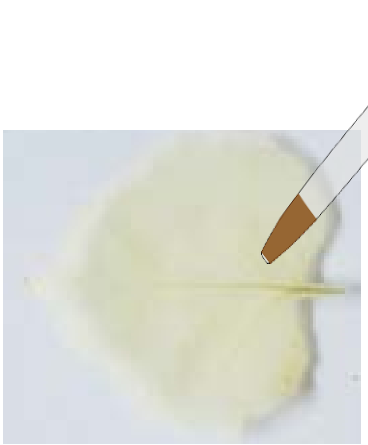
Boiling tube with leaf and methylated spirits

Beaker with boiling tube in water

The students observed that after placing the leaf in warm alcohol for 10 minutes, the alcohol turned green while the leaf turned colourless.

After this, the leaf was rinsed in warm water and spread evenly on a white tile.

The leaf was then soaked in iodine solution.



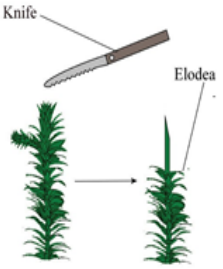
Iodine being poured over a decolourised leaf

Some of the leaf stained a dark colour and the rest was colourless.

Go to send in pages and complete exercise 4.1

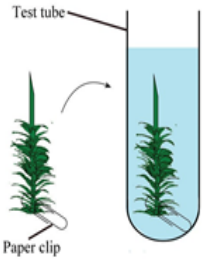
To investigate the influence of light intensity on the rate of photosynthesis

1



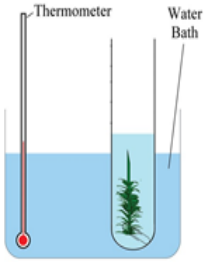
Cut the stem of the elodea at an angle. Remove several leaves from the cut end of the stem.

2



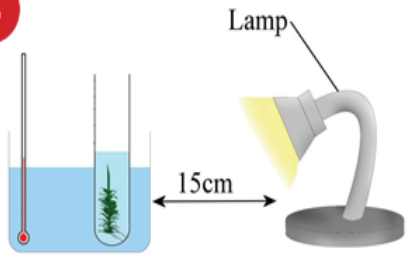
Hook a paper clip onto the end of the elodea. Drop the elodea, stem up, into a boiling tube of pond water.

3



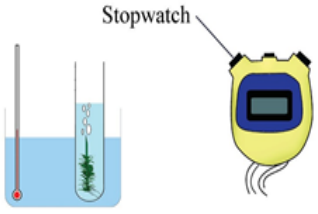
Place the boiling tube, containing the elodea into a water bath at 25°C.

4



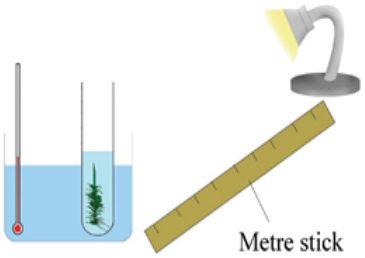
Switch on the light source and place the water bath containing the elodea 15cm from the lamp. Wait 5 minutes.

5

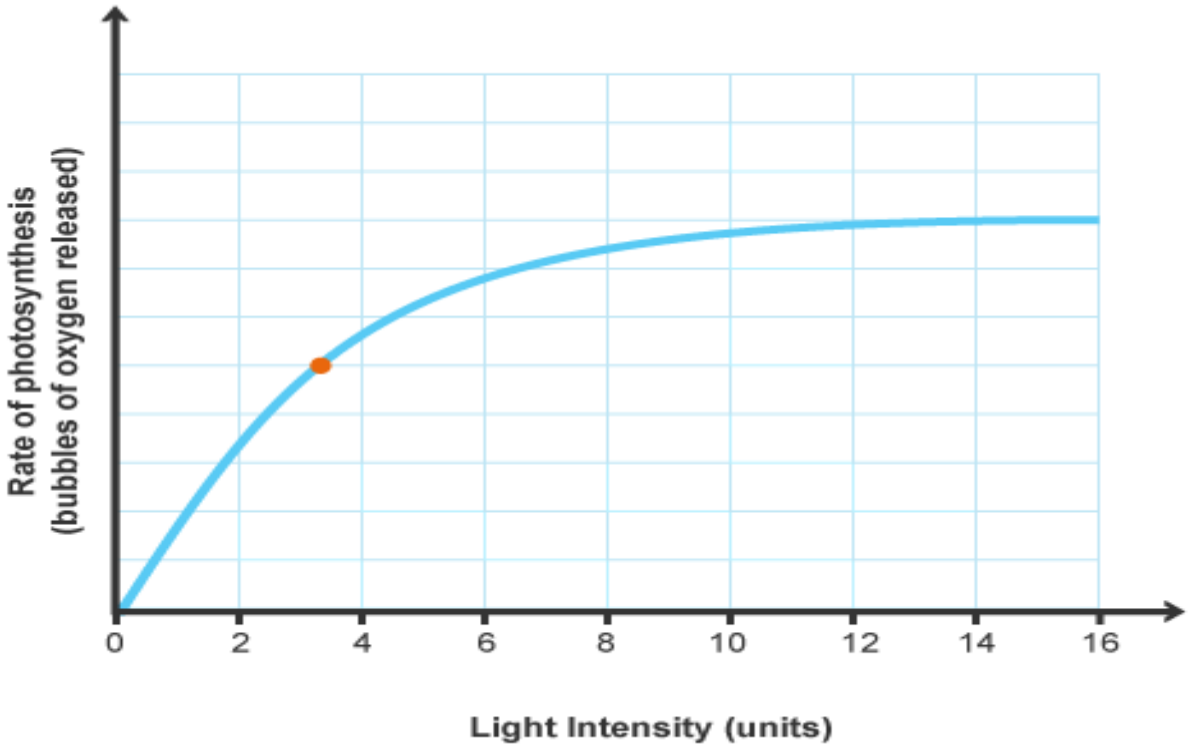


Observe bubbles being released from the cut end of the stem. Count and record the number of bubbles released per minute. Repeat twice.

6



6. Repeat the experiment, varying the distance between the water bath and the lamp.



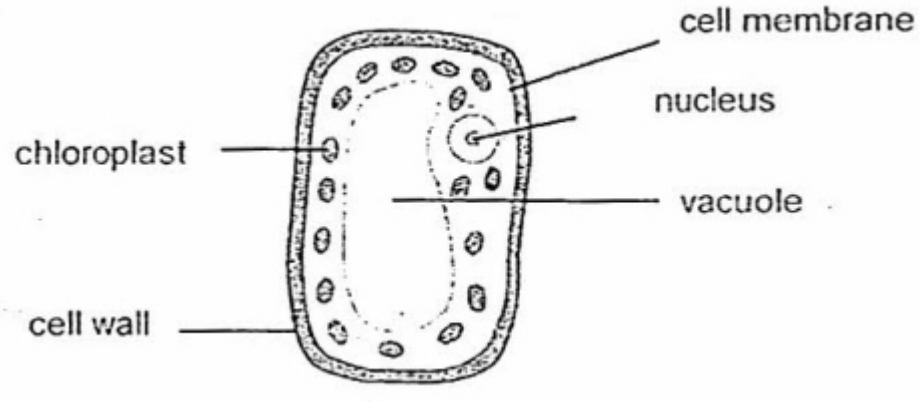
Send-in exercises

Exercise 1.1

Plant Cell Revision

1.Colour all the chloroplasts green in the plant cell below.

A basic plant cell



1. What do chloroplasts do?

_____

_____

_____

2. What does the term autotroph mean? Give an example of an autotrophic organism.

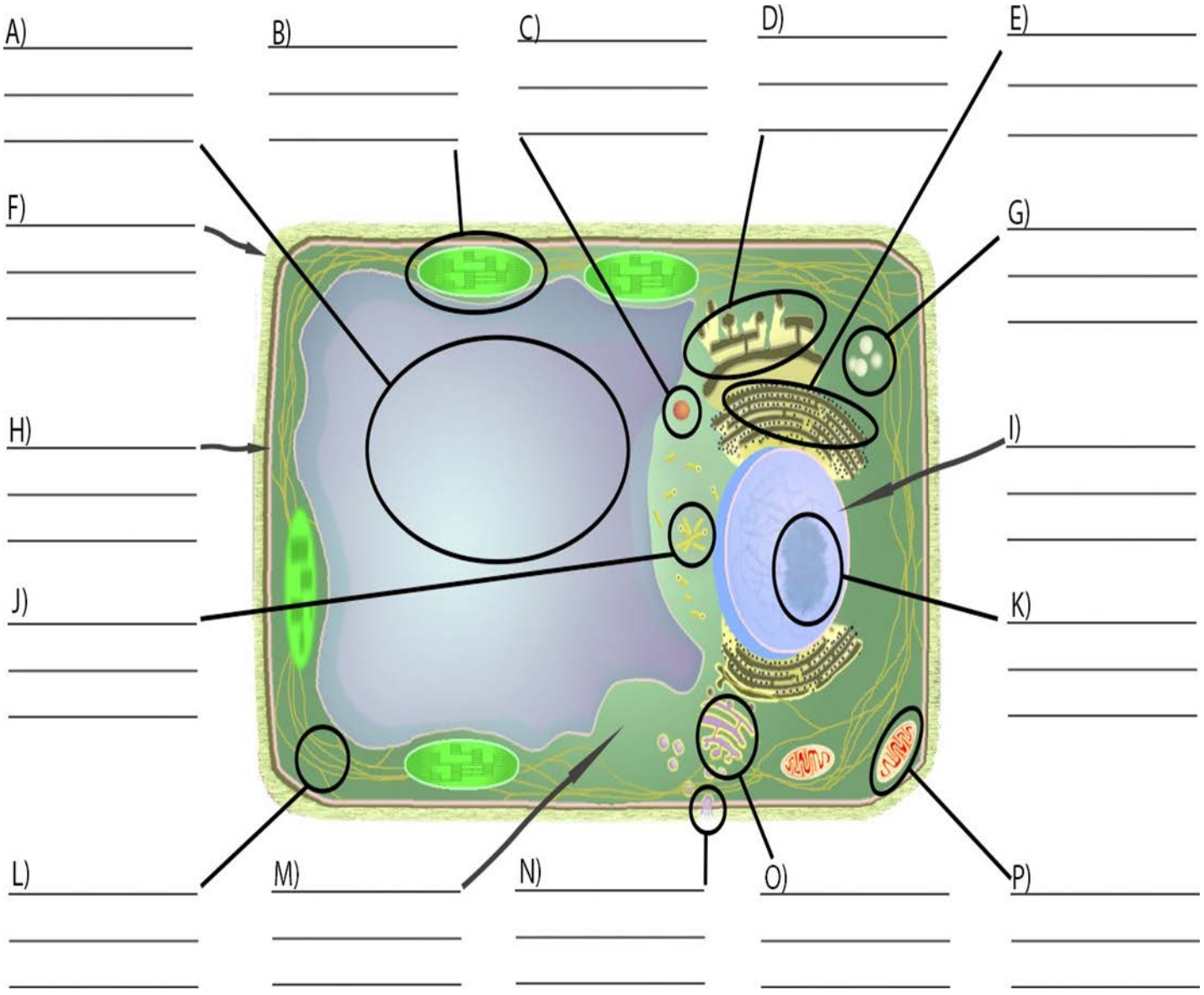
3. Are chloroplasts found in the roots, stem and leaves of plants? Explain your answer.

_____

_____

_____

Exercise 1.2



Exercise 1.3

Specialised plant cell	What the cell does?	How this cell is specialised in its job?

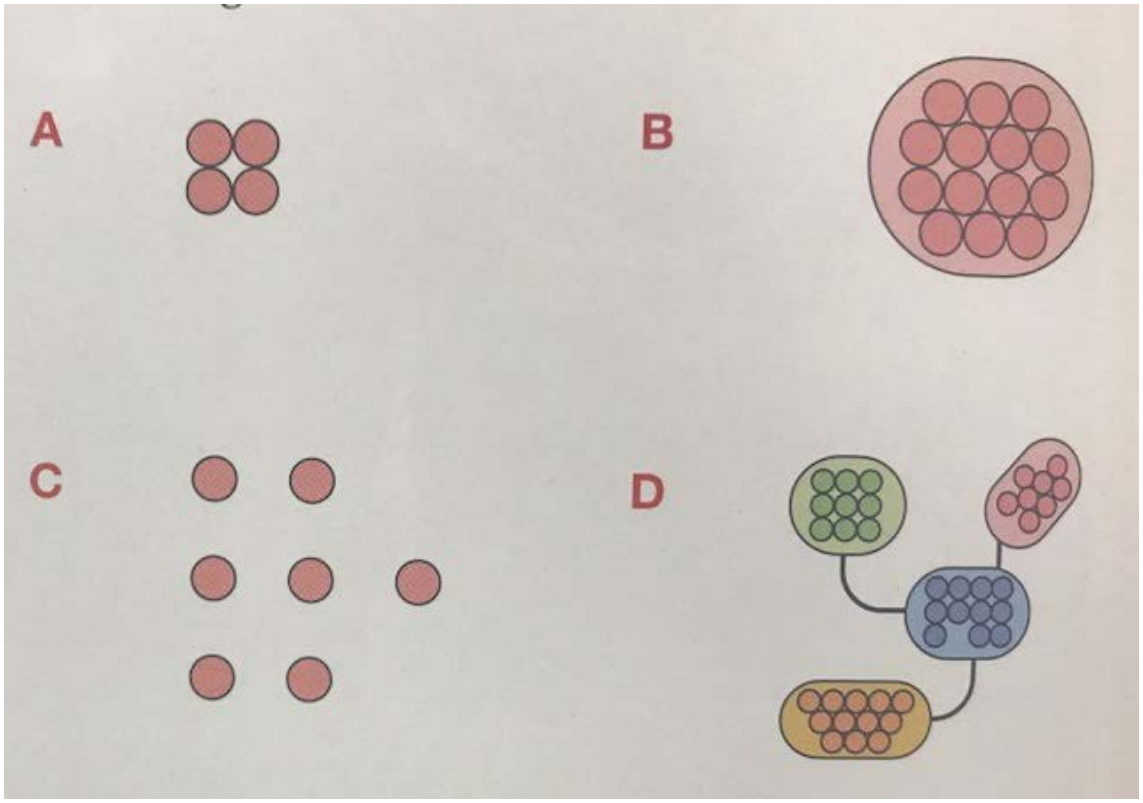
Exercise 2.1

1. Contrast the difference between a cell and a tissue
2. Contrast the difference between an organ and a system
3. In the 4 diagrams below write underneath each one which best represents

   a. individual cells

   b. a body system

   c. an organ



Exercise 3.1

Leaves help to make _____ for a plant. They contain a green substance called chlorophyll. The leaves take in a gas called _____ _____.

The roots take in _____ and other substances from the ground.

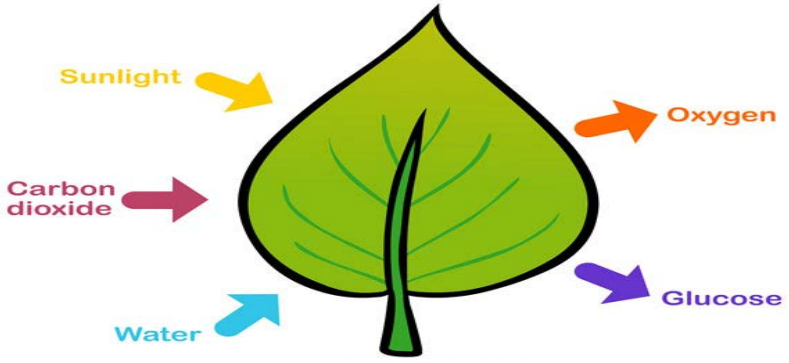
The _____ changes the water and carbon dioxide into the food that the plant needs. This food is a kind of sugar called _____. This whole process of making food is called _____

While this is happening, the leaves give off a gas called _____

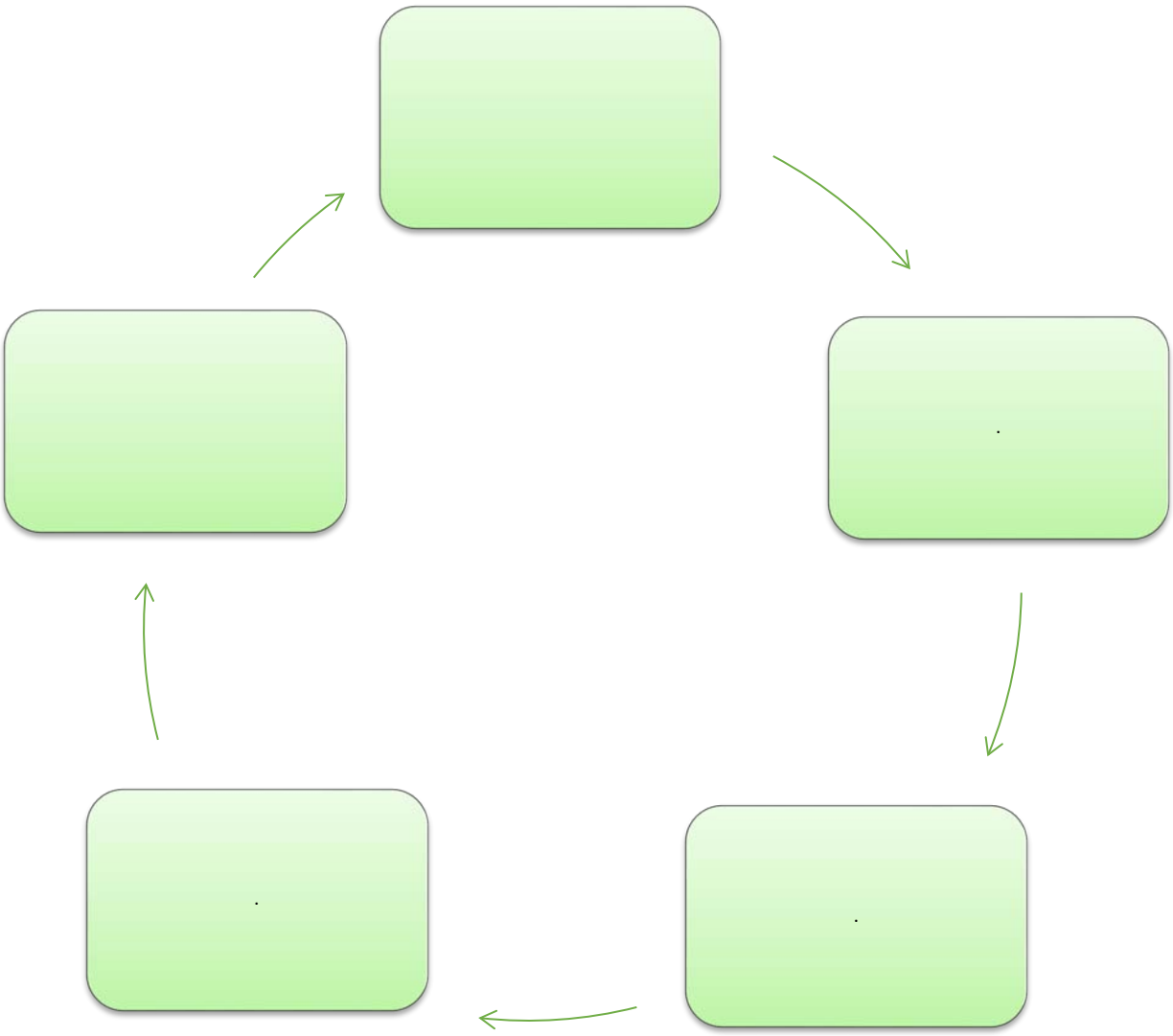
Words to choose from: oxygen, carbon dioxide, photosynthesis, water, food, chlorophyll, glucose

Complete the word equation for photosynthesis

_____ + _____ → _____ + _____



Exercise 3.2 Use this flow chart to summarise the 5 main processes in photosynthesis

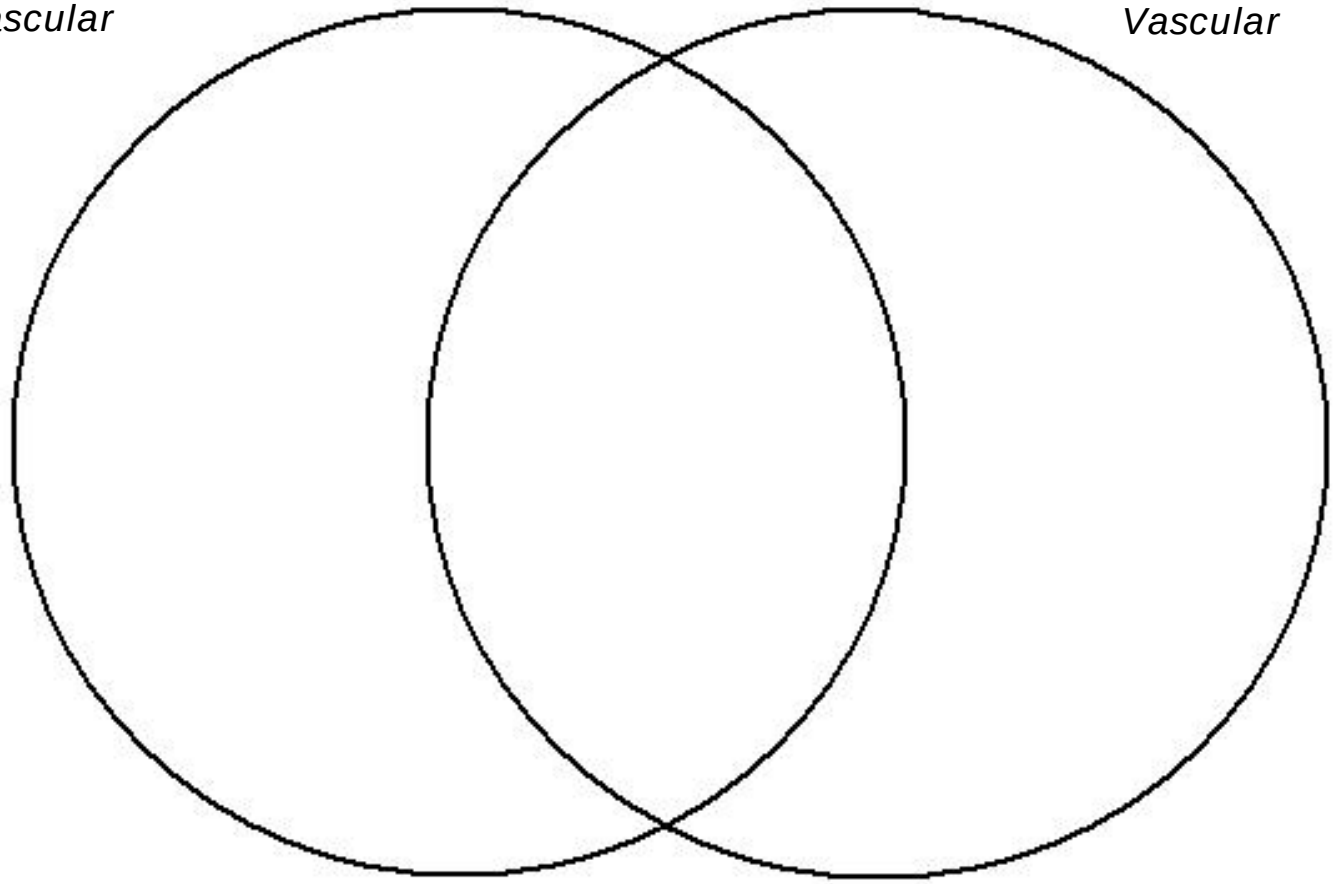


4.1 Compare and contrast vascular and non-vascular plants in the diagram below.

Vascular

Both

Non Vascular



Exercise 4.2

1. Explain why cell division is important for multicellular plants.

_____

_____

2. State the scientific name for flowering plants.

_____

Exercise 4.3

The graph above shows the amount of oxygen produced by an aquatic plant *Eloda* as light intensity was increased.

1. Write an aim for this experiment below.

_____

_____

_____

2. Name the process that produces the oxygen

_____

_____

3. Explain why the amount of oxygen increases as the light intensity increases._____

_____

_____

4. Propose two possible changes to the experiment that would produce even higher amounts of oxygen._____

_____

_____

5. An aquatic plant, such as the pond weed Elodea, is usually used for such an experiment. Explain why an aquatic plant is used in preference to a land plant such as a geranium_____

_____

_____

5. What does the graph tell us in this experiment_____

_____

_____

6.Write a possible conclusion for this experiment.

_____

_____

_____

Exercise 5.1

Write a hypothesis for this experiment?

_____

_____

Outline one safety risk involved in doing this experiment and state how you would minimise this.

One risk is:

_____

_____

This risk can be minimised by:

_____

_____

_____

_____

The image below shows the results of iodine test conducted for leaves kept under two different light conditions:

A B

Based on your understanding of photosynthesis, predict the light conditions under which each of the leaf was kept.

A

_____

_____

B

_____

_____

Write a conclusion for this experiment.

_____

_____

_____