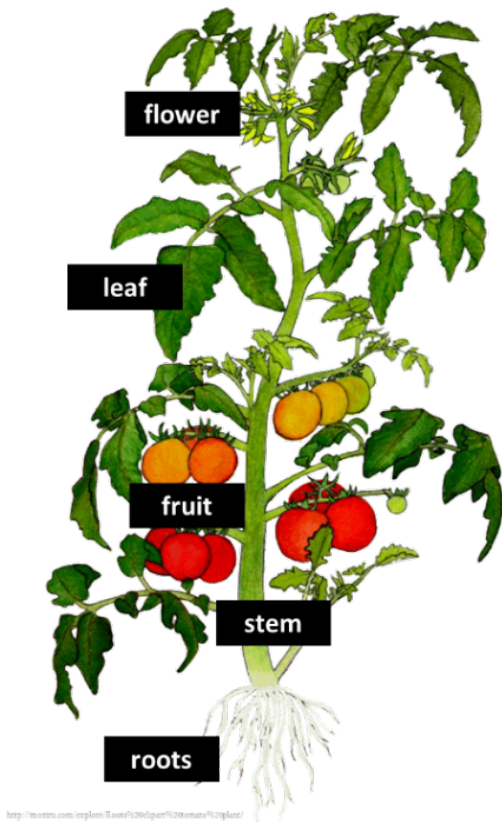




The structure and functions of the plant

Many parts of the plant are involved with the process of photosynthesis, either by helping collect the substances needed (roots, stem, leaves), storing products formed (roots, stem) or providing a place for the process to take place (leaf cells).



The **Shoot System** - Above ground (usually)

Lifts the plant above the soil. Main functions include:

- Leaves - photosynthesis
- Flowers - reproduction
- Fruit – seed dispersal
- Stem - food and water transport

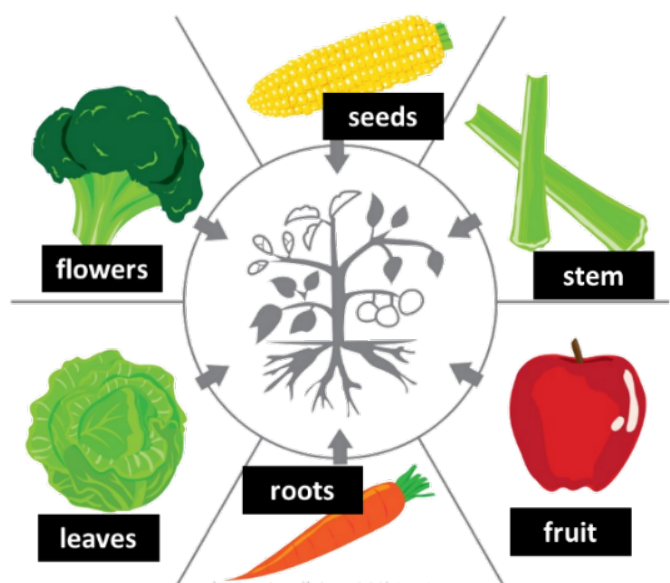
The **Root System** - Underground (usually)

Anchor the plant in the soil. Main functions include:

- Absorb water and nutrients
- Transport water and nutrients
- Food Storage

Parts of a plant we eat

We use many types of plants for food. The fruit and vegetables that we eat, and grow for eating, come from various parts of the plant. We often breed types of plant for food by **exaggerating** a part of a plant, such as flowers of the plant to grow broccoli, to make better use of them.



The significance of photosynthesis in making food

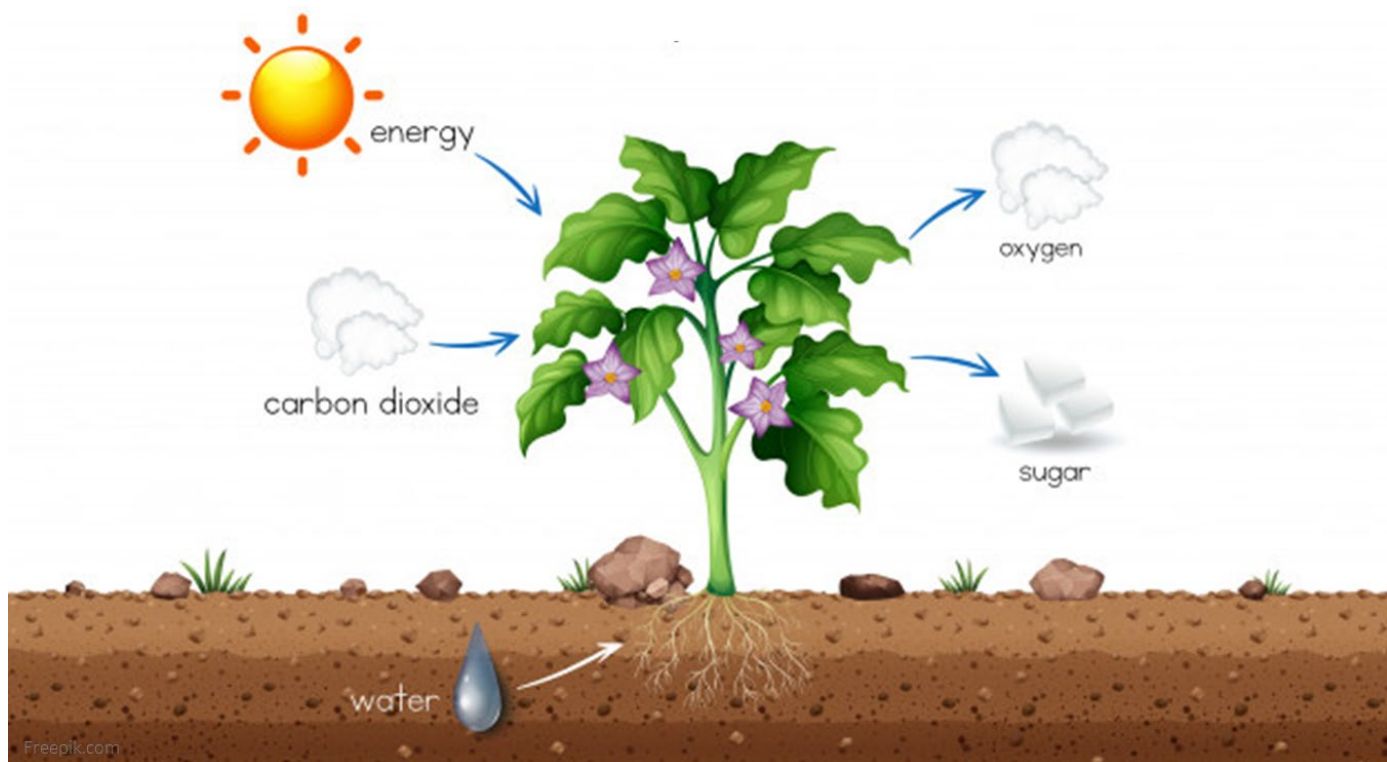
Most living organisms depend on plants to survive. Plants convert (change) energy from sunlight into food stored as carbohydrates through **photosynthesis**. Because animals cannot make their own food, they must eat plants (producers) to gain nutrition. Plants produce oxygen, which is released during photosynthesis, which all organisms need for **respiration**.

Photosynthesis transfers energy from sunlight into energy in chemicals such as glucose and starch.

Light enters the leaf and is trapped by a green substance called chlorophyll contained within structures called the chloroplasts in the cells.

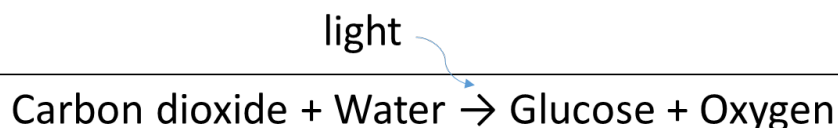
Water is transported via water tube cells called xylem, to the leaf cell and the **carbon dioxide** enters through the stomata and diffuses (spreads) to the leaf cells.

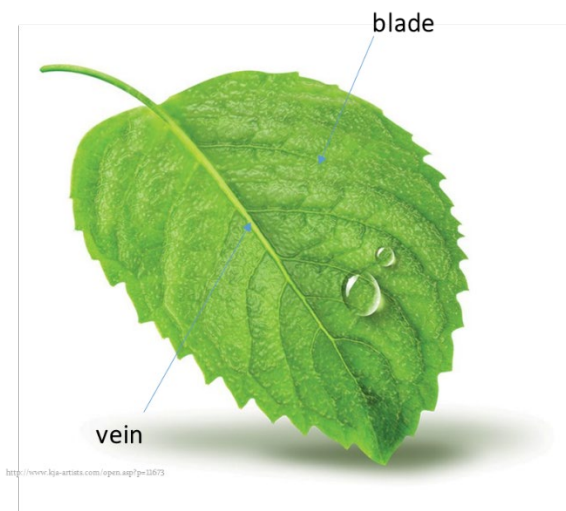
These substances react chemically within the chloroplasts, contained in the leaf cells; powered by the light then **glucose** (a sugar) is produced along with **oxygen**, which diffuses out. The sugar leaves the leaf via sugar/food tube cells.



Reactants and products of photosynthesis

The photosynthesis reaction can be written as a chemical equation with the reactants needed on the left and the products produced on the right



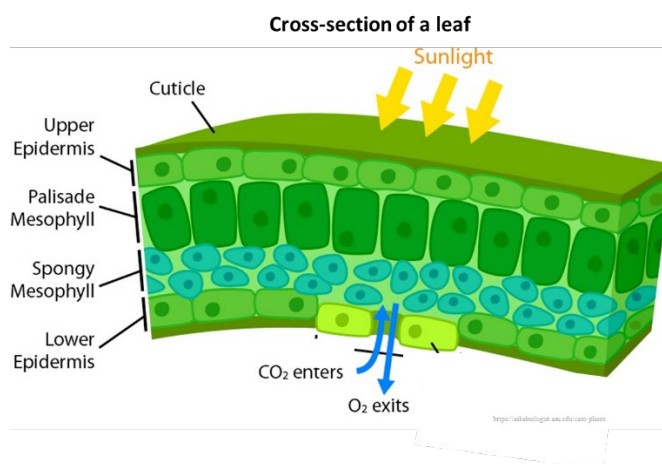


The leaf is the location of most photosynthesis

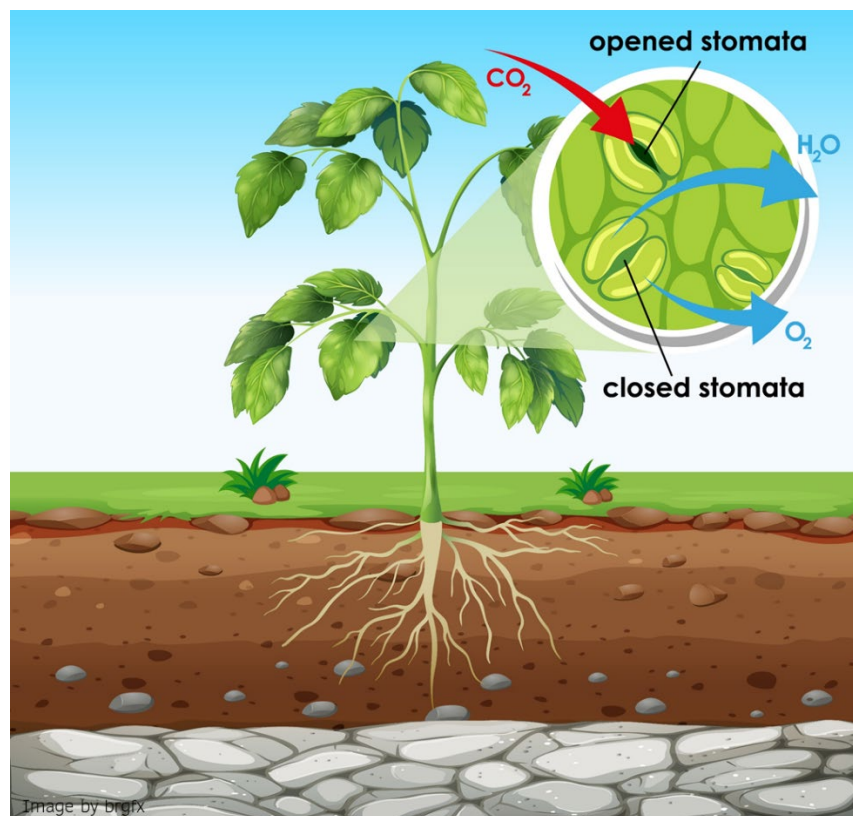
The **flat surface** of the leaf called the blade helps capture maximum sunlight for **photosynthesis**. The leaf is attached by a stem to the plant, which branch out into veins. The **large surface area** of the leaf helps capture as much sunlight as possible. The **green colour** is due to chlorophyll in the leaf cells that captures the light, and where photosynthesis takes place. The **leaf is thin** to allow light (and carbon dioxide gas from the air) to circulate to every cell in the leaf.

Photosynthesis happens in the chloroplasts/ chlorophyll in the leaf cells

The cells at the top of the leaf are filled with **chlorophyll**, and allows the leaf to absorb light energy, which is required for photosynthesis. The **spaces between cells** in the middle allow carbon dioxide to diffuse around through the cells.



The adaptations of leaves for photosynthesis



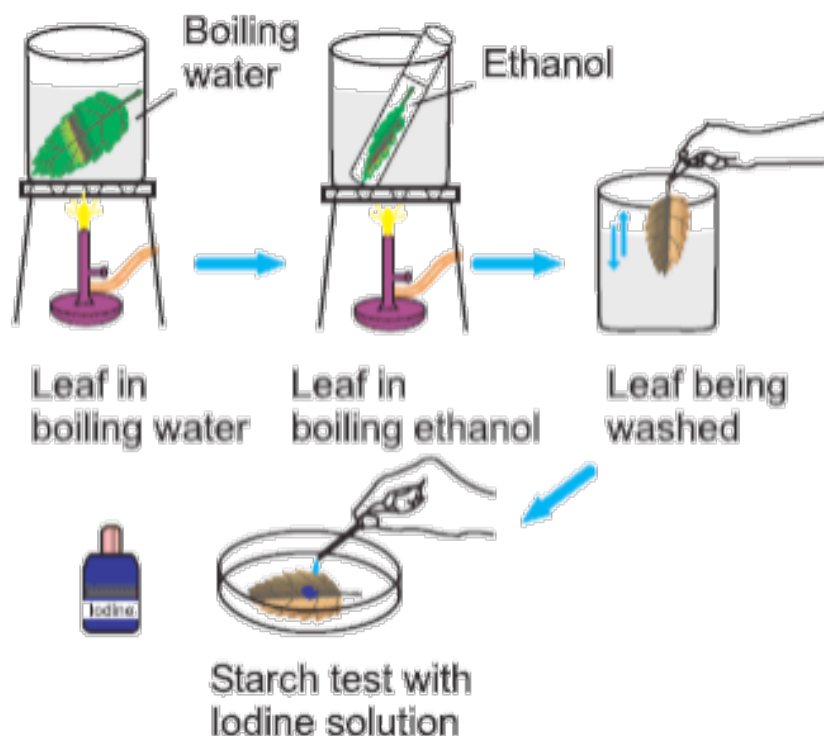
The chloroplasts circulate around the cells, especially the layer of cells that are close to the top of the leaf. This allows maximum amounts of light to be distributed to the chloroplasts for photosynthesis to take place.

A waxy **cuticle** on the outside of the leaf provides a waterproof covering while remaining **transparent** to allow light into the leaf cells for photosynthesis.

Openings (usually on the underside of the leaf) called **stomata** allow carbon dioxide to enter and diffuse into cells as well as allowing oxygen to move in and out. Two guard cells on either side of the stomata open and close the openings.

Starch test

A positive test for starch is the **leaf turning blue- black** when iodine is added. The starch is the storage product of the plant when it produces photosynthesis. A positive test means photosynthesis has occurred.



Step 1. The leaf is boiled in water to soften it.

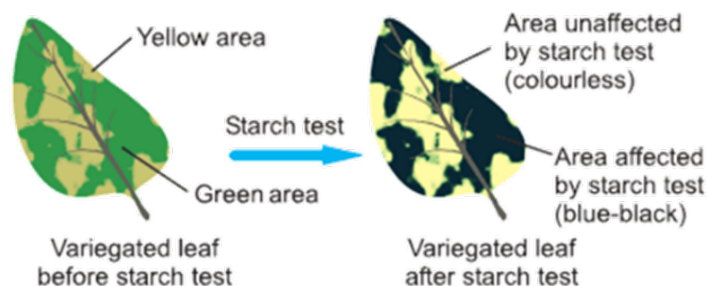
Step 2. The leaf is then placed into a boiling tube of ethanol, which is placed in a beaker of water and heated gently. This will remove the green chlorophyll.

Step 3. The leaf is washed in water to remove all the ethanol.

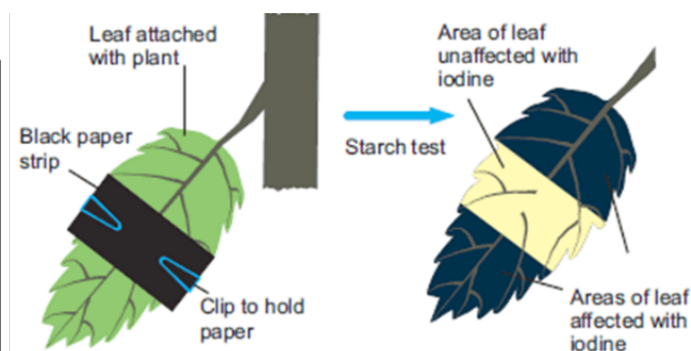
Step 4. Iodine added to the leaf. It will turn blue-black in the presence of starch. The starch indicates photosynthesis and the production of glucose has occurred.

Investigations into photosynthesis requirements

We can investigate that photosynthesis happens in the chloroplasts/chlorophyll in the leaf cells and use the starch test as evidence. When a plant undergoes photosynthesis, it produces glucose, which is converted into starch for storage. If we want to **investigate** what **factors** are required for **photosynthesis** we use the starch test to enable us to reach a conclusion. Factors include chlorophyll, water, carbon dioxide and light present.



Investigating if Chlorophyll is required for photosynthesis:
Select a leaf that is variegated leaf. The green parts contain chlorophyll and the white parts do not. To show chlorophyll is required for photosynthesis only the previous green areas will turn **blue - black**.

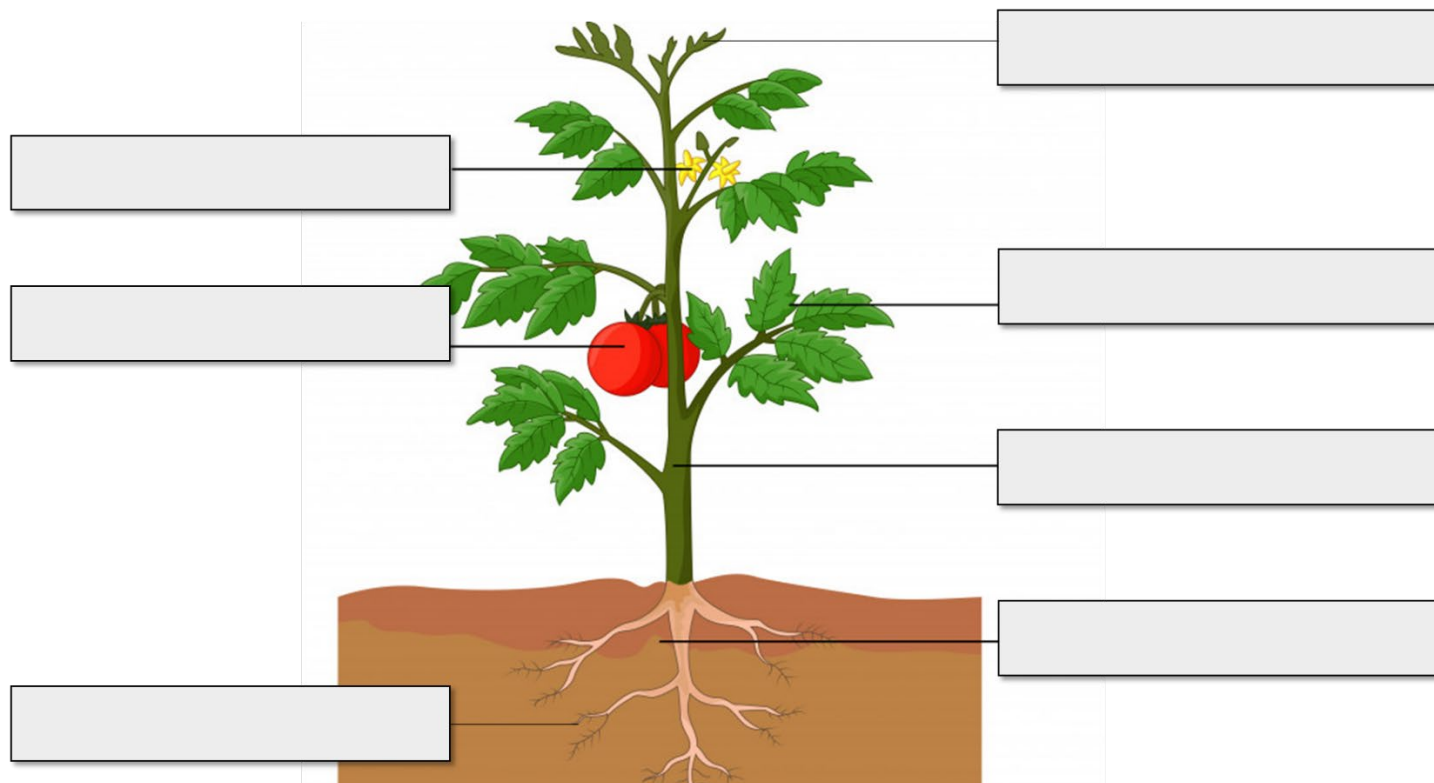


Investigating if light is required for photosynthesis:
Place a piece of black paper over a leaf and leave for a few days still on the plant. To show light is required for photosynthesis only the uncovered areas will turn **blue - black**.



1. Label the parts of the plant below

Root hair	leaf bud	stem	fruit	flower	root	leaf
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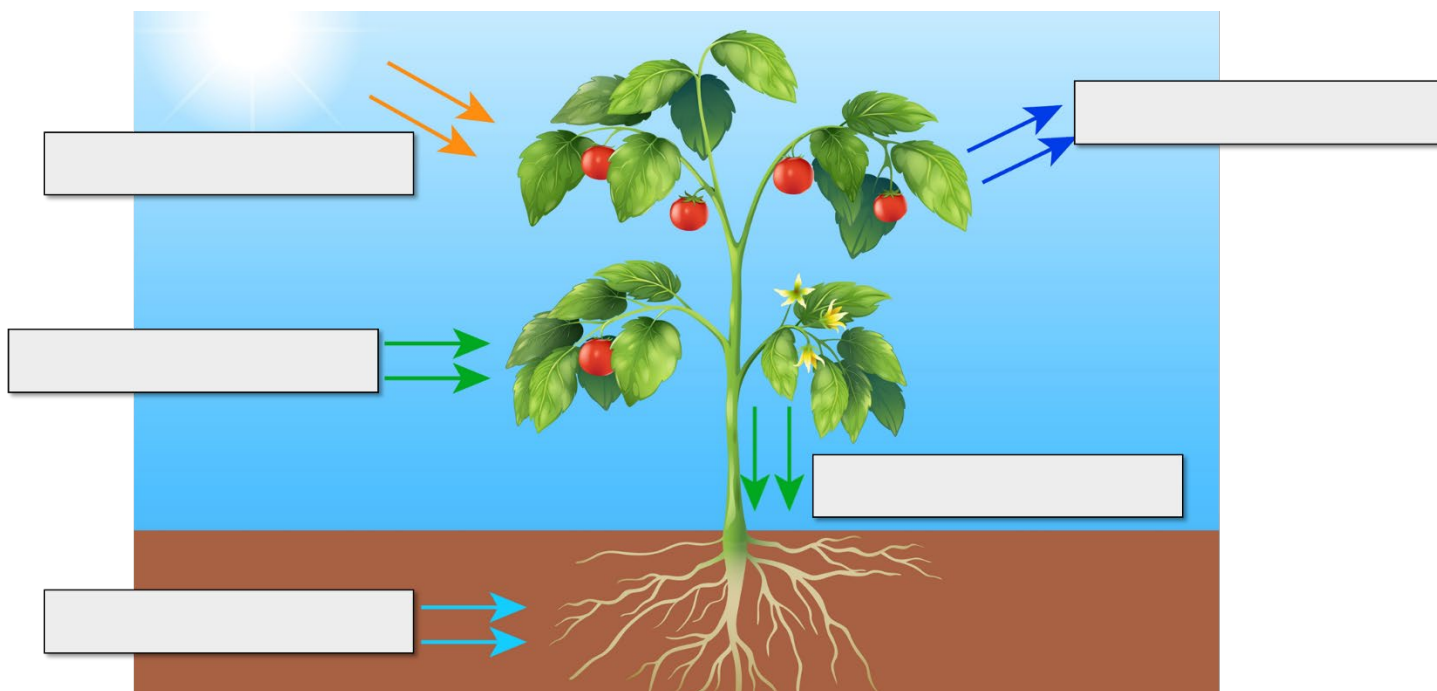


2. Group the vegetables below into the correct plant part box



Stem	fruit	leaf	seed	root	flower

3. Complete the diagram showing photosynthesis by adding the reactants going in (left) and products going out (right) of the plant



4. Write the word equation for photosynthesis, using the reactants and products above


+
→
+

5. Write down **CORRECT** order of the steps in a **starch test** by placing NUMBERS (1 -13) in the box below

Order	Scrambled steps
	place the boiling tube of ethanol in the beaker of hot water
	Light the Bunsen burner to heat water
	Pack up equipment
	Place soft leaf in the boiling tube of ethanol and heat
	Observe areas of the leaf that turn blue-black
	Step up a beaker of water on a Bunsen burner
	Pour ethanol in a boiling tube until it is a third full
	Spread leaf on a tile
	Place a leaf in the beaker of hot water
	Add drops of iodine to leaf
	Remove leaf from water
	Rinse leaf in water
	Remove leaf from the ethanol

6. Some plants have leaves that are **variegated**, where only some parts are green containing chlorophyll, while other parts are yellow or white without chlorophyll. A student wants to test if photosynthesis occurs in the parts of the leaf without chlorophyll using a **starch test**. The student needs to use a **fair test**, where only one variable, the part of the leaf has green chlorophyll or does not, is changed, while keeping all other variables the same.

Complete the investigation format sheet below of that fair test.

My question:	
My prediction: I predict that	
Variables (things) I will change	Variables (things) I will keep the same
How I will do this (diagrams and words)	
Step One 	Step Two
Step Three	Step Four 