

Etege Menen Girls' Boarding Secondary School

Biology Department

Grade 10

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Lesson contents

UNIT FOUR

FOOD MAKING AND GROWTH IN PLANT

4.1 The leaf; a photosynthetic machine

4.2 Photosynthesis

UNIT 4
Food making and growth in plant

There is four main organ of flowering plant

- **Flower**-reproductive organ
- **Leaves**-make food by photosynthesis
- **Stem**-transport and support system
- **Roots**-anchoring and absorption

4.1 The leaf: a photosynthetic machine

- **Adaptation of leaf for photosynthesis**
  - **Large surface area** to absorb maximum sun light.
  - **Leaf are thin** hence a short distance for gas exchange.
  - **Have a net work of vein** to transport water, mineral ions and sugar.
  - Presence of an opening called **stomata** to allow CO2 into the leaf and O2 out.
  - Leaves have **large amount of chlorophyll** to absorb sun light and transform into chemical energy.

External structure of the leaf

- **Petiole (leaf stalk)** the leaf is attached to the stem
- **Lamina (leaf blade)** the photosynthetic portion of the leaf
- **Mid rib and veins;** contain xylem and phloem
- **Margin;** is the border line of the leaf

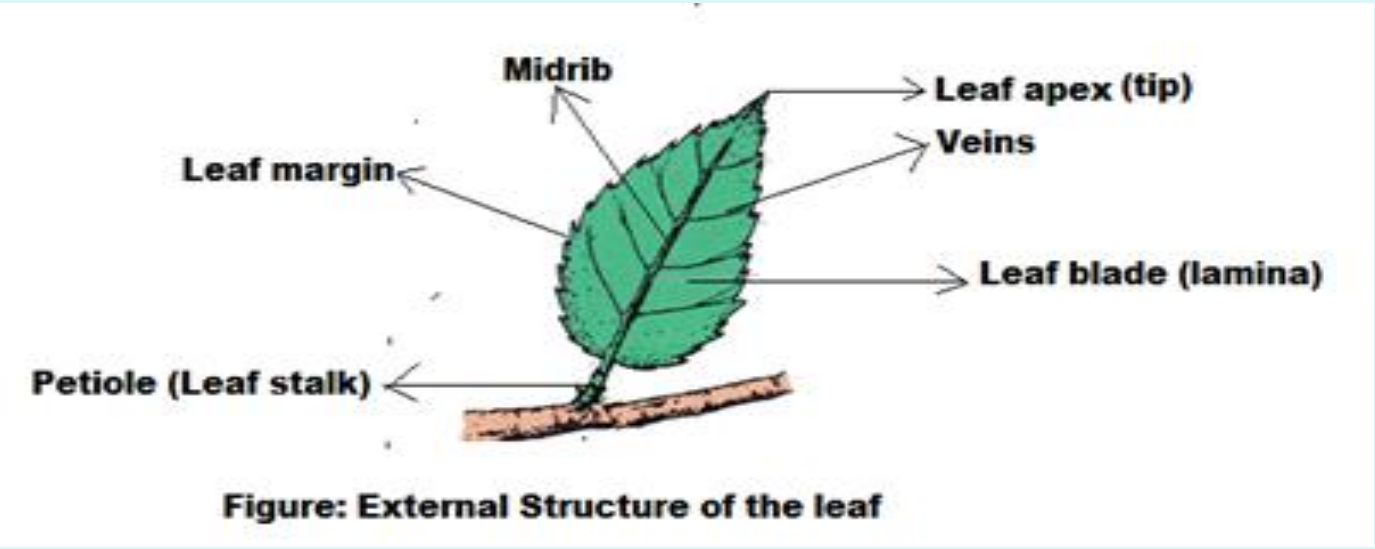
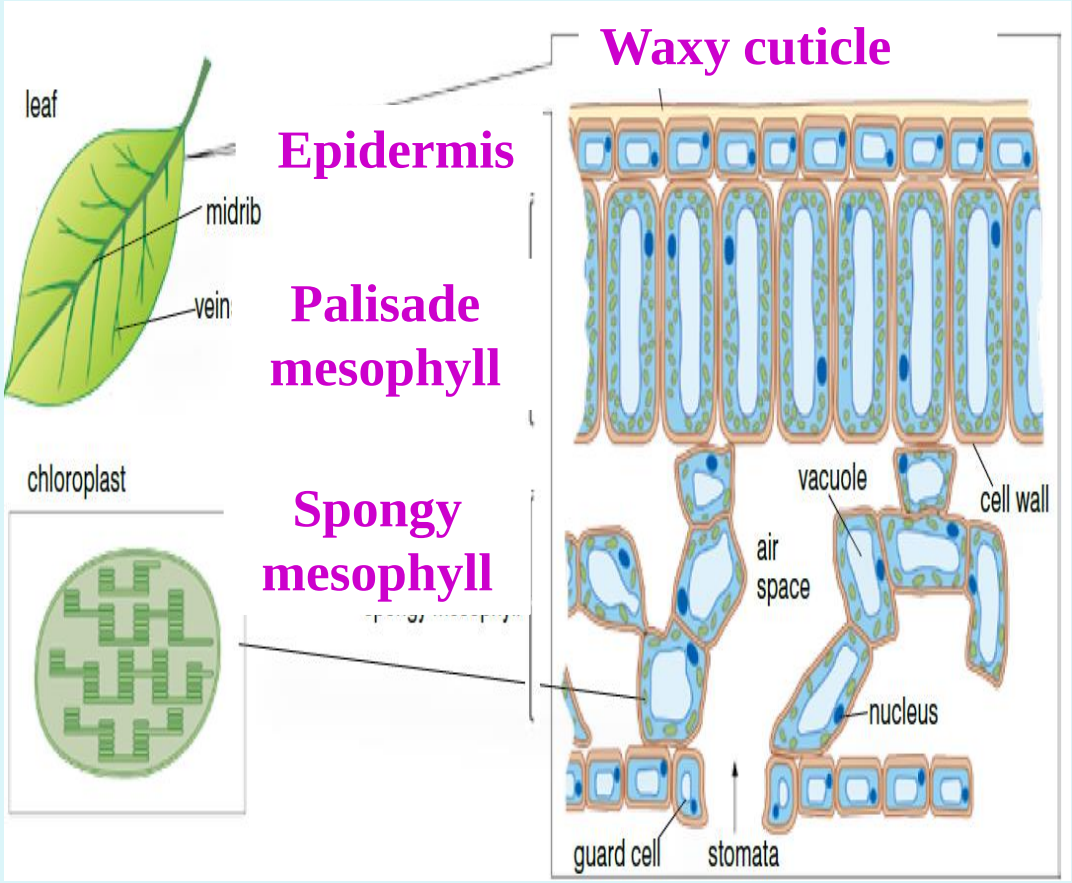


Figure: External Structure of the leaf

Internal structure of the leaf

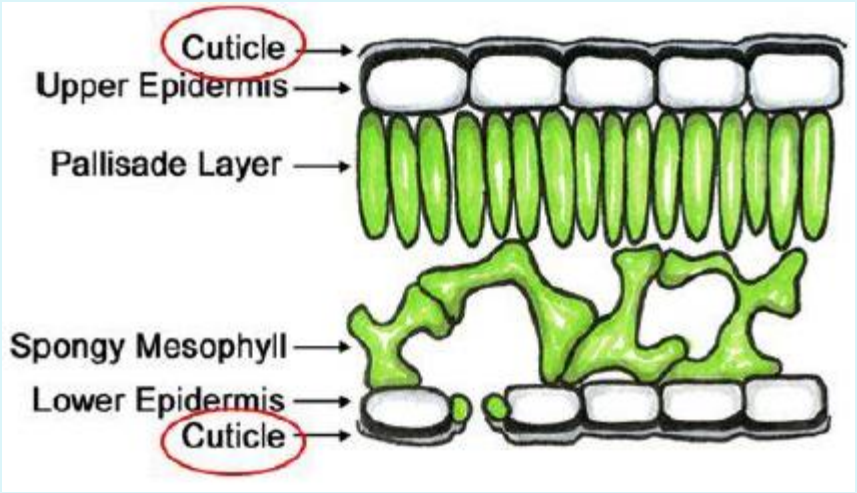
- **Internal structures of leaf**
  - Cuticle
  - Upper epidermis
  - Palisade mesophyll
  - Spongy mesophyll
  - Lower epidermis



1. Waxy cuticle

- The outer thick waxy covering of leaves
- Found on the surface of many leaves
- **Cuticle** protect the plant from drying.
- Help to prevent water loss





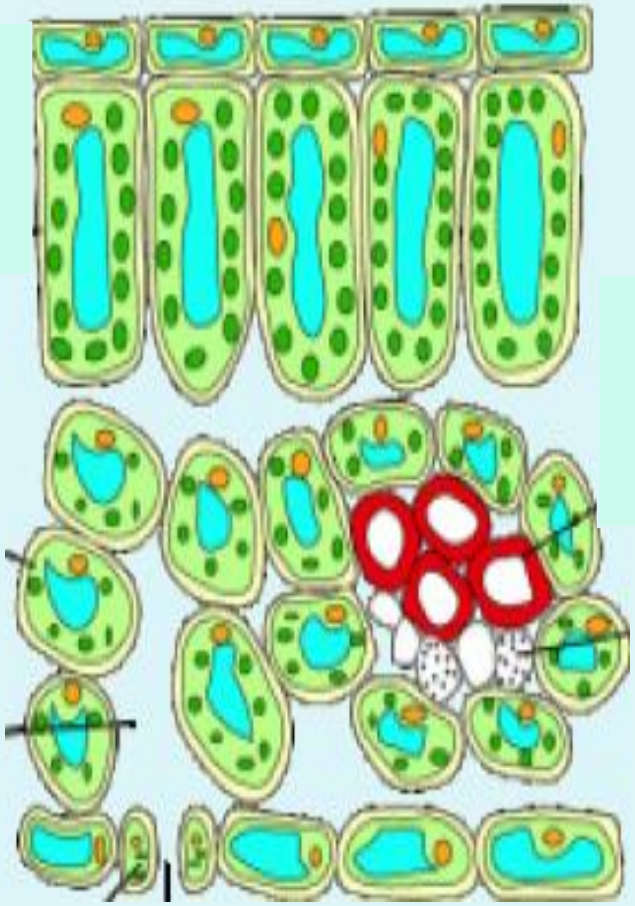
2. Mesophyll

Palisade mesophyll

- Have closely packed cell
- Have many chloroplast
- Has less air space
- The main site of photosynthesis
- Vertically arranged

Spongy mesophyll

- Have loosely arranged cell
- Has few chloroplast
- Has a lot of air space
- Allow exchange of gases
- Irregular arranged.



3. Lower Epidermis

- It refers to a single layer of cells on the lower surface of the leaf.
- Contain opening known as **stomata** and **guard cell**
- Stomata **used to exchange of gases**.
- **Guard cell** control **the opening and closing of stomata**

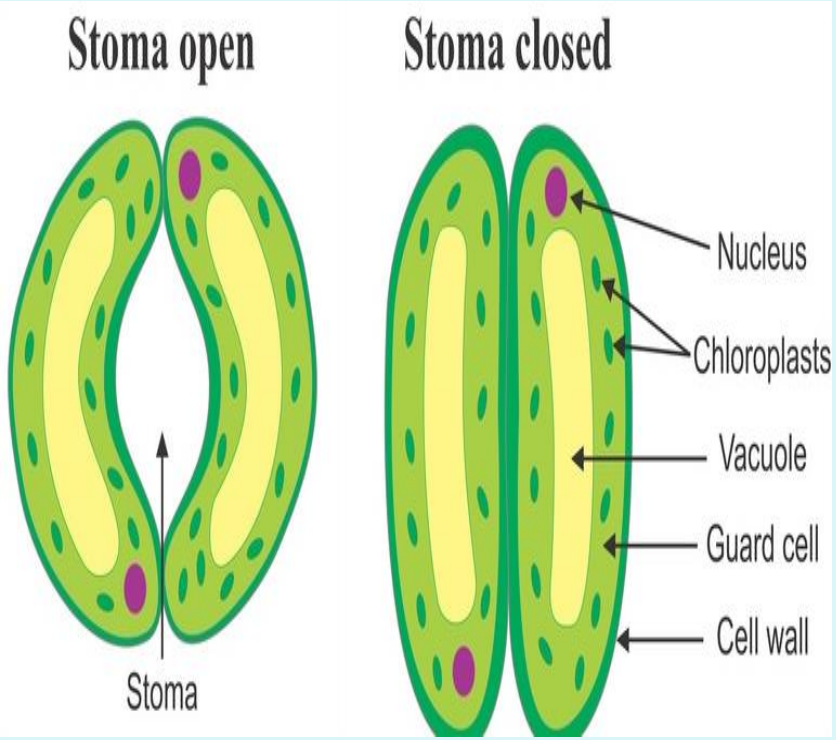
Opening and closing of stomata

❖**During the day**

- Photosynthesis high
- Concentrations of **sugar** in the **guard cell high**
- Water **move into the guard cell** and **swell up**
- **Stomata open**

❖**During night**

- Photosynthesis low
- Concentrations of **sugar** in the **guard cell low**
- Water **move out of guard cell** and **shrinks**
- **Stomata closed**

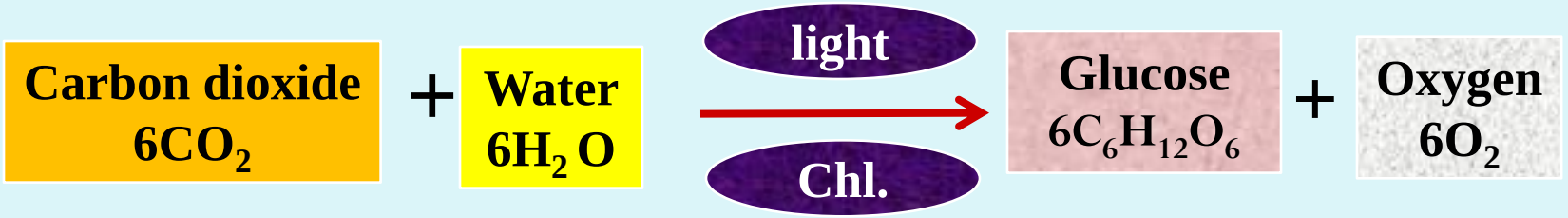


4. Vascular bundle

- Contain xylem and phloem
  - **Xylem:** transport water and dissolved mineral from soil to leaves.
  - **Phloem:** transport product of photosynthesis away from leaves to other parts

4.2 Photosynthesis

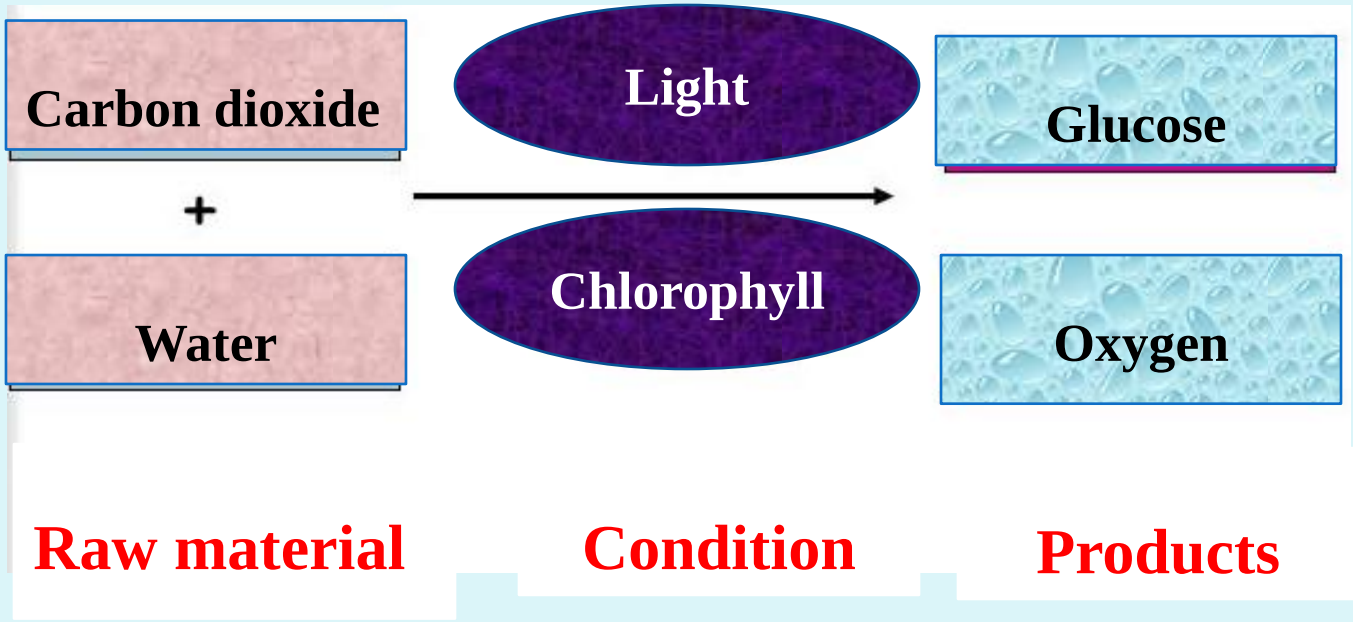
- **Photo** –light
- **synthesis**—making
- **Photosynthesis** process of making food by green plants
  - The process of making food by green plants in the presence light energy and chlorophyll



- Photosynthesis can be summed up in the above equation:

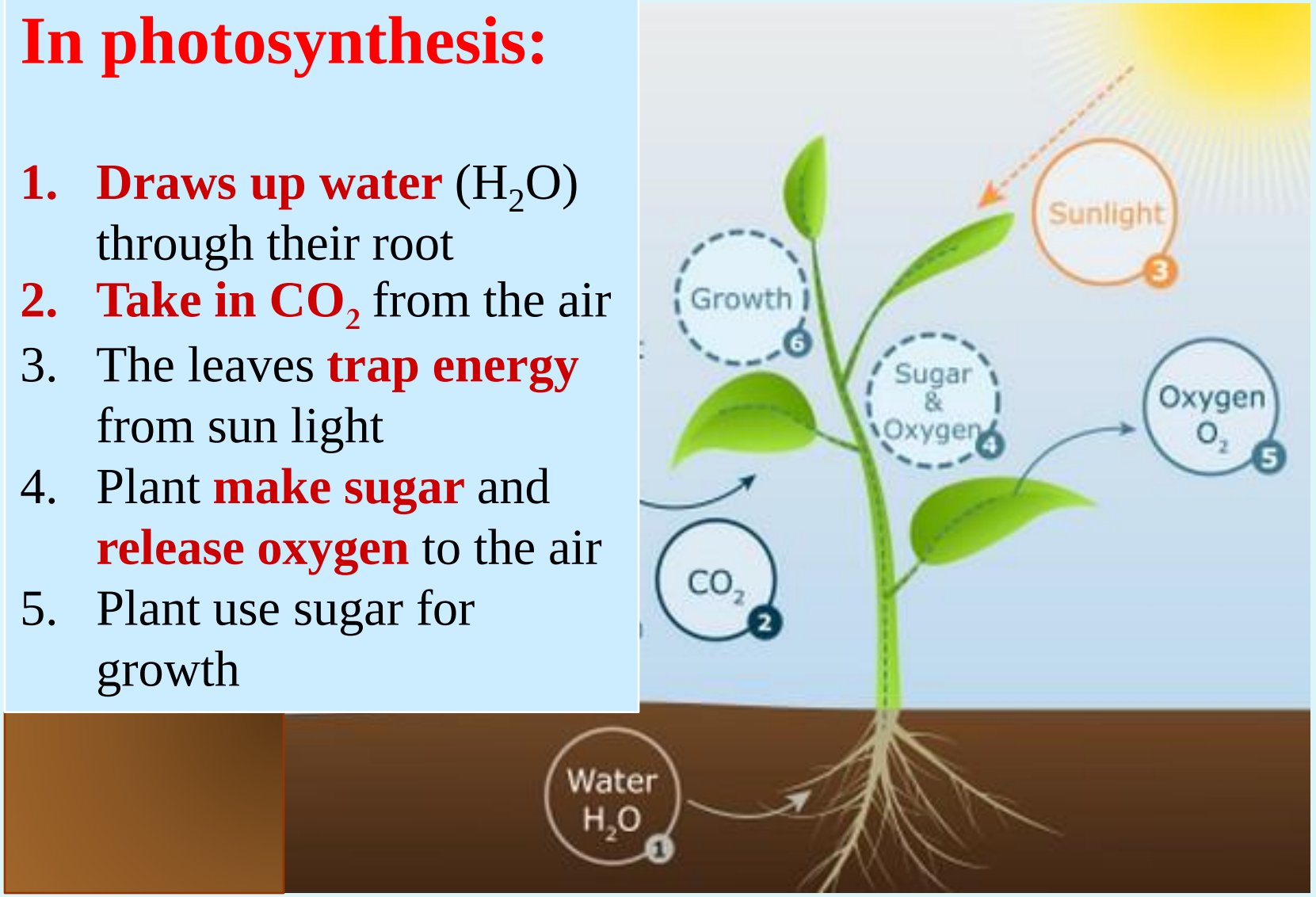
Summery equation for photosynthesis

- **Two row material**-CO_2 and H_2O
- **Two products** -Glucose and oxygen
- **Two condition**-chlorophyll and light energy



In photosynthesis:

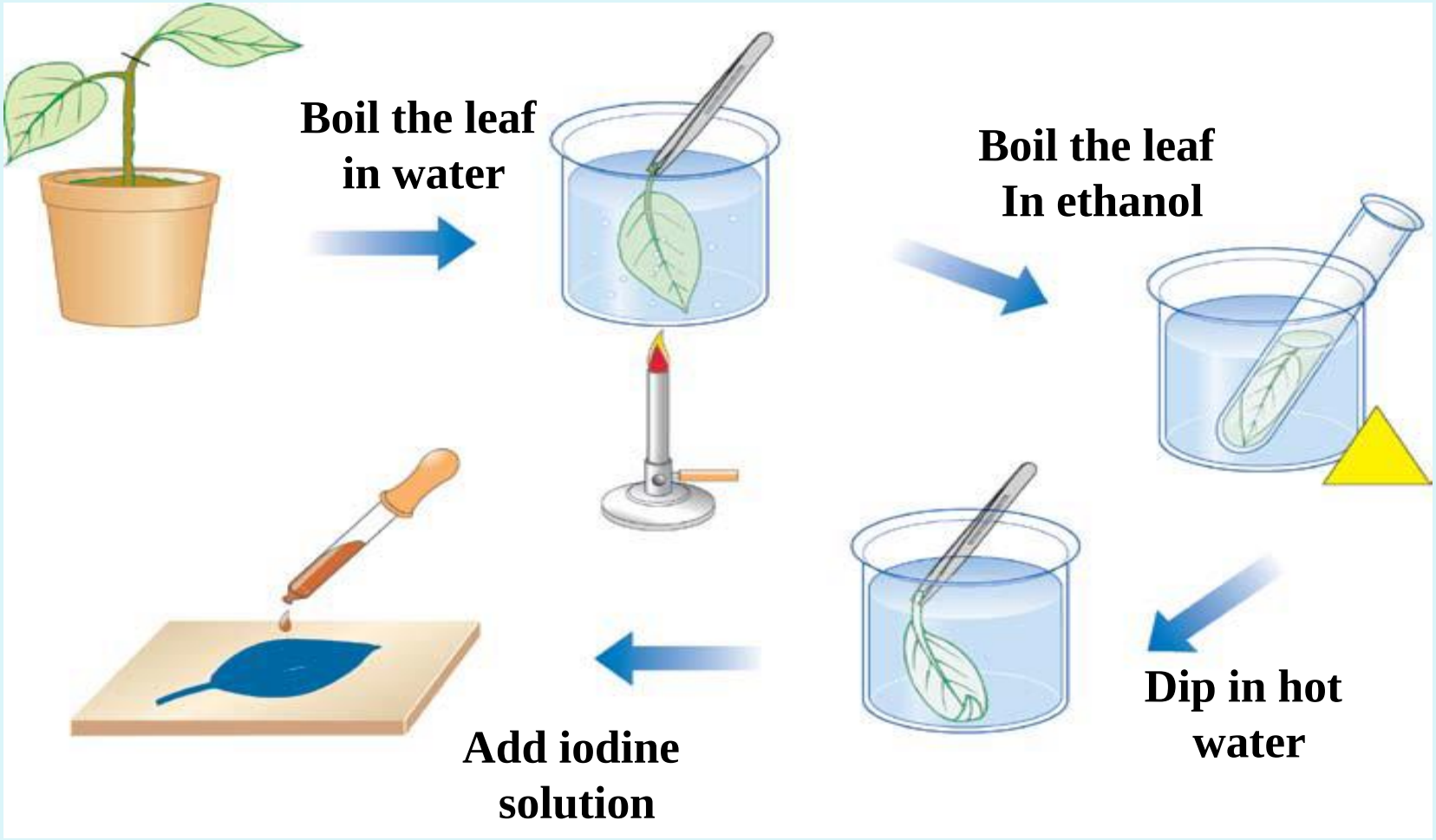
1. **Draws up water** (H_2O) through their root
2. **Take in CO_2** from the air
3. The leaves **trap energy** from sun light
4. Plant **make sugar** and **release oxygen** to the air
5. Plant use sugar for growth



Plant use its primary product glucose :

- as source of energy
- growth
- rapier of tissue
- converted to starch for storage

Testing leaf for starch using iodine solution



Testing leaf for starch…

- **The leaf is put in boiling water because**
  - To stop all the biochemical process by killing the leaf
  - Making the leaf soft for iodine penetration
- **The leaf put in ethanol because**
  - remove chlorophyll (green pigment) from leaf
- **Blue black color** shows the presence of starch in the leaf

Quizzes

2. In testing the leaf for starch, a leaf is put in ethanol because:

A. remove green pigment from leaves

B. kill the cell in the leaf

C. break down starch into glucose

D. make the cell soft for photosynthesis

Phases of photosynthesis

1. Light dependent reaction

- Depend on light
- Chlorophyll absorbs radiant energy of sunlight
- **Light energy** transformed into **chemical energy**
- Light **split water molecule** into hydrogen and oxygen
- Make ATP used as a source energy for the reaction
- $12H_2O \xrightarrow[\text{Light energy}]{\text{Chlorophyll}} 24H^+ + 6O_2$

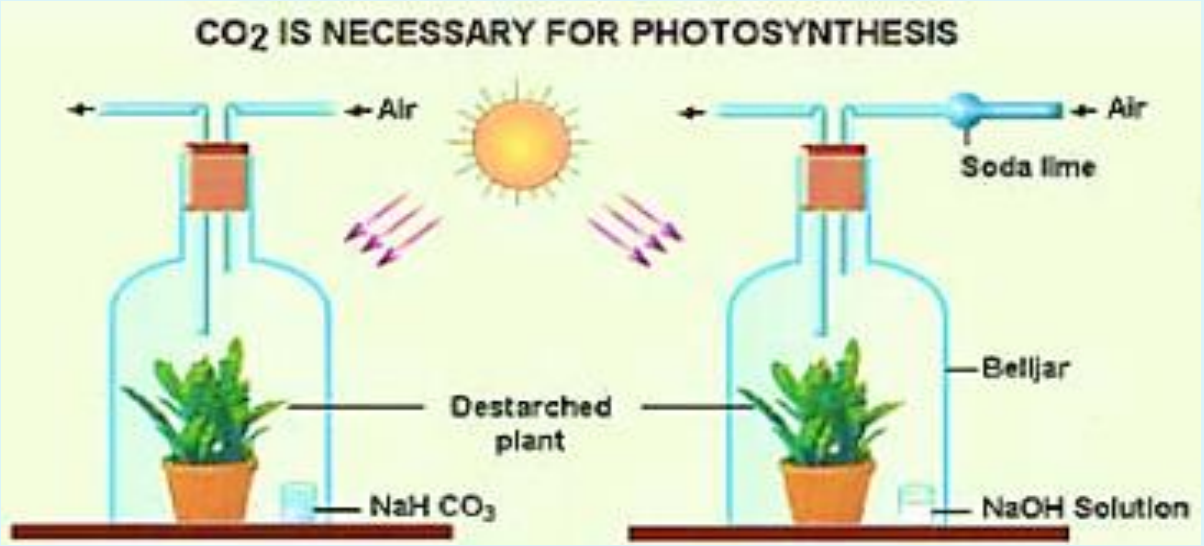
2. Light independent reaction

- Do not require light
- Depend on hydrogen ion and carbon dioxide
- Reduction of CO_2 to glucose
- ATP produce in light dependent reaction used as a source of energy
- $24H^+ + 6CO_2 \longrightarrow C_6H_{12}O_6 + 6H_2O$

Requirements of photosynthesis

1. Carbon dioxide (CO2)

- The source of carbon to prepare sugar
- Plant get CO_2 from the air
- To show up CO_2 is used in photosynthesis **KOH (soda lime**) is used



Quizze

1. The chemical substance used to absorb carbon dioxide in the activity to show its importance of carbon dioxide in photosynthesis is:

A. Iodine solution

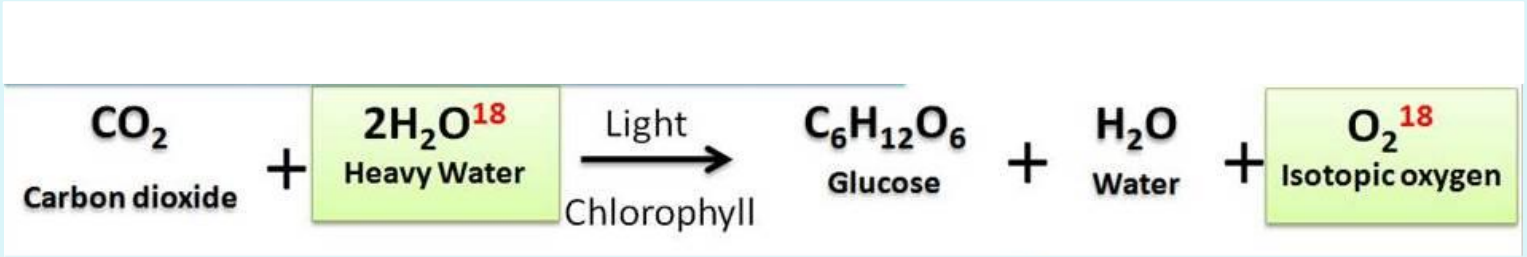
C. Potassium hydroxide solution

B. Benedict’s solution

D. Copper sulphate solution.

2. Water (H_2O)

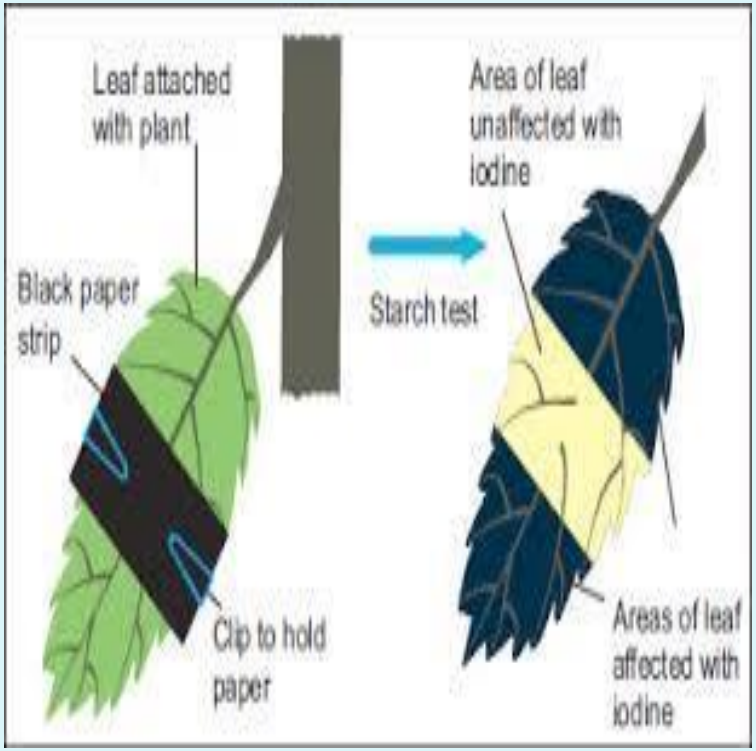
- Water is the source of hydrogen ion to reduce CO_2 to sugar
- Oxygen gas produced from photosynthesis comes from the split of H_2o



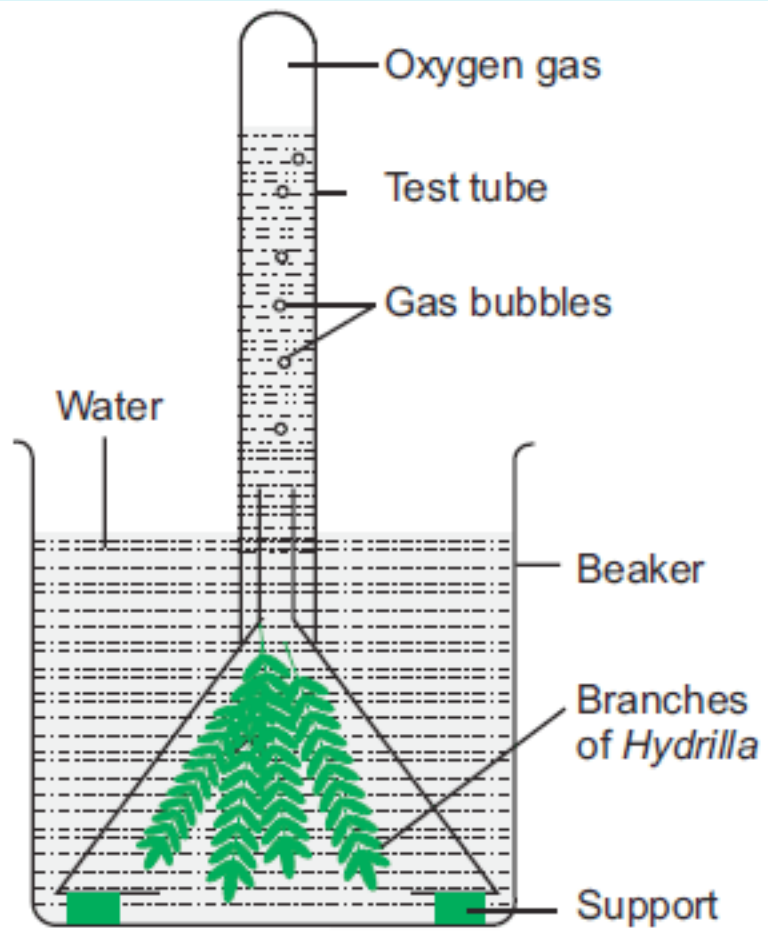
- To show that water is needed for photosynthesis supply the plant with 'heavy' water containing the O^{18} isotope of oxygen.
- The experiment also proves **oxygen** produced in photosynthesis **come from water** not carbon dioxide

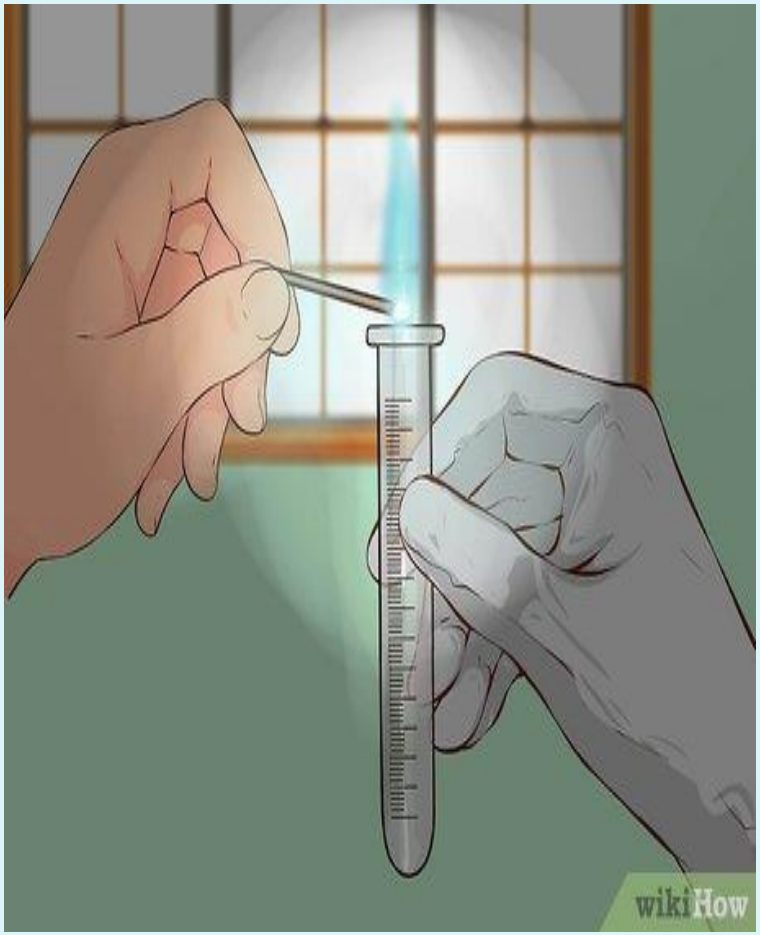
3. Sun light

- Used to break down water into hydrogen ion and oxygen
- Destarch the plant
- The leaf is partly covered with black paper
- Remove the leaf after 24 hour and perform starch test using iodine solution



How to show oxygen is a by product of photosynthesis?





4. Chlorophyll

- Chlorophyll is the green pigment in chloroplast
- Used to trap light energy
- **Variegated leaves** (**leaf with different color**) are used to show the importance of chlorophylls for photosynthesis



Importance of photosynthesis

1. Food

- Produce food for almost all organisms

2. Fresh" air

- Removes carbon dioxide from, and add oxygen to, the atmosphere

Lesson summery

- **The leaf: a photosynthetic machine**
  - What is the adaptation of the leaf for photosynthesis?
  - Describe the external structure of the leaf?
  - Explain the internal structure of the leaf
- **Photosynthesis**
  - What is photosynthesis?
  - How do we test the presence of starch in the leaf?
  - Explain the phase of photosynthesis?
  - Describe the basic requirements of photosynthesis?
  - Explain the importance of photosynthesis?

Lesson quizzes

1. Why do plants convert their primary product of photosynthesis, glucose to starch?

A .Because starch is important for making cell wall of plants.

B. Because large amount of glucose becomes toxic for plants.

C. Because starch does not affect the water balance

D. Because glucose cannot be used for respiration directly

2. In one of experiments conducted to prove the necessary condition for photosynthesis variegated leaves used. The use of variegated leaves to show the presence of

A. Chlorophyll.

B. carbon dioxide.

C Light.

D. water.