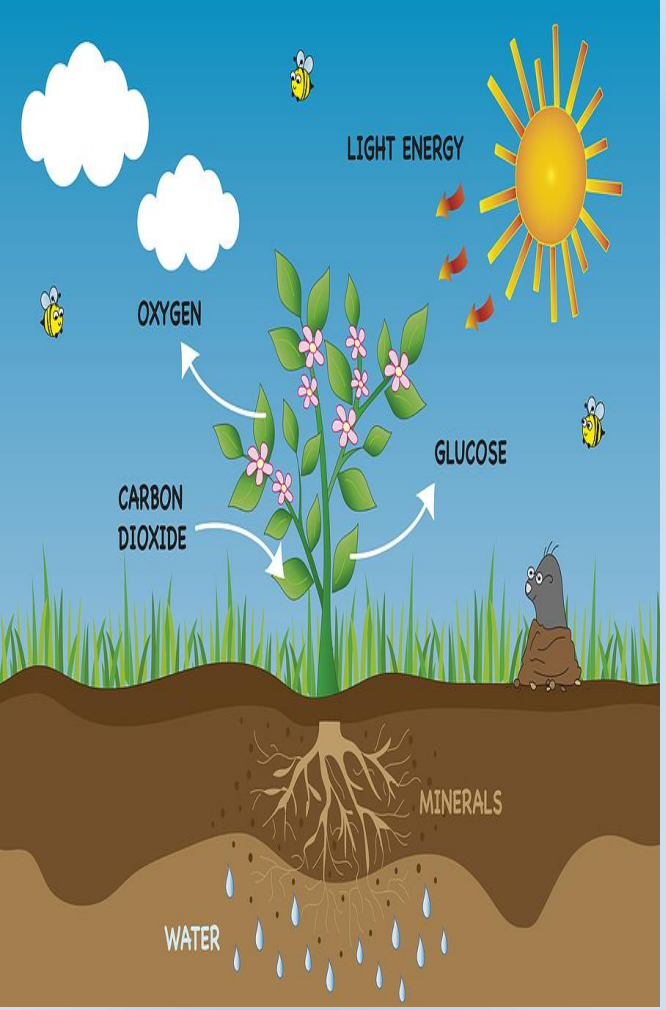


Biology Grade 7

Chapter 2: Nutritive needs of chlorophyllic plants

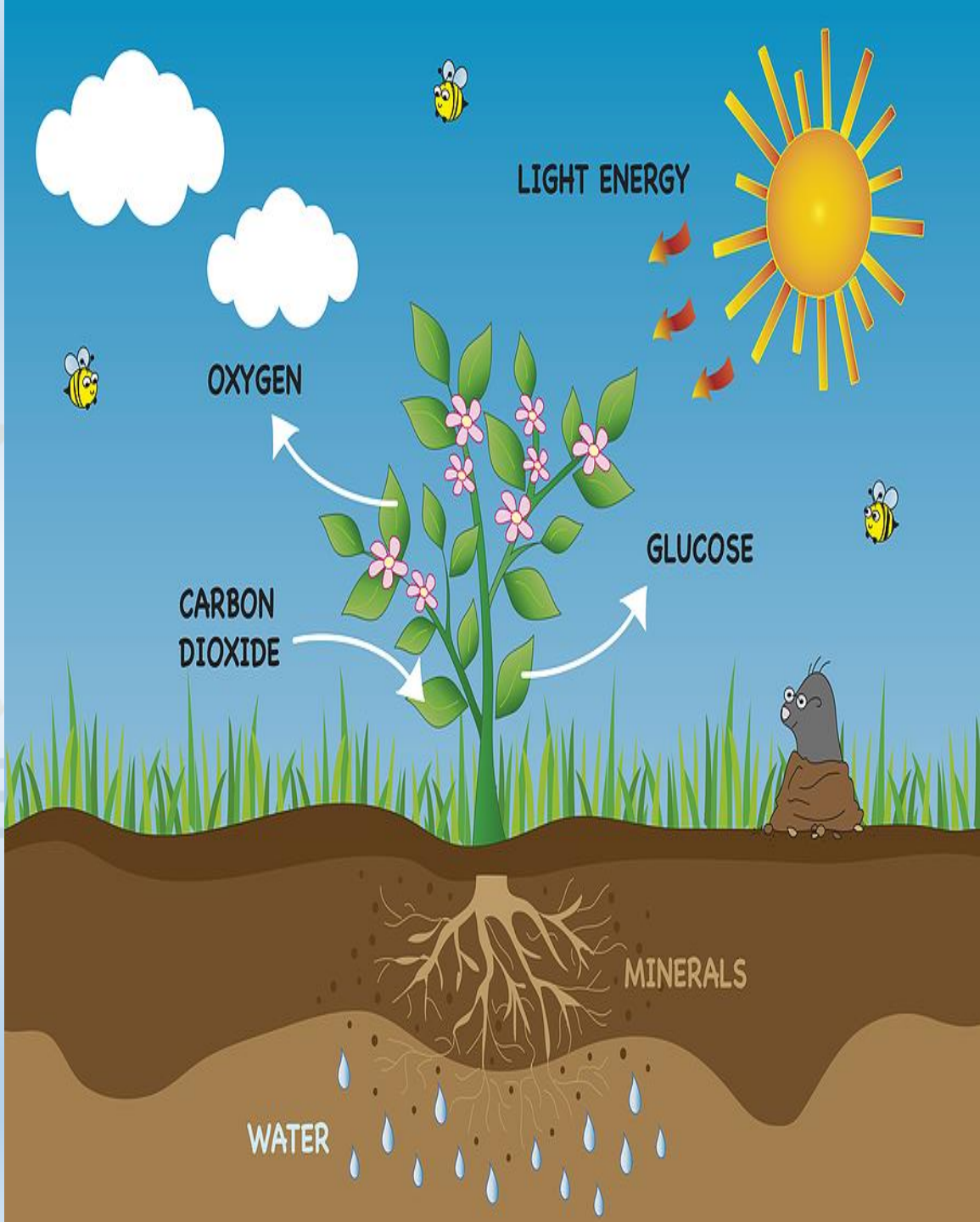
Activity 3: Photosynthesis; production of organic matter

INSTRUCTOR: SUHAIB AUDI

❖ Introduction:

- Water and mineral salts, absorbed by chlorophyllic plants, are used by leaves in the synthesis of organic matter. That synthesis, which results in the formation of starch, requires the intervention of other elements.
- What are these elements?
- What is the importance of the manufacture of organic matter?

- Green plants can produce their own food in the form of **organic matter** by a process called **"photosynthesis"** if they are provided with the suitable conditions.
- This organic matter like proteins, starch, lipids & sugars, are **produced in the leaves then stored in fruits.**



❖ Photosynthesis:

- Photosynthesis is the process by which green plants make their own food called “organic matter” (starch) using:

✓ Sunlight

✓ Carbon dioxide (CO_2) from the air

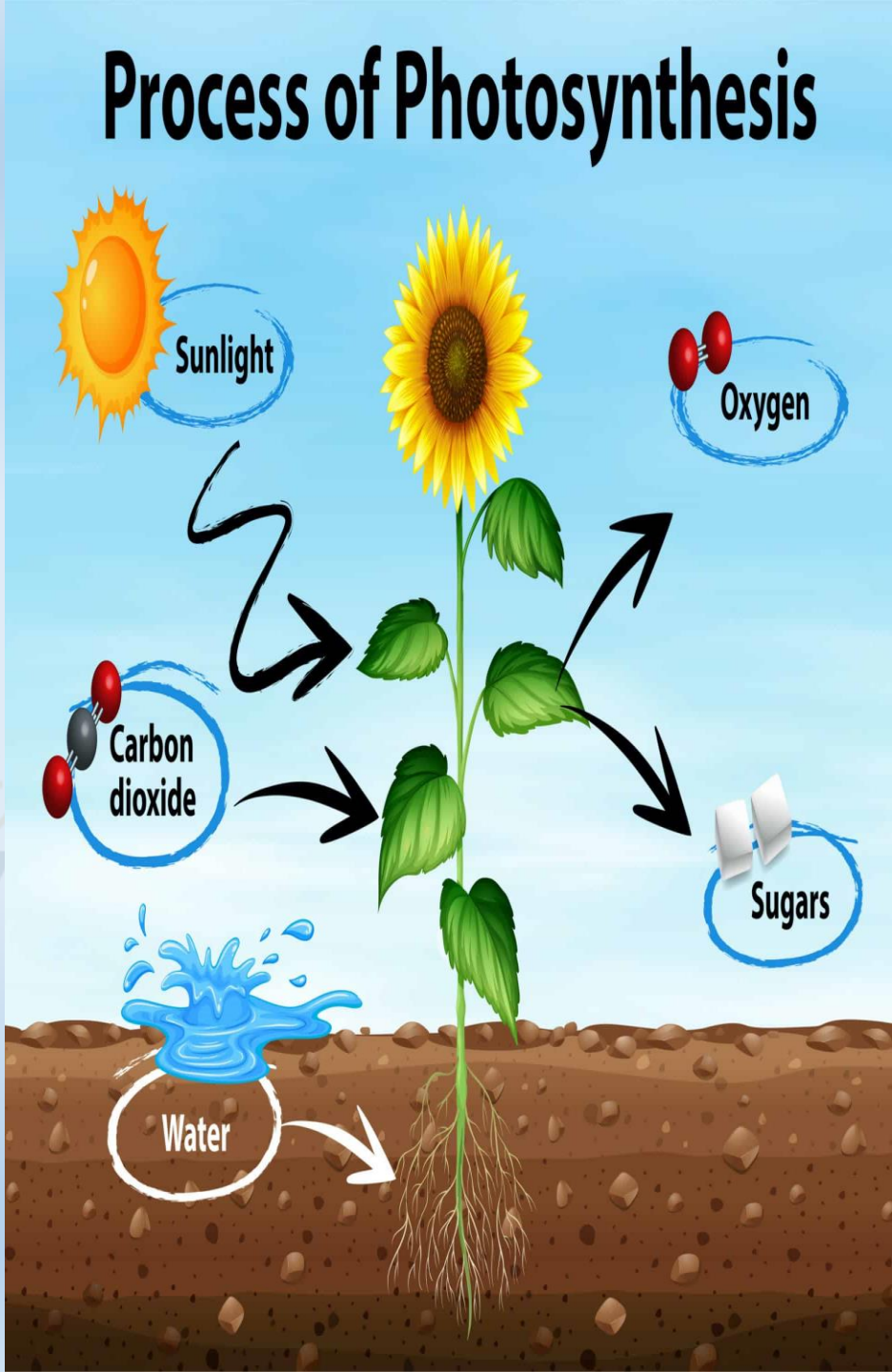
✓ Water (H_2O) from the soil

✓ Mineral salts

- Photosynthesis takes place in the **leaves** of green plants and occurs **only during the daytime,** in the presence of sunlight.

- During this process, the green plant **absorbs carbon dioxide (CO_2)** from the air and **releases oxygen (O_2)** into the atmosphere.

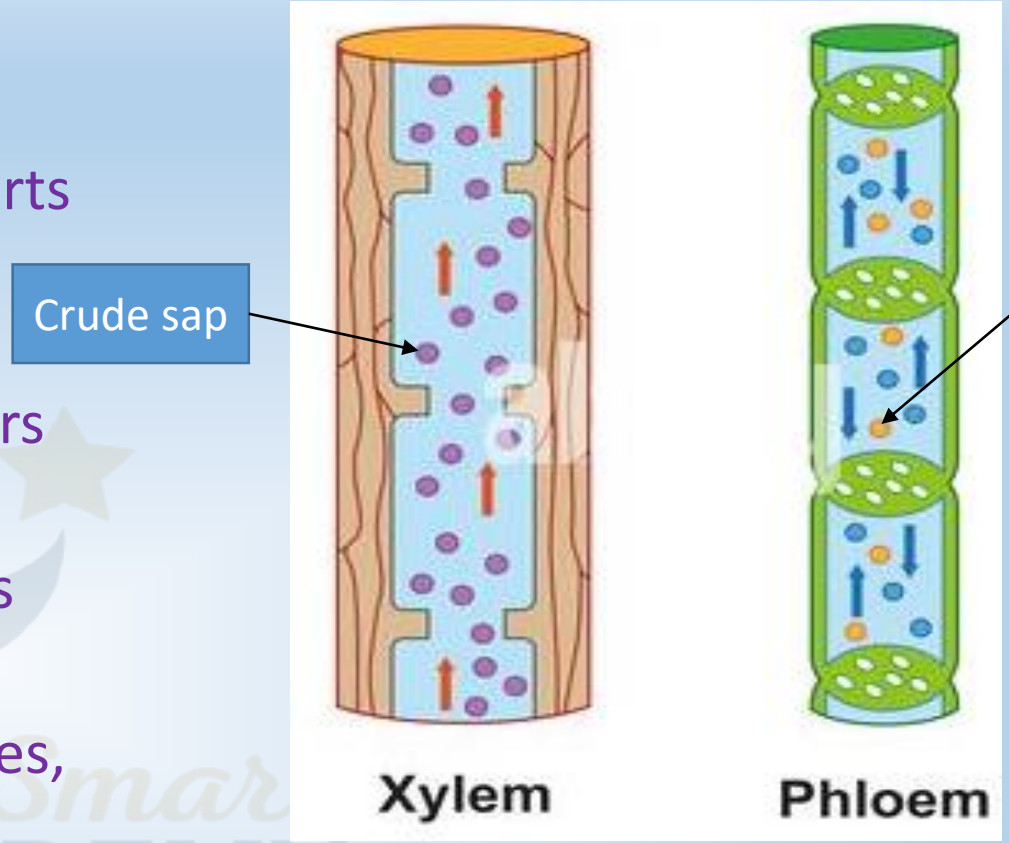
- The **extra organic matter** produced during photosynthesis is **stored in the plant's reserve organs**, such as: **tubers** (e.g., potatoes), **fruits, flowers and grains**



- The produced organic matter is called **elaborated sap**.
- This elaborated sap is transported to all parts of the plant through specific conducting vessels known as **phloem**.
- The movement of the elaborated sap occurs in **both directions**:

✓ **Descending** (downward) to reach the roots and lower parts.

✓ **Ascending** (upward) to reach growing leaves, buds, and fruits.



❑ The Steps of Photosynthesis Process are:

1. The green plant absorbs the crude sap (water and mineral salts) by root hairs.

2. The crude sap is carried upward to the leaves by conducting vessels called Xylem.

3. Carbon dioxide gas enters the leaves through small openings called stomata.

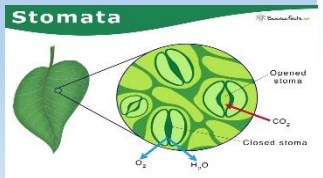
4. Sunlight is trapped or absorbed by the chlorophyll.

5. The plant changes these elements (crude sap, carbon dioxide and sunlight) into food (organic matter) and oxygen gas.

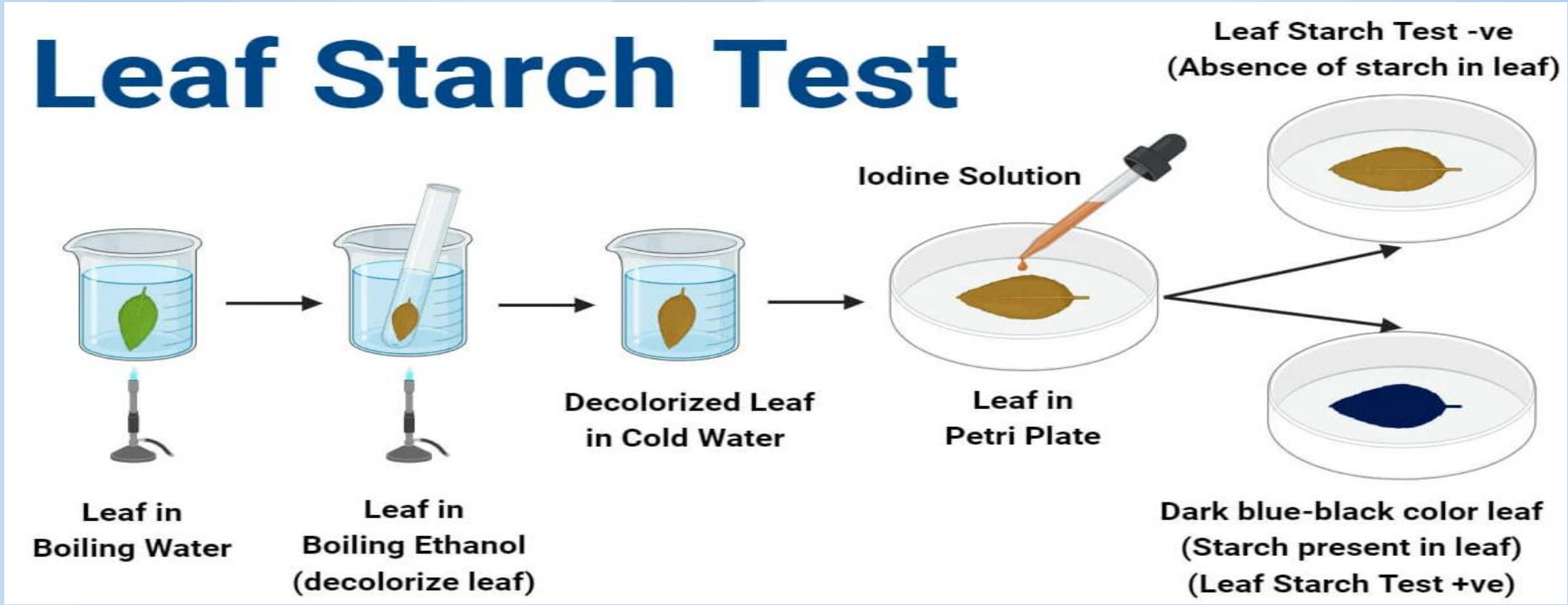
6. Oxygen gas is released to the air.

7. Organic matter (starch) is mixed with water forming elaborated sap that is distributed to all parts of the plant by conducting vessels called phloem.

Note: the leaf takes CO2 and releases O2 through stomata.



- To know if a certain plant is growing or not, we have to check whether it produces its food like "starch". For this reason, iodine test is applied on the leaves, iodine solution turns dark blue in color in presence of starch and yellow in absence of starch.

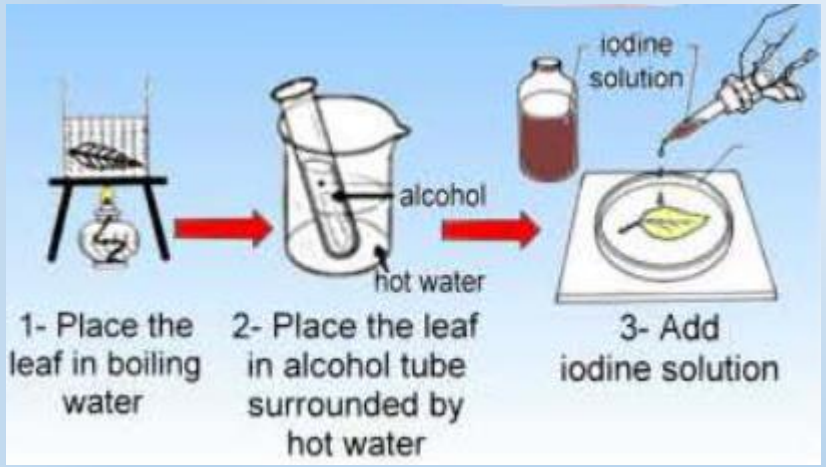


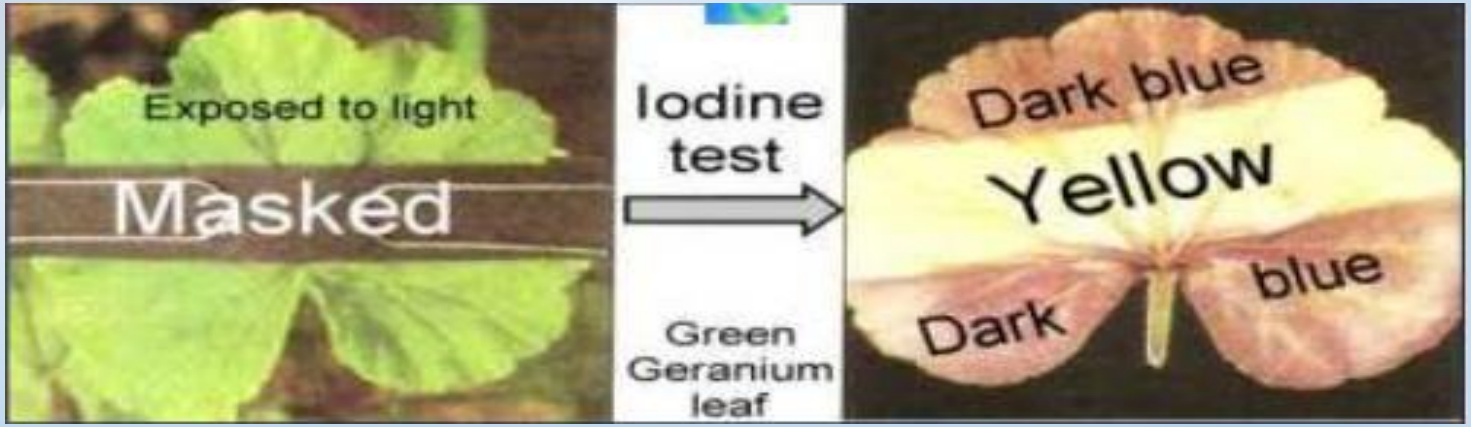
❖ Necessary elements for photosynthesis:

1. Importance of Sun light

Procedure:

- Take a leaf from a green plant which has been exposed to light for several hours.
- Place the leaf for ten minutes in hot alcohol placed in a hot bath; (to avoid burning of alcohol vapor).
- Dip the leaf in iodine water for five minutes. A blue color appears indicating the presence of starch.





- A black mask covers a part of a green geranium leaf exposed to light.
- After 24 hours, the mask is removed and the leaf is treated with hot alcohol and iodine water.

1. Pose the problem at the origin of this experiment.

- Do green plants need sun light to make photosynthesis ?

2. Formulate the tested hypothesis.

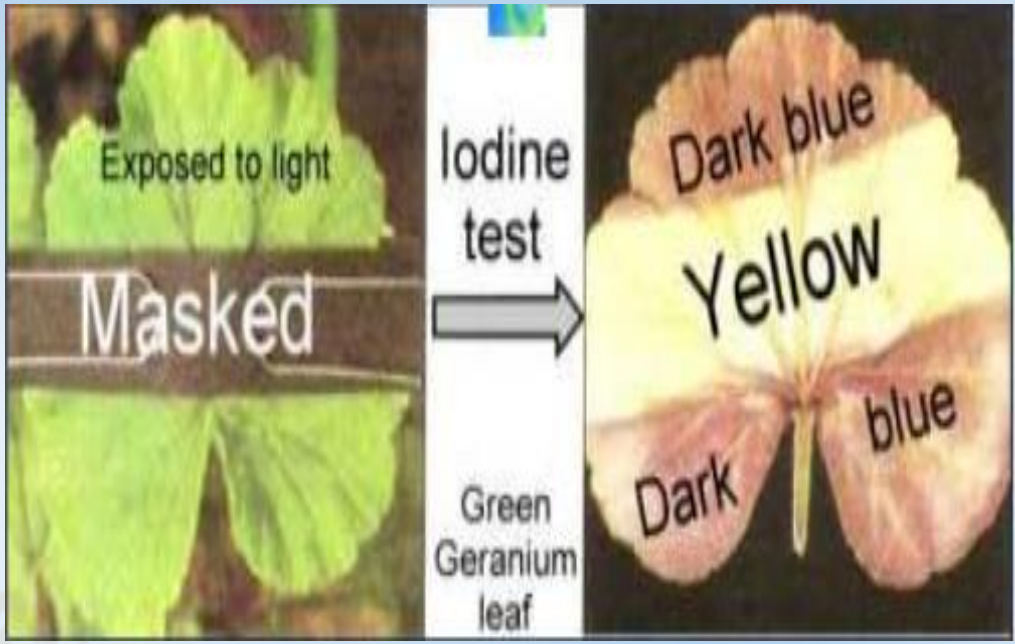
- Hypothesis: Sun light is necessary for the green plant to make photosynthesis.

3.Indicates the importance of the hot alcohol and iodine solution.

- Hot alcohol is used to dissolve chlorophyll, it removes the green color of the leaf.
- iodine solution is used to detect the presence of starch.

4. Identify the variable Factor.

- Since part of the leaf is masked and not exposed to light while the other part is exposed to light, so the variable factor is the light.



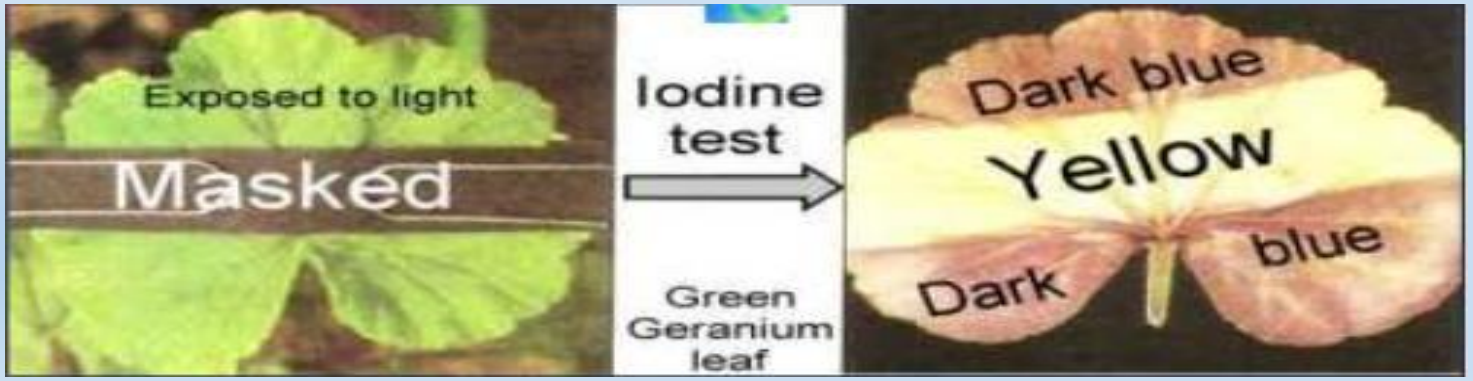
5. Interpret the results of this experiment.

- The masked part of the leaf remains **yellow**, while the uncovered part becomes **dark blue** after applying iodine test to the whole leaf.
- This implies that the part of the leaf that was exposed to light contains the starch, while the part of the leaf that was deprived of light doesn't contain starch.

6. What can you conclude ?

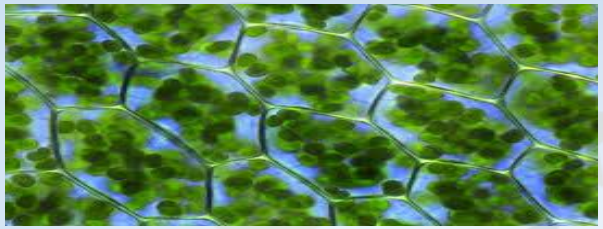
- We can conclude that a green plant needs light to carry out photosynthesis (to synthesize starch).

Therefore, without light photosynthesis can not take place.



2. Importance of Chlorophyll

Chlorophyll is a pigment present inside the cells of the leaf. It gives the leaf its green color. Some plants have a multicolored leaves due to the absence of chlorophyll in only some parts of the leaf. Is chlorophyll a necessity for photosynthesis to take place? To answer this question, we conduct the following experiment on a multicolored geranium leaf.



1. Pick out:

1.1. The posed problem.

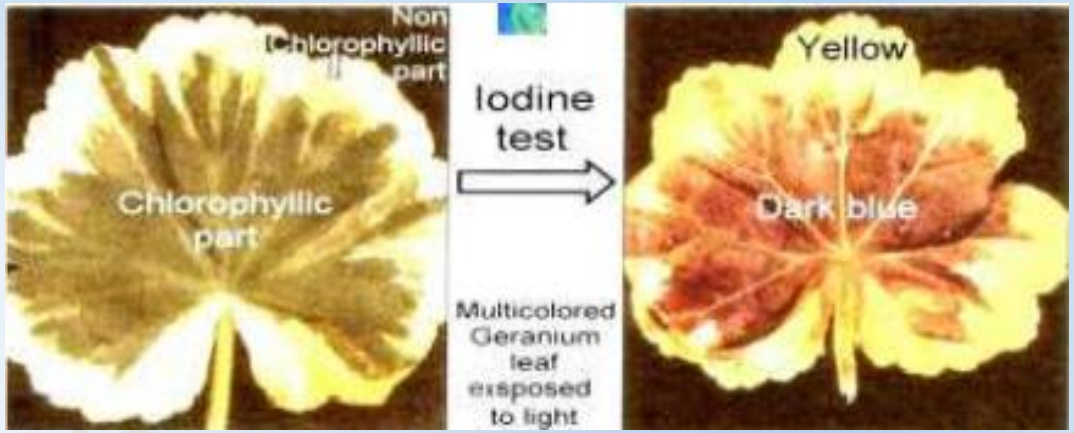
Is chlorophyll a necessary need for the plant to do photosynthesis?

1.2. The variable factor.

Chlorophyll

2. Specify the part that produces starch.

The middle chlorophyllic part only produced starch since iodine test shows **dark blue color** in the middle part only.



3- Is the problem solved? Justify.

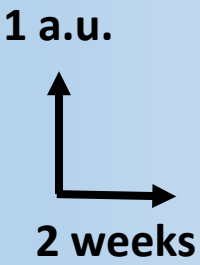
Yes since the middle part that contains chorophyll could produce starch, while the outer non chlorophyllic part couldn't produce starch.
so chlorophyll is an important condition for the plant to produce its food.

❖ How to Draw a Graph?

The following table shows the variation of the quantity of organic matter (a.u.) as a function of time (weeks).

Time (week)	0	2	4	6	8	10
Quantity of organic matter (a.u.)	0	2	4	5	6	7

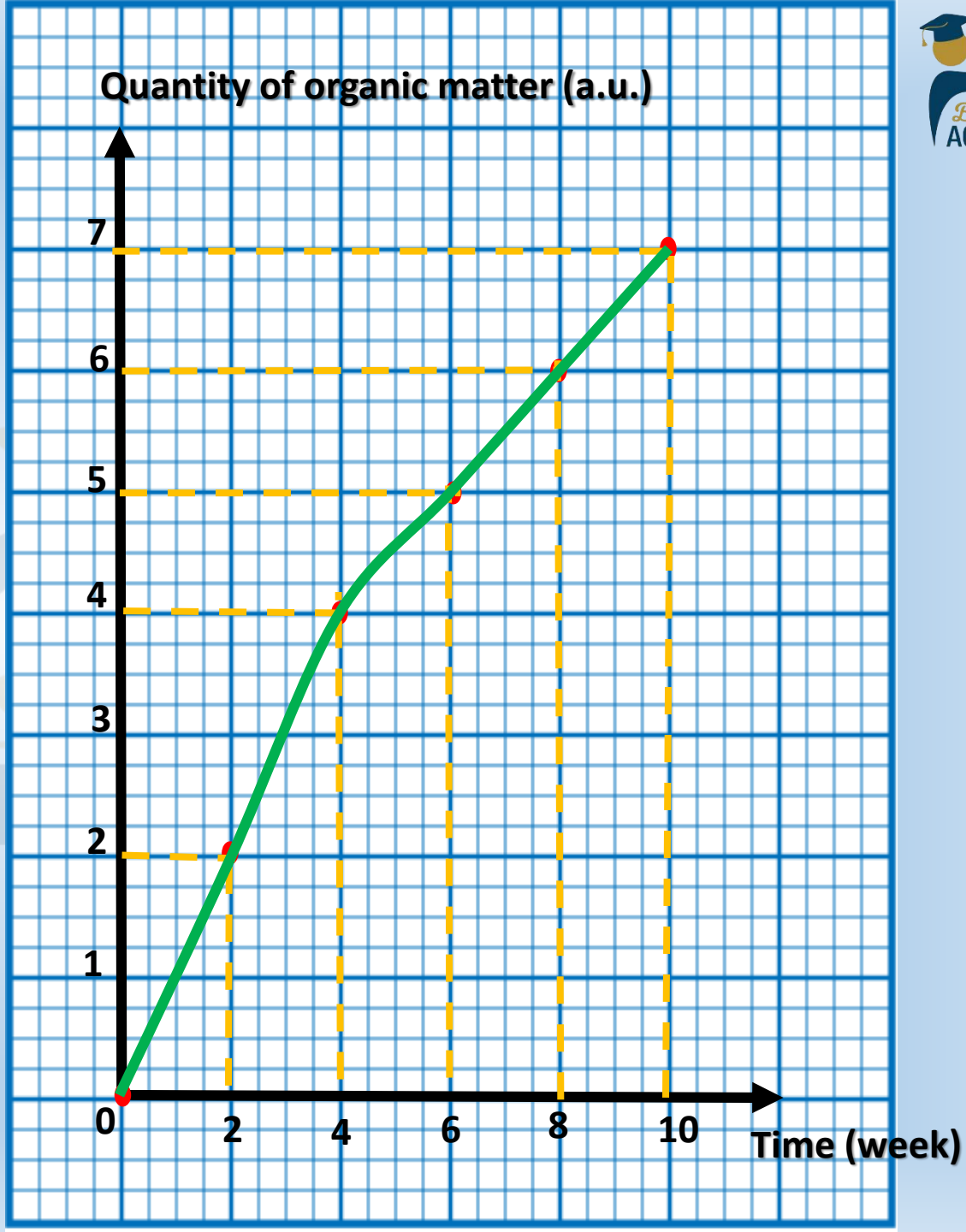
Scale:



Title: A graph showing the variation of the quantity of organic matter (a.u.) as a function of time (weeks).

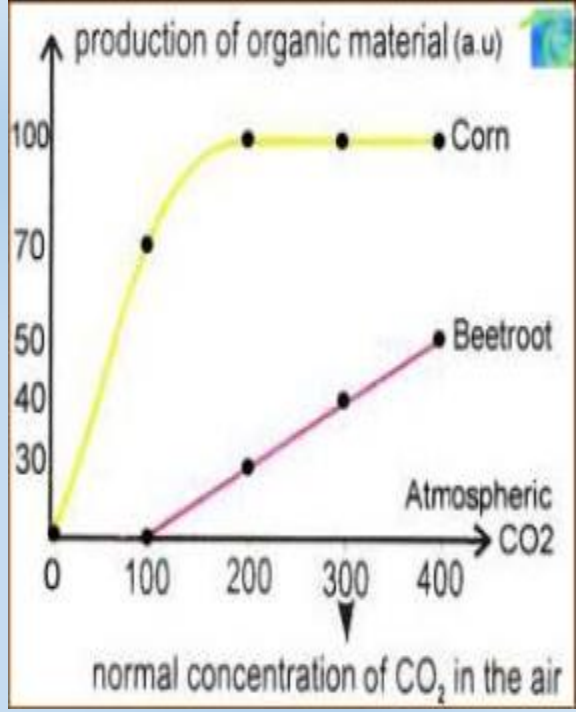
- Analyze the graph.

As the time increases from 0 to 10 weeks, the quantity of organic matter increases from 0 to 7 a.u.



❖ The Effect of CO_2 on the Production of Starch

In order to study the effect of CO2 on the production of starch, we measured the amount of organic material (starch) produced in 2 different plants supplied with different amounts of CO2 in the medium.



1. Pick out the objective.

To study the effect of CO_2 on the production of starch

2. Analyze the obtained results.

The production of organic material in corn increases from 0 to 100 a.u as atmospheric CO_2 **increases** from 0 to 150 then **remains constant** at 100 a.u ,**while** this production in beetroot **increases** from 0 to 50 a.u as CO2 **increases** from 100 to 400.

3. Derive a conclusion.

We conclude that the increase of CO_2 for a limited value favors the increase of organic production.

4. Transform the graph into a table.

Atmospheric CO_2		0	100	200	300	400
Production of organic material in (a.u)	Corn	0	70	100	100	100
	Beetroot	0	0	30	40	50

❑ Photosynthesis and production of plant matter

1.Analyze the table.

when the age of the plant **increased** from 1 day to 42 days, the mass of dry matter **increased** from 0.12 grams to 1.97 grams.

Age of the plant in days	Mass of dry plant matter in grams
1	0.12
5	0.15
14	0.25
28	0.82
35	1.47
42	1.97

2. Green plants are the producers of living matter. Justify this statement.

Green plants are called producers because they make their own food (starch) through photosynthesis.
This food is a type of organic matter that is used by other living things, such as animals and humans, for energy.

Summary:

1- Compare the composition of the crude sap to that of the elaborated sap.

Both saps contain water, but elaborated sap contains starch while crude sap contains mineral salts.

2-Indicate the origin of the constituents of each sap

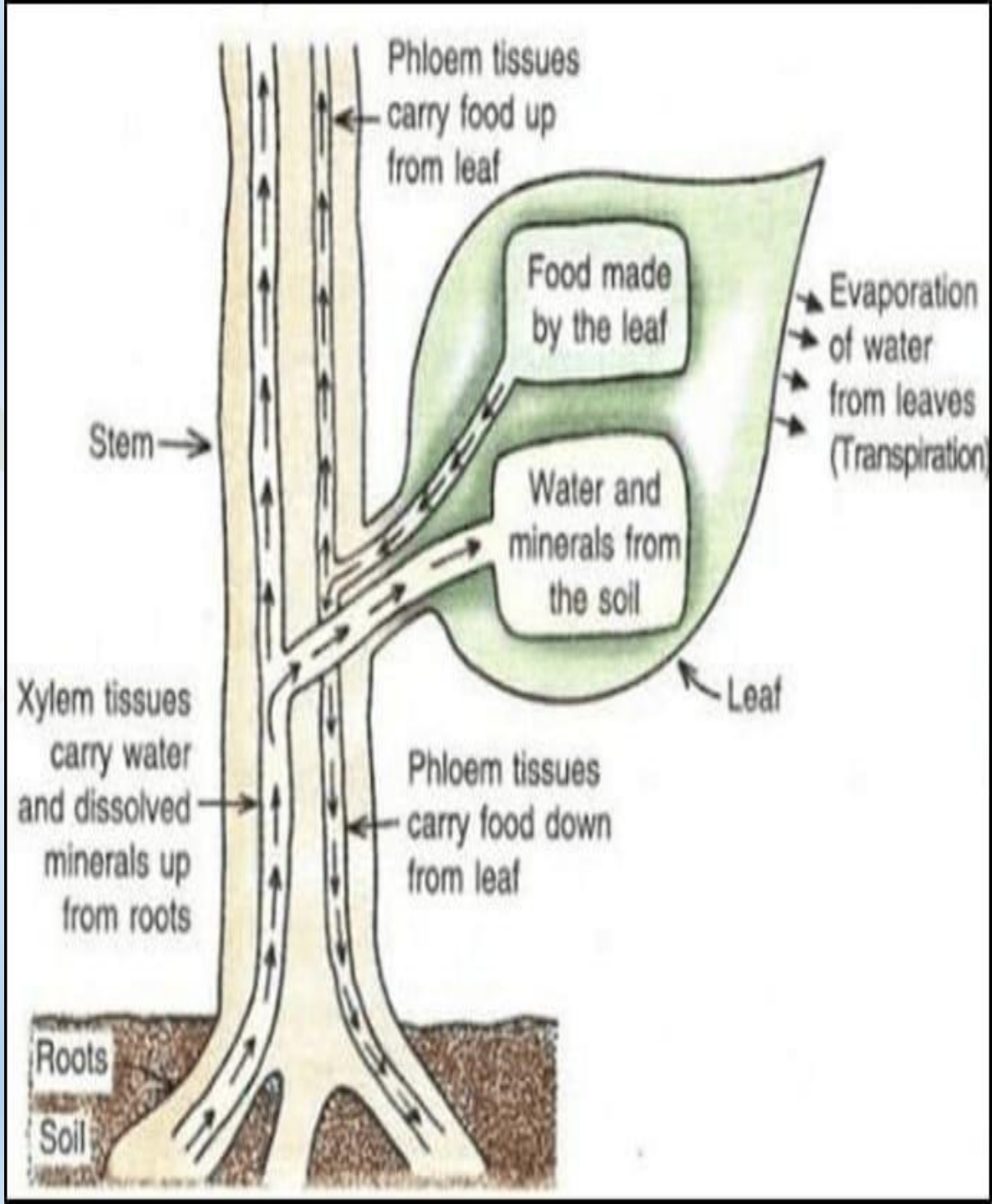
The origin of the crude sap is the soil, while the origin of the elaborated sap is the photosynthesis.

3- Indicate the pathway of crude sap and elaborated sap.

- Pathway of crude sap: Root hairs → Root → Stem→ leaves.
- Pathway of the elaborated sap: leaves → Stem → (Fruit, Tuber and Bud).

4-Indicate by which structures, the crude sap and the elaborated sap are conducted

Conducting vessels



1- Pick out:

a- The gas absorbed by leaves.

Carbon dioxide

b- The needs from soil.

Water + Mineral salts

c- The structure of absorption

Root hairs

d- The name of sap that is conducted upward.

Crude Sap

2- Indicate the site of starch production.

In the Leaves

3- Pick out the gas released

Oxygen

4- Conclude the name of the process that takes place.

Photosynthesis

5- Name the sap that conducts the organic products to the whole plant.

Elaborated Sap

6- Indicate the storage organ of the excess products above soil.

Fruits

7- Indicate the storage organ of the excess products below soil.

Tuber