

A. MULTIPLE CHOICE TYPE

Q – 1 Multiple choice questions

- The production of starch, and not glucose, is often used as a measure of photosynthesis in leaves because
 - starch is immediate product of photosynthesis,
 - glucose formed in photosynthesis soon gets converted into starch,
 - starch is soluble in water,
 - sugar cannot be used
- The number of water molecules required in the chemical reactions to produce one molecule of glucose during photosynthesis is
 - six,
 - twelve,
 - eighteen,
 - twenty-four
- The rate of photosynthesis is not affected by
 - light intensity,
 - humidity,
 - temperature,
 - CO₂ concentration
- Chlorophyll in a leaf is required for
 - breaking down water into hydrogen and oxygen,
 - emitting green light,
 - trapping light energy,
 - storing starch in the leaves
- If the rate of respiration becomes more than the rate of photosynthesis, plants will:
 - continue to live, but will not be able to store food,
 - be killed instantly,
 - grow more vigorously because more energy will be available,
 - stop growing and die gradually of starvation
- Which one chemical reaction occurs during photosynthesis?
 - Carbon dioxide is reduced and water is oxidised,
 - Water is reduced and CO₂ is oxidised,
 - Both carbon dioxide and water are oxidised,
 - Both carbon dioxide and water are reduced
- The specific function of light energy in the process of photosynthesis is to
 - reduce carbon dioxide,
 - synthesise glucose,
 - activate chlorophyll,
 - split water molecule
- A plant is kept in a dark cupboard for 48 hours before conducting any experiment on photosynthesis in order to
 - remove chlorophyll from leaves,
 - remove starch from the leaves,
 - ensure that no photosynthesis occurred,
 - ensure that the leaves are free from starch
- During photosynthesis, the oxygen in glucose comes from
 - CO₂,
 - water,
 - both CO₂ and water,
 - oxygen via air

B. VERY SHORT ANSWER TYPE

Q – 1 Name the following

1. The category of organisms that prepare their own food from basic raw materials.
Producers / Autotrophs
2. The kind of plastids found in the mesophyll cells of the leaf.
Chloroplasts
3. The compound which stores energy in the cells.
ATP (Adenosine triphosphate)
4. The first form of food substance produced during photosynthesis.
Glucose
5. The source of carbon dioxide for aquatic plants.
Carbon dioxide dissolved in water
6. The part of chloroplast where the dark reaction of photosynthesis takes place.
Stroma
7. The tissue that transports manufactured type of starch from leaves to all parts of the plants.
Phloem
8. The organisms that can be called "natural purifiers" of the air.
Green plants

Q – 2 Given below are groups of terms. In each group, the first pair indicates the relationship between the two terms. Complete the second pair accordingly.

1. Chlorophyll : Magnesium :: Haemoglobin : Iron
2. Light reaction : Granum :: Dark reaction : Stroma
3. Producers : Autotrophs :: Consumers : Heterotrophs
4. Respiration : Carbon dioxide :: Photosynthesis : Oxygen
5. Water and minerals : Xylem :: Prepared food : Phloem

C. SHORT ANSWER TYPE

Q – 1 Identify false statements and rewrite them correctly by changing first or last word only.

1. Dark reaction of photosynthesis occurs during night time. (False)
Correct Statement: Dark reaction of photosynthesis is independent of light and occurs simultaneously with light reaction.
2. Photosynthesis requires enzymes. (True)
3. Green plants are consumers. (False)
Correct Statement: Green plants are producers.
4. Photosynthesis results in loss of dry weight of the plants. (False)
Correct Statement: Respiration results in loss of dry weight of the plants.
5. Photosynthesis stops at a temperature of about 35°C. (False)

Correct Statement: Photosynthesis stops at a temperature of above 40°C.

6. Photosynthesis occurs only in cells containing chloroplasts. (True)
7. Green plants perform photosynthesis. (True)
8. Algae are autotrophs. (True)
9. Immediate product of photosynthesis is glucose. (True)
10. Starch produced in a leaf remains stored in it for 2-3 weeks before it is used by other parts of the plant. (False)

Correct Statement: Starch produced in a leaf is stored temporarily in the leaf until the process of photosynthesis. At night it is converted back into soluble sugar and translocated to different part of the body either for the utilization or for the storage.

Q – 2 Fill in the blanks with the appropriate answer from the choices given in the brackets.

1. The site of light reaction in the cells of a leaf is (cytoplasm, stroma, grana)
2. The chemical substance used to test the presence of starch in the cell of a leaf is (CaCl₂, iodine solution, Benedict solution)
3. Stroma is ground substance in (cytoplasm, chloroplast, ribosomes)
4. The dark reaction of photosynthesis is known as (Hill reaction, cyclic phosphorylation, Calvin cycle)
5. In the flowering plants, food is transported in the form of (sucrose, glucose, starch)

Q – 3 Are the following statements true or false? Give reason in support of your answer.

1. The rate of photosynthesis continues to rise as long as the intensity of light rises.
False, Photosynthesis increases with the light intensity up to a certain limit only and then it gets stabilized.
2. The outside atmospheric temperature has no effect on the rate of photosynthesis.
False, The atmospheric temperature is an important external factor affecting photosynthesis. The rate of photosynthesis increases up to the temperature 35°C after which the rate falls and the photosynthesis stops after 40°C.
3. If you immerse a leaf intact on the plant in ice cold water, it will continue to photosynthesise in bright sunshine.
False, Ice cold water will hamper the process of photosynthesis in the immersed leaf, even if there is sufficient sunshine because the temperature is an important factor for the rate of photosynthesis.
4. Destarching of the leaves of a potted plant can occur only at night.
False, For destarching, the potted plant can be kept in a dark room for 24-48 hours.
5. If a plant is kept in bright light all the 24 hours for a few days, the dark reaction (biosynthetic phase) will fail to occur.

False, If a plant is kept in bright light all the 24 hours for a few days, the dark reaction (biosynthetic phase) will continue to occur because the dark reaction is independent of light and it occurs simultaneously with the light dependent reaction.

6. Photosynthesis is considered as a process supporting all life on earth.

True

7. The starting point of carbon cycle is the release of carbon dioxide by animals during respiration.

False, There is no start point or end point in the carbon cycle, the carbon is constantly circulated between the atmosphere and the living organisms.

Q – 4 Given below are five terms. Rewrite the terms in the correct order so as to be in logical sequence with regard to photosynthesis: (i) water molecules, (ii) oxygen, (iii) grana, (iv) hydrogen and hydroxyl ions, (v) photons.

Answer : Photons, grana, water molecules, hydrogen and hydroxyl ions, oxygen

Q – 5 State any four differences between photosynthesis and respiration.

Photosynthesis	Respiration
Carbon dioxide is used up and oxygen is released.	Oxygen is used up and carbon dioxide is released.
Photosynthesis occurs in plants and some bacteria.	Respiration occurs in all living organisms.
Photosynthesis results in gain of dry weight of the plants.	Respiration results in loss of dry weight of the plants.
Glucose is produced which is utilized by the plants.	Glucose is broken down to obtain energy.
The raw materials for the photosynthesis are water, carbon dioxide and sunlight.	The raw material for respiration is glucose.

Q – 6 Complete the following food chains by writing the names of appropriate organisms in the blanks:

- Grass → Snake →
Grass → Rabbit. → Snake → Hawk
- → Mouse → Peacock
Grass/Corn → Mouse → Snake → Peacock

Q – 7 How do non-green plants such as fungi and bacteria obtain their nourishment?

Non-green plants such as fungi and bacteria obtain their nourishment from decaying organic matter in their environment. This matter comes from dead animals and plants. Fungi and bacteria break down the organic matter to obtain the nourishment and they release carbon dioxide back in the atmosphere.

Q – 8 All life owes its existence to chlorophyll. Give reason.

Chlorophyll is the foundation site for the photosynthesis in green plants. The initiation of photosynthesis takes place when the chlorophyll molecule traps the light energy. The light energy is then converted into chemical energy in the form of glucose using carbon dioxide (CO₂) from the atmosphere, and water (H₂O) from the soil. All other organisms, directly or indirectly depend on this food for their survival. The starting point of any food chain is always a plant. If green plants were to suddenly disappear, then so would virtually all life on Earth. Thus, we can say that all life owes its existence to chlorophyll.

Q – 9 Complete the following by filling the blanks 1 to 5 with appropriate words/ terms/ phrases:

To test the leaf for starch, the leaf is boiled in water to (1). It is next boiled in methylated spirit to(2). The leaf is placed in warm water to soften it. It is then placed in a dish and(3) solution is added. The region, which contains starch, turns (4) and the region, which does not contain starch, turns(5)

Answer:

To test the leaf for starch, the leaf is boiled in water to kill the cells. It is next boiled in methylated spirit to remove chlorophyll. The leaf is placed in warm water to soften it. It is then placed in a dish and iodine solution is added. The region, which contains starch, turns blue-black and the region, which does not contain starch, turns brown.

Q – 10 "Oxygen is a waste product of photosynthesis." Comment.

Oxygen is released during photosynthesis. Some of this oxygen may be used in respiration in the leaf cells, but the major portion of it is not required and it diffuses out into the atmosphere through the stomata. However, in a sense, even this oxygen is not a waste because all organisms require it for their existence including the plants.

D. DESCRIPTIVE TYPE

Q – 1 Define the following terms.

1. Photosynthesis

Photosynthesis is the process by which living plant cells, containing chlorophyll, produce food substances (glucose and starch), from carbon dioxide and water, by using light energy and release oxygen as a by-product.

2. Thylakoids

Closely packed flattened sacs arranged in piles in the interior of chloroplasts are called Thylakoids.

3. Chloroplast

Chloroplasts are minute oval bodies bounded by a double membrane which contains Thylakoids arranged in piles called Grana lying in a colourless ground substance called Stroma.

4. **Photolysis of water**

Photolysis of water is defined as the splitting of H₂O molecules into hydrogen ions and oxygen in the presence of light.

5. **Polymerisation**

Polymerisation is the process in which several glucose molecules are transformed to produce one molecule of starch.

Q – 2 Photosynthesis in green plants is directly and indirectly dependent on so many plant structures. Explain briefly the role of the following structures in this process.

1. Guard cells

They are located in the leaf epidermis and pairs of guard cells surround and form stomatal pores. Guard cells use osmotic pressure to open and close stomata. And thus regulate the entry of carbon dioxide through the stomata.

2. Cuticle

Cuticle is transparent and water proof to allow light to enter freely.

3. Chlorophyll

Chlorophyll is vital for photosynthesis, which allows plants to absorb energy from light. Light energy is converted into chemical energy. With photosynthesis, chlorophyll absorbs energy and then transforms water and carbon dioxide into oxygen and carbohydrates.

4. Stomata...

The main function of Stomata is to let in carbon dioxide from the atmosphere for photosynthesis. Also most of the oxygen produced during photosynthesis diffuses out into the atmosphere through the stomata.

5. Xylem tissue in the leaf veins

Xylem cells mainly transport water and minerals from the roots to the leaves. Water is essential for photosynthesis to occur. Water is taken up by the roots from the soil, sent up through the stem and finally brought to the leaves (site of photosynthesis) through the xylem tissue. The water is then distributed in the mesophyll tissue.

6. Phloem tissue in the leaf veins

The Phloem is composed of still living cells. Prepared food is transported from leaves to all parts of the plant by the phloem tissue. The glucose is converted into insoluble starch and later into soluble sugar sucrose, which is transported in solution through the phloem in the veins of the leaf and down through the phloem of the stem.

7. Mesophyll cells

Mesophyll cells are the main sites for photosynthesis. Chloroplasts are mainly contained in the mesophyll cells. When sunlight falls on the leaf, the light energy is trapped by the chlorophyll of the upper layers of mesophyll, especially the palisade cells.

Q – 3 Give reasons / explain

1. It is necessary to place a plant in the dark before starting an experiment on photosynthesis.

The presence of starch is regarded as evidence of photosynthesis. Hence before starting an experiment on photosynthesis, the plant should be placed in the dark for 24-48 hours to destarch the leaves. During this period, all the starch from the leaves will be sent to the storage organs and the leaves will not show the presence of starch. So the various experiments on photosynthesis can be carried out effectively.

2. It is not possible to demonstrate respiration in a green plant kept in sunlight.

If a green plant is kept in bright light, it tends to use up all the CO₂ produced during respiration, for photosynthesis. Thus, the release of CO₂ cannot be demonstrated. Hence, it is difficult to demonstrate respiration as these two processes occur simultaneously.

3. Most leaves have the upper surface more green and shiny than the lower surface.

The chloroplasts are concentrated in the upper layers of the leaf which helps cells to trap the sunlight quickly. Also the epidermis is covered by a waxy, waterproof layer of cuticle. This layer is thicker on the upper surface than the lower one. Hence most leaves have the upper surface more green and shiny than the lower one.

4. During the starch test the leaf is –

(1) boiled in water,

The leaf is boiled in water to kill the cells.

(2) boiled in methylated spirit.

The leaf is boiled in methylated spirit till it becomes pale-white due to the removal of chlorophyll.

The leaf now becomes hard and brittle.

Q – 4 Distinguish between the following pairs on the basis of words indicated in the brackets:

1. Light and dark reactions (products formed)

Light reactions	Dark reactions
Hydrogen and oxygen are produced here, along with release of electrons, which converts ADP into ATP.	Glucose is the main product formed during dark reaction.

2. Producers and consumers (organisms)

Producers	Consumers
They are autotrophs.	They are heterotrophs.

They can convert inorganic substances into organic substances.	They cannot convert inorganic substances into organic substances.
It includes green plants and photosynthetic micro-organisms.	It includes herbivores and carnivores.
For example — green plants	For example — Animals

3. Grass and grasshopper (mode of nutrition)

Grass	Grasshopper
Green grass being a producer is capable of producing its own food by photosynthesis.	Grasshopper is a primary consumer (herbivore) and directly feeds on producers like grass.

4. Chlorophyll and chloroplast (part of plant cell)

Chlorophyll	Chloroplast
Chlorophyll is the green pigment present in cell organelles called chloroplasts.	Chloroplasts are cell organelles, situated in the cytoplasm of plant cells. They are present mainly in the mesophyll cells and in the guard cells of stomata.

5. Respiration and photosynthesis (gas released)

Respiration	Photosynthesis
The gas released during respiration is carbon dioxide.	The gas released during photosynthesis is oxygen.

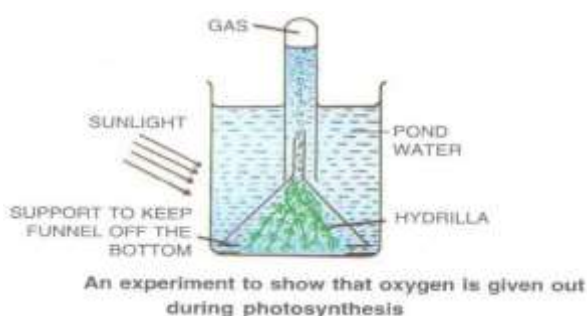
6. Stoma and stroma (structure)

Stoma	Stroma
A stoma is a microscopic pore surrounded by two specialized guard cells found in the leaves and stems. Its main function is gaseous exchange.	Stroma is the colourless ground substance found in the chloroplast. It is the site of the light independent reactions of photosynthesis.

Q – 5 How would you demonstrate that green plants release oxygen when exposed to light?

Procedure:

1. Place hydrilla plant (a water plant) in a beaker containing pond water and cover it by a short-stemmed funnel. (Make sure the level of water in the beaker is above the level of the stem of the funnel)
2. Invert a test tube full of water over the stem of the funnel.
3. Place the set up in the sun light for a few hours.



Observation:

- Bubbles appear in the stem which rise and are collected in the test tube. When sufficient gas gets collected, a glowing splinter will be introduced in the test tube, which will burst into flames.

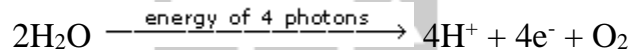
Inference:

- The splinter glows due the presence of oxygen in the test tube which proves that the gas collected in the test is released by hydrilla during photosynthesis.

Q – 6 Describe the main chemical changes which occur during photosynthesis in: (i) Light reaction, (ii) Dark reaction

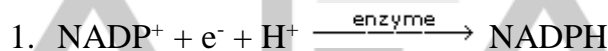
(i) Light Reaction:

The light reaction occurs in two main steps: (1) Activation of chlorophyll - On exposure to light energy, chlorophyll becomes activated by absorbing photons. (2) Splitting of water - The absorbed energy is used in splitting the water molecule into hydrogen and oxygen, releasing energy. This reaction is known as photolysis of water.

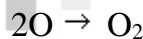


The fate of H^+ , e^- and O component are as follows:

The hydrogen ions (H^+) obtained from above are picked up by a compound NADP (Nicotinamide adenine dinucleotide phosphate) to form NADPH.



The oxygen (O) component is given out as molecular oxygen (O_2).



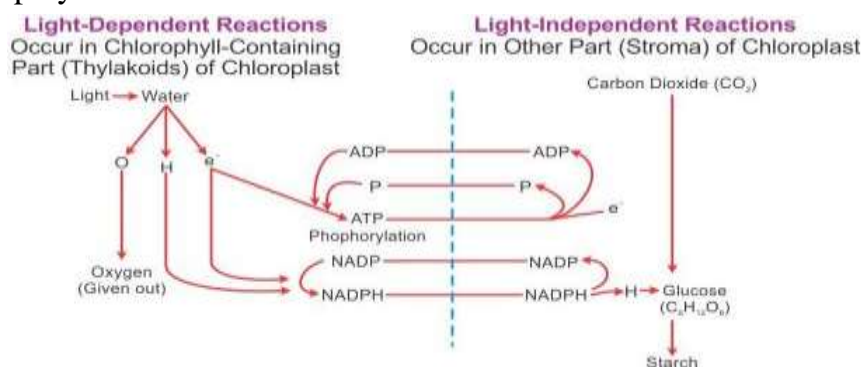
The electrons (e^-) are used in converting ADP into energy rich ATP by adding one inorganic phosphate group P_i .



This process is called photophosphorylation.

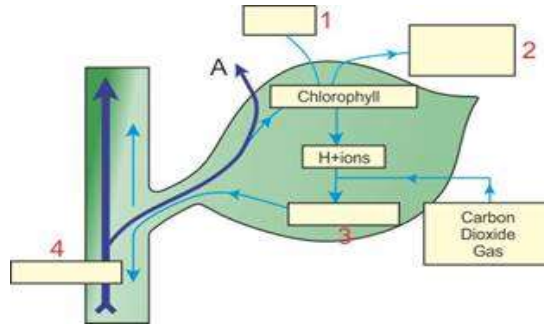
(ii) Dark reaction:

The reactions in this phase does not require light energy and occur simultaneously with the light reaction. The time gap between the light and dark reaction is less than one thousandth of a second. In the dark reaction, ATP and NADPH molecules (produced during light reaction) are used to produce glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) from carbon dioxide. Fixation and reduction of carbon dioxide occurs in the stroma of the chloroplast through a series of reactions. The glucose produced is either immediately used up by the cells or stored in the form of starch.



E. STRUCTURE / APPLICATION / SKILL TYPE

Q – 1 Given below is a schematic diagram to illustrate some aspects of photosynthesis.



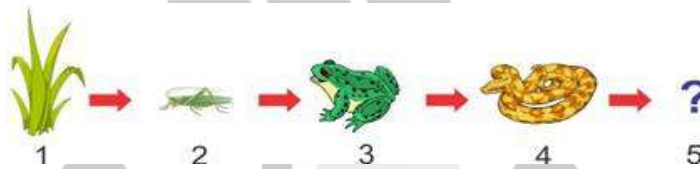
1. Fill up the gaps, in blank spaces (1-4), by writing the names of the correct items.

(1) Sunlight, (2) Oxygen, (3) Glucose, (4) Xylem

2. What phenomenon do the thick arrows A and B indicate?

(A) Transpiration, (B) Translocation

Q – 2 Given below is representation of a certain phenomenon in nature. With four organisms 1-4



1. Name the phenomenon represented.

Food chain

2. Name any one organism that could be shown at No .5

Hawk, eagle

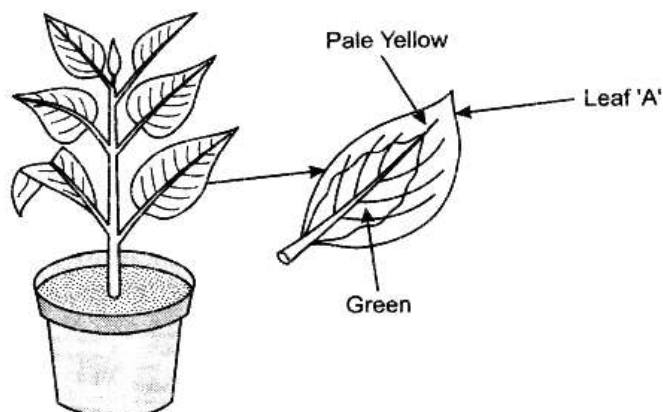
3. Name the biological process which was the starting point of the whole chain.

Photosynthesis

4. Name one natural element which all the organisms 2-4 and even 5 are getting from No. 1 for their survival.

Carbon

Q – 3 A potted plant with variegated leaves was taken in order to prove a factor necessary for photosynthesis. The potted plant was kept in the dark for 24 hours and then places in bright sunlight for a few hours. Observe the diagram and answer the questions.



1. What aspect of photosynthesis was being tested?

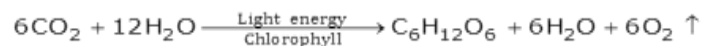
Chlorophyll is required for photosynthesis.

2. Why was the plant placed in the dark before beginning the experiment?

Before beginning the experiment, the plant was kept in dark in order to destarch the leaves, i.e. to remove the pre-existing starch from the storage organs.

3. Write a balanced chemical equation to represent the process of photosynthesis.

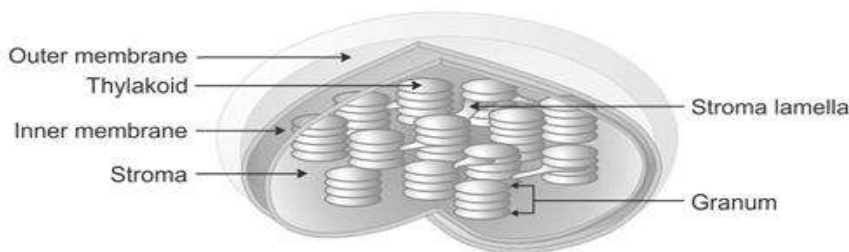
Chemical equation for the process of photosynthesis:



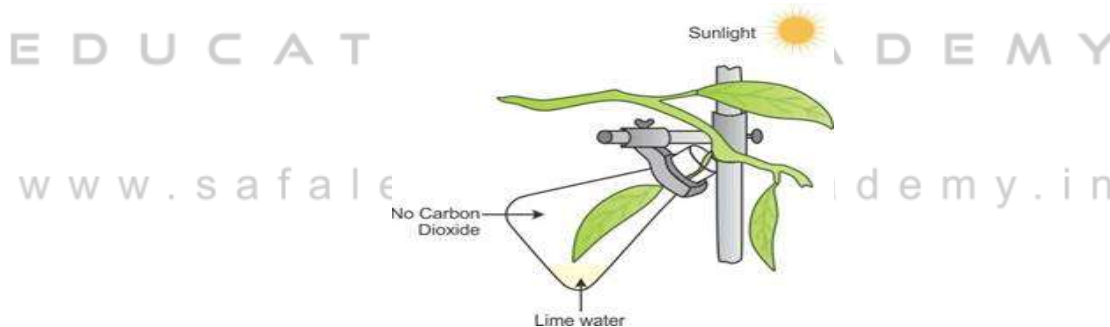
4. What will be the result of starch test when performed on leaf A shown in the diagram. Give an example of a plant with variegated leaves.

The green part of the leaf turns blue black and the pale yellow part will turn brown with iodine solution at the end of the starch test. Examples : Coleus / Geranium / Croton / Tradescantia

5. Draw a neat diagram of a chloroplast and label its parts.



Q – 4 Given alongside is the diagram of an experimental set-up:



1. What is the objective of this experiment?

To demonstrate the importance of carbon dioxide in photosynthesis

2. Will it work satisfactorily? Given reason.

No, the experiment will not work satisfactorily, as the beaker contains lime water and not potassium hydroxide to absorb CO₂.

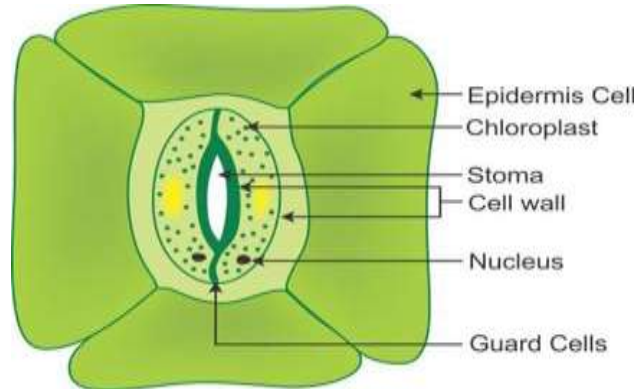
3. What alteration (s) will you make in it for obtaining expected result?

Place potassium hydroxide in the beaker instead of lime water

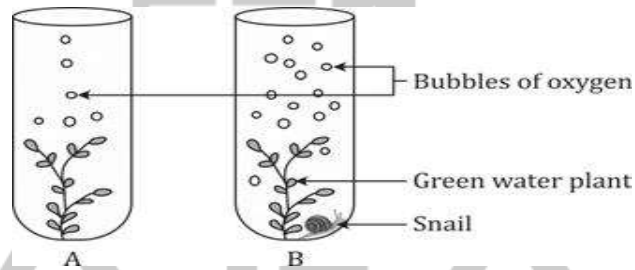
4. Would you take any step before starting the experiment? Describe this step and explain its necessity.

Before starting the experiment, it is necessary to destarch the leaves of the plant by keeping the plant in complete darkness for 48 hours. This is because if the plant is not destarched, then the experiment will give false results because starch stored previously may be detected in the leaf placed in the beaker even if no starch is produced during the experiment.

Q – 5 Draw a neat diagram of the stomatal apparatus found in the epidermis of leaves and label the Stoma, Guard cells, Chloroplast, Epidermal cells, Cell wall and Nucleus.



Q – 6 The diagram below shows two test-tubes A and B. Test-tube A contains a green water plant. Test-tube B contains both a green water plant and a snail. Both test-tubes are kept in sunlight. Answer the questions that follow:



1. Name the physiological process that releases the bubbles of oxygen.

Photosynthesis releases bubbles of oxygen.

2. Explain the physiological process as mentioned above in (a).

Photosynthesis is a physiological process by which plant cells containing chlorophyll produce food in the form of carbohydrates by using carbon dioxide, water and light energy. Oxygen is released as a by-product.

3. What is the purpose of keeping a snail in test-tube B?

Carbon dioxide released by the snail during respiration is used by the plant for photosynthesis. This increases the rate of photosynthesis in the plant placed in test tube B. This also suggests that both respiration and photosynthesis are complementary processes to maintain the concentration of oxygen and carbon dioxide in the atmosphere.

4. Why does test-tube B have more bubbles of oxygen?

A plant and a snail are kept in test tube B. The plant in test tube B has more concentration of CO₂ available because the snail releases CO₂ during respiration. This increases the rate of photosynthesis in the plant placed in test tube B which leads to the release of more amount of oxygen.

5. Give an example of a water plant that can be used in the above experiment.

Hydrilla

6. Write the overall chemical equation for the above process.

Chemical equation for photosynthesis:

