Chapter 6. Photosynthesis

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Solution 1:

(i) Chemical equation of photosynthesis:

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2 + 6H_2O$$

(ii) Advantages of photosynthesis:

a. To produce food for all the organisms on earth.
b. Release oxygen which is a life supporting gas.

Solution 2:

1. Plant pigments – Plant pigments are a variety of different kinds of molecules present in plants that absorb certain wavelengths of light while reflecting others.
2. Quantum – Quantum are the discrete packets which stores energy and these particles can be changed from one form to another.
3. Organic food – The food that is produced by using methods that do not involve synthetic inputs such as synthetic pesticides and chemical fertilizers is called organic food.
4. Light reaction – The reaction of photosynthesis which takes place in the presence of light is called light reaction.
5. Photolysis in photosynthesis – The process of splitting of water by sunlight during light reaction of photosynthesis is called photolysis in photosynthesis.

Solution 3:

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2 + 6H_2O$$

Solution 4:

(i) Hill Reaction and NADP Reduction in chloroplast:

Hill Reaction	NADP Reduction
Hill reaction is a light reaction which is completed in three steps in the presence of light.	NADP reduction is a part of Hill reaction in which NADP reduces to form NADPH.

(ii) Photosynthesis and photophosphorylation:

Photosynthesis	Photophosphorylation
(i) Photosynthesis involves both the light and dark reaction.	(i) Photophosphorylation takes place only during light reaction.
(ii) It is a complete process in which food/glucose is produced in plants.	(ii) It is a part of photosynthesis in which a molecule of phosphate is added to ADP to form ATP.

Solution 5:

1. The aim of the experiment is to prove that CO2 is necessary for photosynthesis.
2. Potassium hydroxide absorbs CO2 from the surrounding. It is placed to remove CO2 within the conical flask.
3. The leaf inside the conical flask would be tested for the presence of starch by the application of iodine.
4. The expected result of the above test is – No change in the colour will be observed.
5. Yes, it is necessary to similarly test on the outer leaf also to show that leaves present in CO2 show photosynthesis.

Solution 6:

1. 1 – Upper Epidermis; 2 – Palisade layer / chloroplast; 3 – Xylem; 4 – Phloem; 5 – Guard cell
2. The two arrows show the release of oxygen and water vapours during the daytime and carbon dioxide and very less amount of oxygen is released during the night.
3. Yes, one more arrow can be added to show the absorption of carbon dioxide by the leaf.
4. One vein has been shown in this section.

Solution 7:

Difference between photosynthesis and respiration:

Photosynthesis	Respiration
(i) Photosynthesis is the process by which green plant manufacture their own food by using carbon dioxide, light energy from the sun and water to make glucose and release oxygen.	(i) Respiration is the process in which oxygen is absorbed and energy and carbon dioxide is released.
(ii) Photosynthesis occurs only in cells containing chlorophyll in the presence of sunlight.	(ii) Respiration is a process which occurs at all times in all living cells.
(iii) It is an anabolic process.	(iii) It is a catabolic process.
(iv) It results in a gain in dry mass.	(iv) It results in a loss in dry mass.

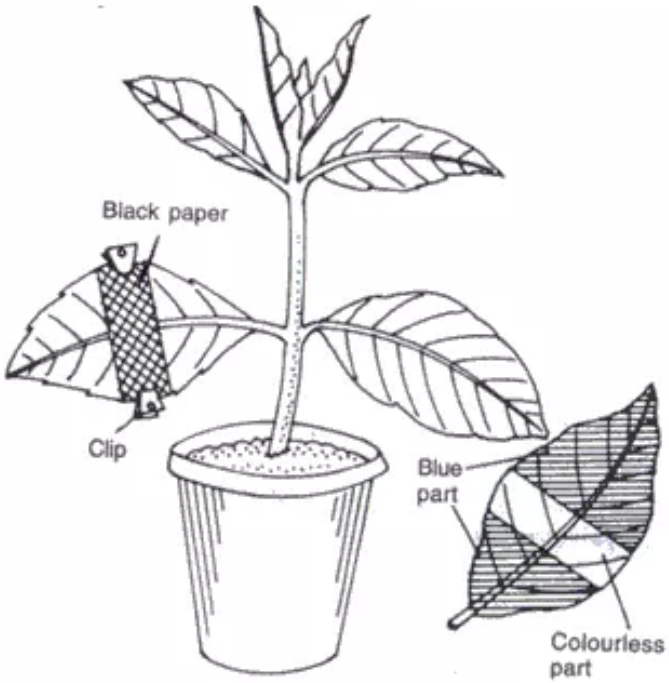
Solution 8:

(i) Dark reaction – It is a reaction in photosynthesis which do not require light and occurs in the stroma of the chloroplast.

(ii) $6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2 + 6H_2O$

(iii) Experiment to prove that sunlight is necessary for photosynthesis:

a. A potted plant is kept in the dark for two days to destarch the leaves.
b. A part of a leaf is covered with a black paper by clip.
c. Now the plant is kept in the light for few hours.
d. The leaf is plucked and is boiled in water and is then decolourized with alcohol.
e. The portion of leaf which received light turns blue with iodine because photosynthesis took place in that part of leaf.
f. The part of leaf which was covered with black paper remains colourless because photosynthesis could not take place in the absence of sunlight.



(iv) Photosynthesis and respiration are opposite to each other in the following ways:

Photosynthesis	Respiration
(i) It is an anabolic process.	(i) It is a catabolic process.
(ii) It results in a gain in dry mass.	(ii) It results in a loss in dry mass.

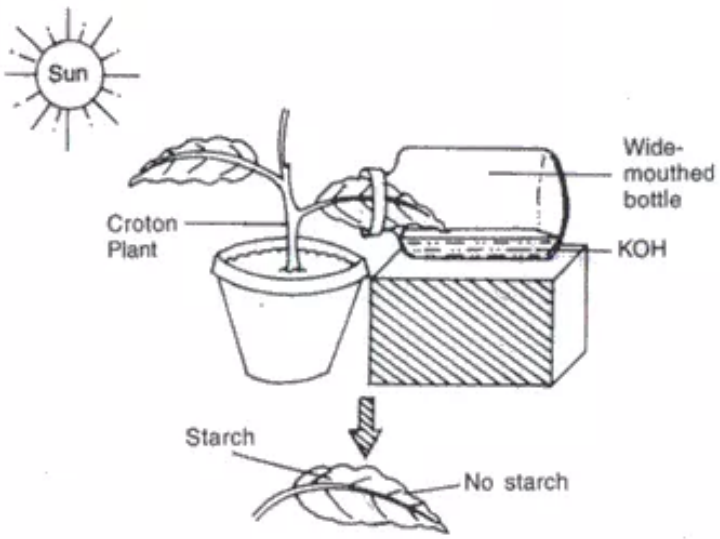
Solution 9:

(i) Photosynthesis: It is an anabolic process by which plants manufacture carbohydrates or food material with the help of water and carbon dioxide in the presence of sunlight and chlorophyll.
It is an important process as:

a. It produces food directly or indirectly for all living organisms on earth.
b. It maintains balance between oxygen and carbon dioxide in the atmosphere.

(ii) Experiment to show that starch is not produced in the leaves when carbon dioxide is not available:

a. A potted plant is kept in the dark for two days to destarch the leaves.
b. Take a wide mouth bottle and fill $1/3^{rd}$ of it with caustic potash solution.
c. Insert half part of the leaf of potted plant in the bottle and do not let the leaf to touch the solution in the bottle.
d. The apparatus is kept in sunlight for few hours.
e. The leaf is plucked and tested for starch.
f. Only the portion of the leaf which is outside the bottle turns blue and the part of the leaf inside the bottle remains colourless because it did not get CO_2 for photosynthesis. All the CO_2 present in the bottle was absorbed by caustic solution.



(iii) The leaves of the oat plant will turn yellow and the seedling will die because photosynthesis will not take place.

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Solution 10:

1. The objective of this experiment is to prove that oxygen is released during photosynthesis.
2. Hydrilla
3. Oxygen

4. The rate of photosynthesis will increase and the rate of bubbling also increases when sodium bicarbonate is added.
5. Photosynthesis will not take place.

Solution 11:

1. The leaf is then treated with iodine solution.
2. The leaf from first plant will not show starch test while the leaf from second plant will become blue-black showing the presence of starch.
3. It is necessary to grease the glass sheet to prevent the entry of air containing CO_2.
4. The hypothesis that CO_2 is necessary for photosynthesis is being tested in this experiment.

Solution 12:

Light intensity is directly proportional to sunlight. Increase in intensity of light increases the rate of photosynthesis. Photosynthesis is maximum in red light followed by blue light and is least in green light.

Solution 13:

1. Advantages of photosynthesis:
    - To produce food for all the organisms on earth.
    - Release oxygen which is a life supporting gas.
2. Respiration is a catabolic process while photosynthesis is an anabolic process. During respiration oxygen is taken and carbon dioxide is given out while during photosynthesis carbon dioxide is taken and oxygen is given out.
3. Chlorophyll is a green coloured pigment found in green plants. it absorbs light energy which is utilized for the formation of ATP and reduction of NADP during photosynthesis.

Solution 14:

Difference between autotroph and heterotroph:

Autotroph	Heterotroph
(i) They can prepare their own food.	(i) They cannot prepare their own food.
(ii) They contain chlorophyll.	(ii) They do not contain chlorophyll.
(iii) Example – Green plants.	(iii) Example – Animals.

Solution 15:

Difference between chloroplast and chlorophyll:

Chloroplast	Chlorophyll
(i) It is an organelle of the cell.	(i) It is the green pigment in chloroplast.
(ii) It is living.	(ii) It is non-living.

Solution 16:

Coelus and mushroom.

Solution 17:
It is because the upper surfaces of broad leaves are directly exposed to sunlight which leads to maximize the rate of photosynthesis.

Solution 18:

(i) (a) $6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2 + 6H_2O$

(b) $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{Energy}$

(ii) Photosynthesis and respiration.

(iii) Difference between photosynthesis and respiration:

Photosynthesis	Respiration
(a) It is an anabolic process.	(a) It is a catabolic process.
(b) It results in a gain in dry mass.	(b) It results in a loss in dry mass.

(iv) Photosynthesis.

Solution 19:
Chlorophyll.

Solution 20:
True

Solution 21:
False

Solution 22:
During the day transpiration and photosynthesis are interlinked as the stomata opens to facilitate the inward diffusion of carbon dioxide for photosynthesis which also leads to loss of water vapours to the outside during transpiration.

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Solution 23:

1. Destarched plant is the plant which lacks starch. Destarching is done by keeping the plant in dark for 2-3 days or covering a part of a leaf with a black paper by clip.
2. (a) The leaf is plucked and is boiled in water and decolourized with alcohol.
   (b) The portion of leaf which received light turns blue with iodine because photosynthesis took place in that part of leaf.
   (c) The part of leaf which was covered with black paper remains colourless because photosynthesis could not take place in the absence of sunlight.

This shows that starch is not manufactured in the absence of light.

Solution 24:

1. Chloroplast.

2. Glucose and oxygen.
3. Fungi, insects and animals.
4. Photolysis.
5. Magnesium.
6. Chloroplast.

Solution 25:

1. True
2. True
3. False
4. True
5. True
6. True
7. False
8. False
9. True

Solution 26:

1. Photosynthesis
2. Atmosphere
3. Glucose
4. Yellow
5. Chloroplast
6. Glucose and oxygen
7. Stomata

Solution 27:

1. (d) During night
2. (e) Green plants
3. (f) Oxygen
4. (b) Light reaction
5. (a) Decomposers

Solution 28:
Chloroplasts are the cell organelles in green plants which have chlorophyll and thus serve as the main site of photosynthesis.

Solution 29:

1. Large surface area of leaves.
2. Presence of more stomata.
3. The thinness of leaves.

Solution 30:
Carbon cycle is a series of chemical reactions in which atmospheric carbon dioxide is used by the organisms and returned to the atmosphere. Photosynthetic plants use carbon as carbon dioxide from the air synthesizing organic compounds. By respiration, burning, decay, etc. the carbon is returned to the atmosphere.

Solution 31:
Carbon in the form of carbon dioxide enters living organisms and then goes back to the atmosphere through several pathways forming the true carbon cycle. Thus, it helps in maintaining the balance of nature.

Solution 32:
The amount of carbon dioxide in the atmosphere is increasing due to increased human activities like burning of fossil fuels, deforestation, etc. which cause the rise in global temperatures. This global warming result in melting of polar ice caps, floods in coastal areas, disturbance in hydrogenic cycle etc. Thus "Human activities are harmful to the balance of nature".

Solution 33:
Carbon dioxide is removed from the atmosphere by:

1. Producers – Producers or green plants use carbon dioxide through photosynthesis. A small amount of carbon dioxide is used by chemosynthetic bacteria also.
2. Marine Organisms – Some amount of carbon dioxide is directly fixed by a few marine organisms and sea water absorbs carbon dioxide in the form of dissolved carbon dioxide, carbonic acid, carbonate and bicarbonates.

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Solution 34:

1. Carbon dioxide is returned back to the atmosphere mainly through the following ways:
    - Respiration – Animals and plants respire and release carbon dioxide in the atmosphere.
    - Decay – Plants and animals decay organic matter with the help of bacteria and fungi and release carbon dioxide.
    - Combustion – Plants and animals which got buried under the soil changed into coal and oil and releases carbon dioxide when these are burnt.
    - Ocean water – Carbon dioxide occurs in the form of lime stone in molluscan shells and as by product of photosynthesis in marine water.
2. (i) To show that sunlight is needed for photosynthesis.
   (ii) Yes, the uncovered portion of the experimental leaf is the control.
   (iii) To destarch the leaf.
   (iv) 1. Boil the leaf in alcohol.

2. Wash the leaf in water to make it soft.
3. Add iodine solution on the leaf. The portion uncovered shows blue-black colour and the portion covered shows brown colour. This indicates that sunlight is needed for photosynthesis.

Solution 35:

1. (e) 5
2. (a) 1
3. (b) 2
4. (e) 5

Solution 36:

1. leaves
2. water
3. hydrogen ion
4. photolysis
5. hydrogen
6. NADPH2
7. ATP
8. photophosphorylation
9. glucose
10. polymerization

Solution 37:

1. (d) 3.5
2. (b) Oxygen
3. (c) Water
4. (c) Decrease because the temperature drops.
5. (b) Increases because more photosynthesis occurs.

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Solution 38:

(i) Sunlight

(ii) To destarch the leaf.

(iii) (1) The leaf was kept in boiling water to kill the cells/releases the starch grains.

(2) It is kept in methylated spirit to remove chlorophyll.

(iv) Iodine

(v)At the end of the starch test it is observed that the covered part of the leaf remains brown and the exposed part of the leaf remains blue-black.

(vi) $6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2 + 6H_2O$

Solution 39:

1. (d) To stop synthesis process in the leaves.
2. (c) Chloroplasts
3. (d) split water
4. (c) Palisade mesophyll
5. (b) ADP
6. (b) liberate O2
7. (a) Grana
8. (b) Red light
9. (d) Carbon dioxide
10. (d) water, carbon dioxide, chlorophyll and sunlight