

PLANT LIFE

By the end of this theme, students will be able to:

- describe photosynthesis and its significance
- explain the factors that affect photosynthesis
- describe respiration in plants
- differentiate between aerobic and anaerobic respiration
- differentiate between photosynthesis and respiration



Warm-up

Encourage students to complete the *Get going* section given at the beginning of the chapter.

GUIDELINES TO TEACH

Introduction

- Test the prior knowledge of students by asking the following questions.

Ask students:

How are the leaves arranged on the stem?

Why are they so arranged?

What are the two main functions of a leaf?

What is transpiration? How does it benefit us?

Can you name some leaves which have colours other than green?

Photosynthesis

- Explain the terms autotrophs and heterotrophs.

Ask students:

Can you recall the names of some plants that depend on insects for food?

- Explain the process of photosynthesis by the simple word equation, as given in the coursebook.
- Explain how we benefit by this process.
- With the help of the figure, given in the coursebook, explain in detail the structure of the leaf.
- Take an epidermal peel as described in the activity '*Observing the stomata*', given in the coursebook, and show students the stomata.
- Explain its structure; that they are modified cells.
- Let students draw its structure in their notebook.

- Explain the structure of the chloroplast.
- Let students draw it and label the parts.


Process

- Explain the process and the role of each component—both raw materials and the products.
- Discuss the factors affecting photosynthesis, as given in the coursebook.
- Demonstrate the activity 'To show that starch is produced during photosynthesis and that chlorophyll is necessary for photosynthesis to occur', given in the coursebook, and explain that glucose is stored as starch.
- Demonstrate the activity, given in the coursebook, to show the importance of light in photosynthesis.
- Demonstrate the activity, given in the coursebook, to show that oxygen is released during photosynthesis.

Ask students:

Why does the rate of photosynthesis decrease when temperature is very low or very high?

What are the three factors that limit the rate of the process?

- Help students recall—
 - the process of osmosis and explain how the guard cells open and close.
 - the structure of the phloem and the process of active transport and explain how sugars are transported.
 - that active transport requires energy.
- Explain what is ATP and how is energy released when it splits up (**SciTech**).
- Share the information from 'Career watch', given in the coursebook.
- Use 'Stop and Check' for a quick recap. 

Give the following instructions to students / Write on the board.

Activity: Make a PowerPoint presentation on deforestation and global warming and its relationship to photosynthesis./How does tree and deforestation relate to global warming?

Respiration

- Test the prior knowledge of students by asking the following questions.

Ask students:

What are the two gases required by the plant?

Which gas is taken in during the day only by the plant? What is it used for?

Which gas is given out during the day by the plant? What do the plants use

oxygen for? What is this process called? Does this process stop during the day?

- Explain why plants need energy.
- With the help of word equation, define respiration.

- Perform the activity, given in the coursebook, to show that carbon dioxide is generated during respiration.
- Explain the process of anaerobic respiration with a word equation.
- Share the information from 'Know more'.
- With the help of the table, given in the coursebook, explain the differences between aerobic and anaerobic respiration.

Ask students:

Name two microorganisms which show anaerobic respiration.

- Explain that the changing of milk to curd or lactic acid is the result of bacterial respiration.
- Explain that the changing of sugar to alcohol is the result of anaerobic respiration of yeast.
- Explain why we feel tired after a long period of exercise by our muscles (due to the accumulation of lactic acid). When we rest, we breathe deeply and take in oxygen which helps to completely break down the lactic acid to carbon dioxide and water. We breathe out carbon dioxide and our muscles recover and get the required oxygen.
- With the help of the table, given in the coursebook, explain the differences between photosynthesis and respiration.
- Discuss the need for growing more plants.

PLANT LIFE

Stop and check

1. True
2. True
3. False

Checkpoint

- A. 1. c. chlorophyll 2. d. plastid 3. b. oxygen 4. a. ethanol
- B. 1. water 2. glucose 3. aerobic, anaerobic 4. carbon dioxide, water

C. 1.

Aerobic respiration	Anaerobic respiration
Happens in the presence of oxygen	Happens in the absence of oxygen
Complete breakdown of glucose into carbon dioxide and water	Partial breakdown of glucose into ethanol / lactic acid and carbon dioxide
More energy (38 ATP molecules) is released	Less energy (2 ATP molecules) is released

2.

Photosynthesis	Respiration
Occurs only during the day	Occurs during the day and night
Occurs only in plant cells that contain chlorophyll	Occurs in all cells of all living things
Carbon dioxide is used up and oxygen is produced during this process.	Oxygen is used up and carbon dioxide is produced during this process.
Glucose is formed in this process	Glucose is broken down in this process

- D. 1. Glucose and oxygen.
2. Excess glucose formed during photosynthesis is converted into starch. Starch is a complex carbohydrate formed by linking many glucose molecules together. Starch is stored as food in parts of the plant. Starch can be further converted to sucrose, a soluble sugar, and then translocated to other parts of the plant.
3. Figure: Refer to course book.
4. Adenosine triphosphate (ATP)
5. Anaerobic respiration
- E. 1. The leaf has structures that help it to capture sunlight, get carbon dioxide and water and transport food to other parts of the plant.
- i. The leaf surface is broad and flat to capture maximum sunlight.
 - ii. The thin cross-section of leaf ensures that sunlight can penetrate inside the leaf.
 - iii. Gases are exchanged through small openings, called stomata, present on the lower surface of the leaves.
 - iv. Each palisade mesophyll cell contains many chloroplasts that contain chlorophyll. Chloroplasts are found in greater number on the upper side of leaves to receive more sunlight. Most of the photosynthesis takes place in the mesophyll cells. Also, there are large spaces between the mesophyll cells to allow the diffusion of carbon dioxide easily.
 - v. Xylem vessels are present in leaves to bring water and minerals from the root to the leaf.
2. Photosynthesis requires carbon dioxide, water, chlorophyll and sunlight.
- i. Carbon dioxide enters the leaf through the stomata.
 - ii. Xylem tissue transports water and minerals from the root to the leaves.
 - iii. Chlorophyll, in the leaves, trap the energy from sunlight. This energy is used to split a water molecule to release oxygen.

- iv. A hydrogen molecule is also released in this process. This hydrogen molecule combines with carbon dioxide to form glucose molecules.
 - v. Oxygen diffuses out of the leaf through the stomata.
 - vi. The plant uses glucose during respiration to get energy.
3. Figure: Refer to the coursebook.
- i. The chloroplast is a double-membrane organelle. It is present in the palisade mesophyll cells of the leaves.
 - ii. The inner membrane is folded to form discs called **thylakoids**.
 - iii. The thylakoids contain chlorophyll.
 - iv. The thylakoid discs are arranged in stacks called **grana**.
 - v. the grana lie in a gel-like substance called **stroma**.
4. i. Enzymes do not work at low (less than 10°C) or high (more than 40°C) temperatures. Thus, photosynthesis can occur only in the range of 20–30°C.
- ii. The stomata remain open only when water is available (as guard cells become turgid). In the absence or decreased availability of water, stomata closes and photosynthesis does not occur.
- iii. The energy from sunlight is used to split water molecule and release oxygen. If the amount of light available is low, then photosynthesis cannot happen.
- iv. Thus, availability of light, carbon dioxide, water and optimal temperature influence the rate of photosynthesis. Even if one of these factors is limited and others are in excess, the rate of photosynthesis decreases.
5. Respiration is the process by which food (in the form of glucose) is broken down to release energy. Plants and animals need energy to carry out all their life processes including growth, movement and reproduction.
6. i. Glucose molecules and oxygen are produced from carbon dioxide and water during photosynthesis. Respiration is the breakdown of glucose molecules (in presence or absence of oxygen) to release carbon dioxide and water.
- ii. Energy from sunlight is trapped by chlorophyll during photosynthesis and hence it can occur only during the day. Energy is released from food by respiration and hence it occurs throughout the day and night.
- iii. Photosynthesis can happen only in organisms that have chlorophyll in the cells, such as plants, algae and so on. Respiration occurs in all living organisms.
7. **Aim:** To show that oxygen is produced during photosynthesis
Materials required: beaker, water, test tube, funnel, *Hydrilla*
Method: Take a beaker that is filled 3/4th with water.
Place a few stems of *Hydrilla* inside the water with the stems facing up.
Place an inverted funnel over the *Hydrilla*.
Then, invert a test tube full of water over the stem of the funnel.
Leave this setup in sunlight for some time.
Observations and conclusions: Bubbles of gas arise from the stem and get collected in the

inverted test tube. A burning splint burns brightly when inserted into the test tube, showing that oxygen gas was collected in the test tube.

Think and answer

The stomata are surrounded by guard cells, which control the movement of gases in and out of the leaf. When the guard cells are filled with water, they become turgid and bulge outwards. This causes the stomata to open. Guard cells become flaccid upon losing water. The stomata then close. Carbon dioxide enters the leaf through stomata and is essential for photosynthesis. If the stomata close due to inadequate water, carbon dioxide availability gets limited and photosynthesis cannot happen.

PLANT LIFE

A. Fill in the blanks.

1. The mode of nutrition in plants is called _____ .
2. Aerobic respiration releases energy in the form of _____ molecules.
3. Excess carbohydrate is stored as _____ in plants.
4. The _____ cells contain chloroplasts.
5. The thylakoids are arranged in stacks called _____ .

Ans: 1. autotrophic 2. ATP 3. starch 4. palisade mesophyll 5. grana

B. Answer the questions.

1. Why are leaves thin and broad?

Ans: Leaves usually have a broad surface so that plenty of sunlight falls on them. The thin surface allows sunlight to penetrate well inside them.

2. Why is photosynthesis important?

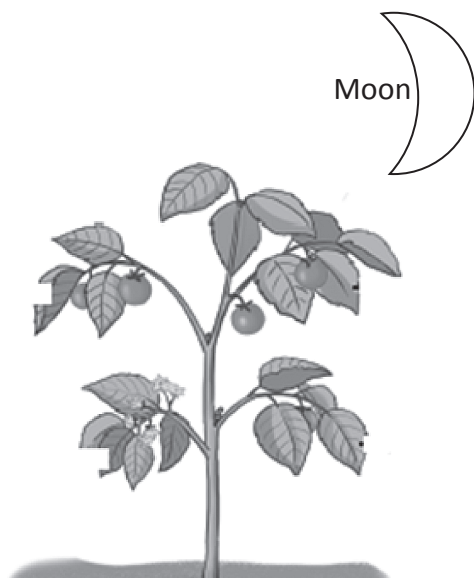
Ans: Plants produce glucose during photosynthesis. Excess glucose is stored as starch in the plant. Starch is a food source for organisms dependent on plants. The oxygen that is released during photosynthesis is essential for respiration in most organisms.

3. Which respiration process release more energy?

Ans: Aerobic respiration.

In this process, glucose is broken down completely into carbon dioxide, water and 38 ATP molecules. However, during anaerobic respiration, glucose is broken down incompletely into ethanol or lactic acid. Less energy in the form of only 2 ATP molecules is released during anaerobic respiration.

4. Look at the picture and answer the following question.



Identify the process taking place. What are the by products of this process?

Ans: Respiration. Carbon dioxide and water.

5. Briefly describe the opening and closing of the stomata with the help of a diagram.

Ans: Figure: Refer to the coursebook.

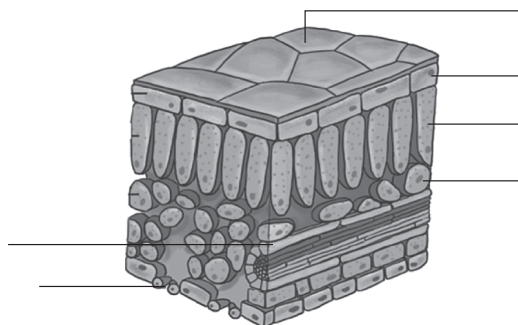
The stomata are surrounded by bean-shaped guard cells. The inner walls of the guard cells are thicker (the side facing the stomata) than the outer walls. When the guard cells are filled with water, they become turgid and bulge outward. This causes the inner walls to move away, thereby, opening the stomata. When guard cells lose water, they become flaccid or loose. The inner walls come closer, closing the stomata.

6. Describe an experiment to prove that carbon dioxide is released during respiration.

Ans: Activity: Refer to the coursebook.



1. Label the figure given. Answer the questions that follow.



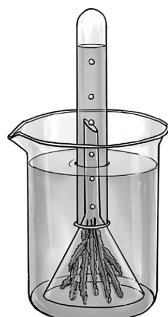
a. Identify the area in the leaf where photosynthesis takes place.

b. Identify the area where stomata are found.

c. List the factors affecting photosynthesis.

d. Name the end products of photosynthesis.

2. Observe the experimental set-up and answer the questions.
Label the figure.



a. Identify the activity in this set-up.

b. How do the gas bubbles form inside the test tube?

c. Explain the importance of this gas.

ANSWER KEY FOR THE WORKSHEET

PLANT LIFE

1. Diagram: Refer the coursebook.
 - a. Palisade mesophyll cells
 - b. Upper and lower epidermis
 - c. Sunlight, carbon dioxide, water and optimum range of temperature (20–30°C)
 - d. Glucose and oxygen
2. Diagram: Refer the coursebook.
 - a. To show that oxygen is given out during photosynthesis
 - b. When the set-up was kept in sunlight, the *Hydrilla* plant carried out photosynthesis. Bubbles of oxygen gas rose from the stem as a byproduct of photosynthesis.
 - c. Oxygen is essential for respiration in most organisms, including plants.