1 NUTRITION IN PLANTS

Jan (or John) Ingenhousz or Ingen-Housz (8th December 1730 - 7th September 1799) was a Dutch-born British biologist, physiologist, and chemist.

He is famous for discovering photosynthesis by showing that light is necessary for the process to take place in which green plants absorb carbon dioxide and release oxygen. Ingenhousz discovered that, in the presence of light, plants give off bubbles from their green parts while, in the shade, the bubbles eventually stop. He identified the gas as oxygen. He also discovered that, in the dark, plants give off carbon dioxide. He realised that the amount of oxygen given off in the light is more than the amount of carbon dioxide given off in the dark. He also discovered that just like animals plants also have cellular respiration.

CONCEPT MAP

(The process of taking in food by an organism and its utilisation by the body for various life processes is nutrition)

Mode of Nutrition

- Autotrophic (All green plants are autotrophic. These organisms make their own food)
- Heterotrophic (Organisms obtain their food from other organisms eg. Animals, human beings etc.)
- Other modes of nutrition in plants are
  (i) Parasitic mode
  (ii) Insectivorous mode
  (iii) Saprophytic mode
  (iv) Symbiotic mode

Concept 1

Introduction:

Energy is required by all living organisms to carry out various activities and they obtain this energy from the food they eat. The food in an organism's body is broken down into simpler substances to get energy. The process of taking in food and its utilisation by the body for various life processes is called **nutrition**. Carbohydrates, proteins, fats, vitamins, minerals, roughage, and water are the different nutritional components of food. These are called nutrients. These nutrients give us energy, help in the growth and repair of body tissues and keep us free from diseases.

Food is required by all living organisms. Plants can synthesise food for themselves, but animals and humans cannot. They get it from plants or animals that eat plants. Thus, humans and animals are directly or indirectly dependent on plants.

Modes of Nutrition in Plants:

Plants obtain their nutrition by various modes. The mode of nutrition can be divided into two distinct types. Living organisms exhibit two main modes of nutrition.

1. Autotrophic Nutrition
2. Heterotrophic Nutrition

Autotrophic Nutrition (Auto-self, Trophos-nourishment):

The mode of nutrition in which organisms synthesise or make their own food with the help of simple inorganic substances (such as carbon dioxide and water) is called autotrophic nutrition, and such organisms are called autotrophs. They are also called producers, e.g., green plants.

Heterotrophic Nutrition (Hetero-other, Trophos - nourishment):

Heterotrophic nutrition is the process by which organisms consume food from either plants or other animals. Such organisms are called heterotrophs, e.g., All Animals, Non-Green Plants, Fungi, Most Bacteria etc. Heterotrophs are directly or indirectly dependent on green plants for their nutrition.

Knowledge Box

Heterotrophic nutrition occurs in plants that cannot produce their own food. They depend on other organisms for sustenance.

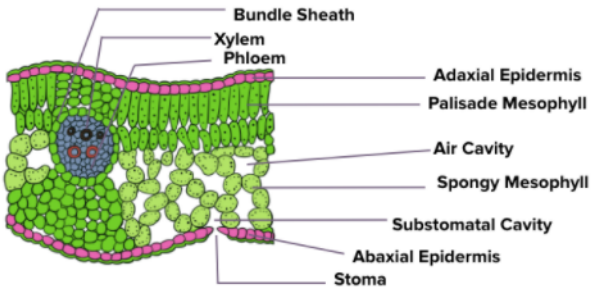
Photosynthesis: Food - Making Process in Plants:

The process of making of food by green plants in the presence of sunlight and chlorophyll is known as photosynthesis. Photosynthesis is the combination of two words - Photo + Synthesis. 'Photo' means light and 'Synthesis' means to make.

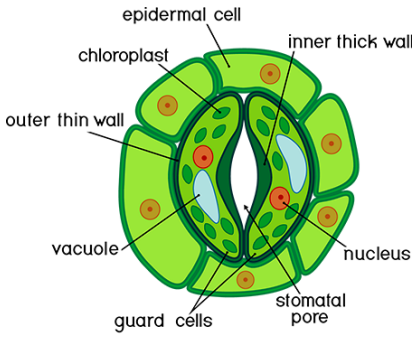
Process of Food Making in Green Plants:

Green plants make their food by themselves. Green leaves make food from Carbon dioxide and water in the presence of sunlight and chlorophyll. Hence, for taking place of photosynthesis, carbon dioxide, water and sunlight must reach the green leaves in addition to the presence of chlorophyll.

Leaves have numerous tiny pore-like structures on their lower surface, known as stomata, which are surrounded by guard cells. These stomata help in absorbing carbon dioxide from the air. Water is transported to the leaves through thin, hair-like pipelines that extend from the roots. These pipelines run continuously throughout the plant, from the roots to the branches and leaves, ensuring the smooth transport of essential nutrients. These vessels, called xylem, are a specialized type of tissue responsible for carrying water and minerals efficiently to different parts of the plant.



T . S. of Leaf

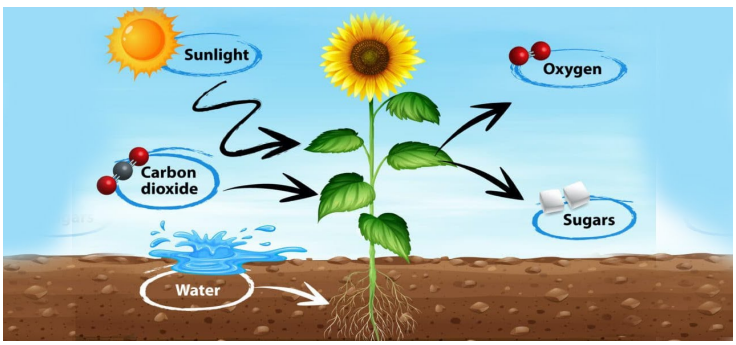


Stomata open

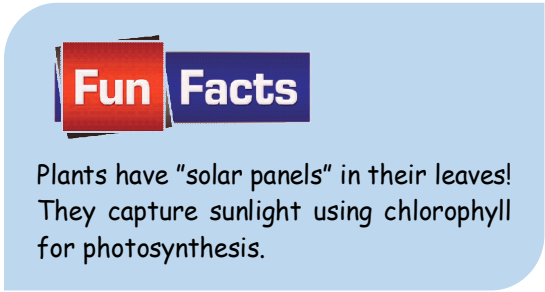
Chlorophyll, the green pigment present in leaves, plays a crucial role in photosynthesis. It absorbs sunlight and provides energy for the process. By utilizing sunlight, chlorophyll, along with carbon dioxide and water, facilitates the conversion of these elements into carbohydrates and oxygen. The carbohydrates serve as food for the plant, while oxygen is released into the atmosphere. This entire process, through which plants produce their own food, is known as photosynthesis.

The chemical equation representing photosynthesis is as follows:

$$\underset{\text{(Carbon dioxide)}}{6CO_2} + \underset{\text{(Water)}}{6H_2O} \rightarrow \underset{\text{(Glucose)}}{C_6H_{12}O_6} + \underset{\text{(Oxygen)}}{6O_2}$$



At the end, the carbohydrate (glucose) is transformed into starch. The presence of starch in leaves is an indication of the occurrence of photosynthesis. As the process of photosynthesis mainly occurs in the leaves of the plant, thus leaves are considered as food factories or kitchens of plants. Besides leaves, photosynthesis can also occur in certain other green plant parts such as green stems and green branches of the plant.



Synthesis of Nutrients other than Carbohydrates:

Plants synthesise carbohydrates through the process of photosynthesis. However, for their proper growth and development, plants require various other nutrients also such as proteins and fats. Carbohydrates synthesised by plants during photosynthesis are made up of carbon(C), hydrogen(H), and oxygen (O). The synthesis of proteins also requires nitrogen. Although nitrogen is present in abundance in the atmosphere, plants cannot use this free nitrogen directly. Plants obtain their nitrogen supply in two ways:

- Certain nitrogen-fixing bacteria, such as Rhizobium, present in the soil, convert atmospheric nitrogen into water-soluble nitrogenous compounds like ammonia. These compounds are then released into the soil, allowing plants to absorb them along with water for their growth and development.
- Farmers add nitrogenous fertilisers to the soil to provide nitrogen to the soil and increase its fertility. Plants obtain nitrogen through these fertilisers.

Factors Affecting Photosynthesis:

The rate of photosynthetic process is affected by several factors. These factors are discussed below:

Light:

Solar radiation, or light from the sun, is the primary source of light for photosynthesis in green plants. Only a very small amount of the solar energy that is received by the earth is used for photosynthesis. The rate of photosynthesis is reduced on days with low light intensity, like cloudy days.

Temperature:

Temperature rise up to 40^0C boost the rate of photosynthesis. The rate of photosynthesis decreases above this temperature. In a similar way, cold temperatures prevent the photosynthesis.

Carbon Dioxide:

The rate of photosynthesis generally increases by increasing the concentration of carbon dioxide in the atmosphere.

Water:

Water is an essential raw material in photosynthesis. Less than 1% of the water absorbed by a plant is used in photosynthesis. If plants are not given enough water, photosynthesis proceeds at a slower rate.

CLASSROOM DISCUSSION QUESTIONS CDQ 01

1. **What is the process of utilizing food by an animal to obtain energy for growth and development known as?**
   (A) Respiration
   (B) Egestion
   (C) Nutrition
   (D) Photosynthesis
2. **Which of the following is NOT a component of food mentioned in the passage?**
   (A) Carbohydrates
   (B) Sugars
   (C) Proteins
   (D) Gases
3. **What are plants called when they make their own food?**
   (A) Heterotrophs
   (B) Chemotrophs
   (C) Autotrophs
   (D) Parasites
4. **What is the combination of two words that form the term "Photosynthesis"?**
   (A) Synthesis + Light
   (B) Sun + Energy
   (C) Photo + Synthesis
   (D) Water + Food
5. **Which of the following is NOT a requirement for photosynthesis mentioned in the passage?**
   (A) Carbon dioxide
   (B) Water
   (C) Nitrogen
   (D) Sunlight
6. **What is the main pigment responsible for absorbing sunlight in plants?**
   (A) Melanin
   (B) Chlorophyll
   (C) Haemoglobin
   (D) Carotene
7. **What is the byproduct of photosynthesis that is released into the atmosphere?**
   (A) Carbon dioxide
   (B) Nitrogen
   (C) Oxygen
   (D) Methane
8. **Which part of the plant is referred to as the "kitchen" or "food factories"?**
   (A) Roots
   (B) Stems
   (C) Flowers
   (D) Leaves
9. **In which types of plants does photosynthesis take place?**
   (A) Red plants
   (B) Brown plants
   (C) Green plants
   (D) Blue plants
10. **What is the ultimate source of energy for all living organisms, as mentioned in the passage?**
    (A) Wind (B) Water
    (C) Soil (D) Sun

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken ☐ Minutes

1 Ⓐ Ⓑ Ⓒ Ⓓ	2 Ⓐ Ⓑ Ⓒ Ⓓ	3 Ⓐ Ⓑ Ⓒ Ⓓ	4 Ⓐ Ⓑ Ⓒ Ⓓ	5 Ⓐ Ⓑ Ⓒ Ⓓ
6 Ⓐ Ⓑ Ⓒ Ⓓ	7 Ⓐ Ⓑ Ⓒ Ⓓ	8 Ⓐ Ⓑ Ⓒ Ⓓ	9 Ⓐ Ⓑ Ⓒ Ⓓ	10 Ⓐ Ⓑ Ⓒ Ⓓ

Concept 2

Photosynthesis in Algae:

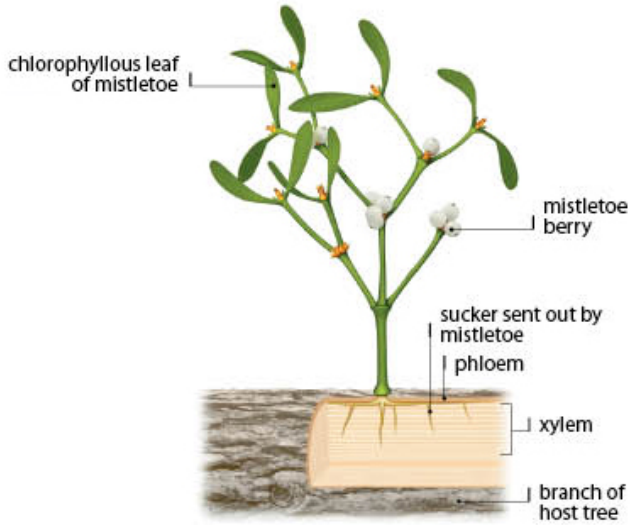
Green patches in ponds or near the stagnant water can be seen easily. These green patches are living organism called algae. Algae are plants. Often algae grow near the shallow waterlogged areas such as near tube-wells, taps, etc. One may slip over it. Algae look green because of presence of Chlorophyll. Algae prepare their own food by the process of photosynthesis.

Other Modes of Nutrition in Plants:

Generally, there are two broad categories of plants falling in heterotrophic nutrition i.e., parasitic plants and insectivorous plants.

Heterotrophic Nutrition in Plants:

Some plants do not have the chlorophyll. Hence, they cannot synthesize their food by themselves. Such plants are known as non-green plants. They depend on other organisms for food. Such plants use the heterotrophic mode of nutrition.



Misconception :

Misconception : All plants are green and perform photosynthesis.

Correction : Non-green plants like fungi and some parasitic plants depend on other organisms for nutrition.

Parasite (Parasitic Plants):

A parasite is an organism that lives on the body of another organism in order to derive nutrition. The organism from which a parasite derives its nutrition is called a host. A parasitic plant derives all or some of its nutrients from the living host plant. They have special root-like structures called haustoria.

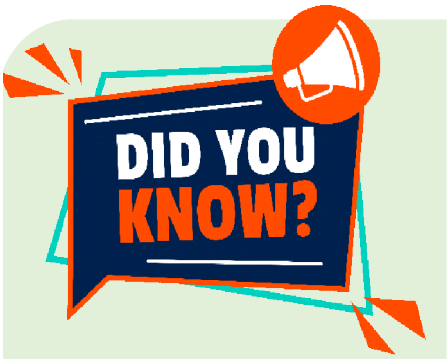
Example: Cuscuta, Mistletoe.

Loranthus

Cuscuta

Cuscuta (Dodder):

Portion of Parasite Attached to the Stem of Host Cuscuta is a vine like plant with yellowish stem. It twines around big trees, like banyan tree. Cuscuta gets nutrition from the tree on which it lives. The tree upon which it climbs and lives is called the host. Here, banyan is the host and Cuscuta is the parasite.



Dodder (Cuscuta) is a parasitic plant that derives nutrients from its host using special structures called haustoria.

Orobanche Ramosa:

The young seedling of santalum (branched broomrape) grows independently for up to one year. After this period, a few roots develop haustoria, which makes contact with the roots of neighbouring trees. Some plants are total parasites while others are partial parasites. A total parasite completely depends on other plants for its nutrition.

Example: Tobacco, Potato and Tomato.

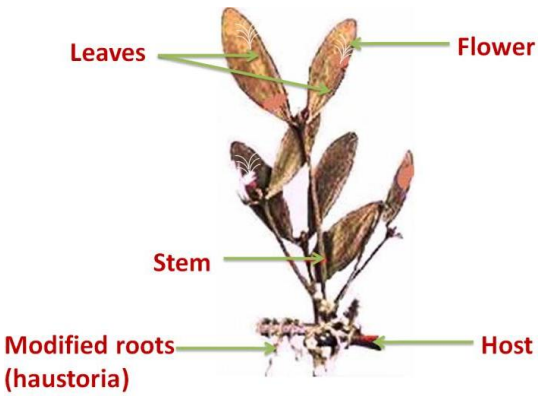
Rafflesia:

It is also a total parasite growing on the roots of host plant. It lacks chlorophyll and its stem is thread like penetrating the roots of host plant and sucks the food from there. Rafflesia bears the biggest flower in the world. A single flower measures about 50-90 cm and weighs nearly 10 kg. It has smell of rotten meat.

Partial Parasite:

Partial parasites depend in part on their hosts.

Partial parasitic plants are typically chlorophyllous, thus they are dependent on water and nutrients from their hosts. Other activities of these plants are handled by their green leaves.



Viscum

Example: Viscum, album, Plant Attached to Host Stem Cut Open to Show Haustoria Sandalwood- this is also a interesting parasite. It commonly grows in jungles of Karnataka, Tamilnadu and Kerala. These are rootless plants growing on roots of host plants.

CLASSROOM DISCUSSION QUESTIONS CDQ 02

1. **What gives algae their green colour?**
   (A) Presence of fats
   (B) Presence of nitrogen
   (C) Presence of chlorophyll
   (D) Presence of carbohydrates
2. **How do algae prepare their own food?**
   (A) By absorbing nutrients from the soil
   (B) By consuming other organisms
   (C) By the process of photosynthesis
   (D) By extracting minerals from water
3. **From where do plants obtain nitrogen for protein synthesis?**
   (A) From the atmosphere
   (B) From water
   (C) From the soil
   (D) From sunlight
4. **What is the role of Rhizobium bacteria in nitrogen fixation?**
   (A) They convert soil into nitrogen gas
   (B) They release nitrogen into the atmosphere
   (C) They convert gaseous nitrogen into a usable form for plants
   (D) They absorb nitrogen from the soil
5. **What mode of nutrition do non-green plants generally use?**
   (A) Autotrophic
   (B) Heterotrophic
   (C) Parasitic
   (D) Saprophytic
6. **What is a parasite?**
   (A) An organism that produces its own food
   (B) An organism that lives on or inside another organism and obtains food from it
   (C) An organism that relies on sunlight for energy
   (D) An organism that feeds on dead organic matter
7. **Which of the following plants is an example of a parasite?**
   (A) Oak tree
   (B) Cuscuta (Dodder)
   (C) Rose bush
   (D) Sunflower
8. **What is the host in the relationship between Cuscuta and a banyan tree?**
   (A) Cuscuta
   (B) Banyan tree
   (C) Both Cuscuta and banyan tree
   (D) Another plant

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken ☐ Minutes

1 Ⓐ Ⓑ Ⓒ Ⓓ	2 Ⓐ Ⓑ Ⓒ Ⓓ	3 Ⓐ Ⓑ Ⓒ Ⓓ	4 Ⓐ Ⓑ Ⓒ Ⓓ	5 Ⓐ Ⓑ Ⓒ Ⓓ
6 Ⓐ Ⓑ Ⓒ Ⓓ	7 Ⓐ Ⓑ Ⓒ Ⓓ	8 Ⓐ Ⓑ Ⓒ Ⓓ	9 Ⓐ Ⓑ Ⓒ Ⓓ	10 Ⓐ Ⓑ Ⓒ Ⓓ

Concept 3

Insectivorous Plant:

Some plants eat insects. Such plants are called insectivorous plants. They trap insects to obtain nitrogen due to poor soil nutrients and digest the insects. Pitcher plant is the example of an insectivorous plant. In pitcher plant the leaf is modified to form a pitcher like structure. The bright colour of the pitcher makes it very attractive to insects. Inside the pitcher there are several hair-like structures. These hairs direct the trapped insects downwards. When an insect sits on the pitcher of the plant, the lid closes and the insects get trapped inside the pitcher. The insect is then digested by the enzymes secreted by the cells of the plants.

Fun Facts

Insectivorous plants eat insects because the soil they grow in is poor in nutrients like nitrogen. It's their "fast food" fix!

Pitcher plant (Nepenthes)

Venus flytrap (Dionaea)

Cause of Eating of Insects by Plants:

The soil of marshy land is deficient in nitrogen. Plants living in marshy areas do not get nitrogen from the soil. Their nitrogen need is fulfilled by sucking the juice of insects. Venus flytrap, Utricularia, Drosera are the other examples of insectivorous plants.

Saprotrophs:

Saprotrophs are non-green plants e.g. Agaricus (Mushroom) fungi, yeast and bacteria. Saprotrophs get their food from dead or decaying organic matters. They grow on decaying organic matters such as cow-dung, wood, bread, etc.

Fungi:

Fungi are saprotrophic organisms that feed on dead and decaying organic matter. The fungus known as bread mould grows on old bread, fruits, pickles, leather products, cow manure, etc. It is a white cottony mass of fine threads. The fungal spores are generally present in the air. When they land on wet and warm things they germinate and grow. A few types of fungi, like mushrooms, are edible and are eaten as vegetables. They are vitamin-rich. Some fungi are also employed in the manufacture of pharmaceuticals, for example, penicillium.

Bacteria:

Bacteria are unicellular microorganisms showing the saprotrophic mode of nutrition e.g. Pseudomonas, Spirochaeta and E.coli. They obtain their food from dead and decaying organic matter. They are basically soil dwelling and are found in association with soil fungi.

Symbiosis or Mutualism:

Symbiosis is the combination of two Greek words 'Sym' means 'with' and 'biosis' means 'living', which means living together. In symbiosis or mutualism two different types of organisms live and work together for their mutual benefit from each other. They share shelter and nutrients, **e.g.** Lichen which is an association between an alga, and a fungus living together. The fungus provides shelter, water, and minerals to the alga and in return, the alga prepares and provides food to the fungus.

Fun Facts

Symbiosis is like a "win-win friendship" between organisms. For example, fungi and algae form lichens to help each other thrive.

- A bird sitting on the back of a rhino is an example of symbiosis. The bird gets worms to eat, while the rhino gets rid of those worms.

Replenishment of Nutrients in the Soil:

For growth, plants require nutrients that they absorb from the soil. Continuous growing of crops in a field makes it deficient in vital nutrients like nitrogen (N), phosphorus (P), and Potassium (K). To enrich the soil again with these nutrients they are added from time to time. This enrichment of soil can be done in the following ways:

Riddle

I'm a plant but don't have green,
Living on others is my scene.
Who am I?

- To increase the fertility of the crop, manure and fertilisers are added regularly to the field. Manure add organic matter to the soil to increase its fertility and fertilisers are rich in specific plant nutrients such as nitrogen, potassium, etc.
- After harvesting the crop, the soil becomes deficient in nitrogen. To overcome this farmers grow leguminous crops (e.g., peas, beans, etc.) to replenish nitrogen in the soil because Rhizobium, bacteria present in the roots of legume crops add soluble nitrogenous compounds in the soil to be absorbed by plants. In this way, the symbiotic association is of great significance for the farmers. They do not need to add nitrogen fertiliser to the soil in which leguminous plants are grown.

CHALLENGE

Discuss how symbiosis benefits both organisms involved in lichens.

CLASSROOM DISCUSSION QUESTIONS CDQ 03

1. **What are plants called that eat insects?**
   (A) Autotrophic plants
   (B) Heterotrophic plants
   (C) Insectivorous plants
   (D) Parasitic plants
2. **How do pitcher plants trap insects?**
   (A) By emitting a sweet scent
   (B) By closing their lid when an insect sits on them
   (C) By shooting out sticky threads
   (D) By releasing toxic gases
3. **What is the cause of insect-eating in plants like Venus flytrap?**
   (A) Deficiency of nitrogen in the soil
   (B) Overabundance of insects in the environment
   (C) Lack of sunlight
   (D) Lack of water
4. **What is holophytic nutrition in plants?**
   (A) Absorbing food with the help of roots
   (B) Making their own food through photosynthesis
   (C) Eating insects
   (D) Obtaining nutrients from dead organic matter
5. **What is holozoic nutrition in animals?**
   (A) Making their own food through photosynthesis
   (B) Absorbing nutrients from dead organic matter
   (C) Eating readymade food from different sources
   (D) Feeding on insects
6. **What are saprotrophs?**
   (A) Green plants
   (B) Animals that feed on dead organic matter
   (C) Non-green plants that obtain nutrients from dead or decaying organic matter
   (D) Insects that live on plants
7. **How do saprotrophs obtain nutrients?**
   (A) By hunting and capturing prey
   (B) By absorbing nutrients through their roots
   (C) By secreting digestive juices over decaying material and absorbing nutrients
   (D) By photosynthesis
8. **What is symbiosis?**
   (A) When two organisms live and work together for mutual benefit
   (B) When one organism benefits at the expense of another
   (C) When organisms compete for resources
   (D) When organisms have no interaction

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken ____ Minutes

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R.K.C. (Review of Key Concepts)

1. Nutrition can be defined as the process by which an organism obtains food which is used to provide energy & materials for its life sustaining activities.
2. Thus, the term nutrition includes the means by which an organism obtains its food and also the processes by which the nutrients in the food are broken down to simpler molecules for utilization by the body.
3. Thus, the study of the process of nutrition in various organisms gives us an idea about their nutritional requirements.
4. Various inorganic and organic raw materials are required for building the structure and maintaining the body functions of an organism.
5. All plants whether autotrophic or heterotrophic require mineral nutrition for growth and metabolism.
6. The parasitic plant, cuscuta has haustoria to derive nourishment from the host plant.
7. A plant needs many essential nutrients for a healthy growth. They could be macro elements (required in large quantity) or microelements (required in traces).
8. By using the water culture technique or soil-less culture, it is possible to ascertain the importance of particular minerals.
9. Some elements are structural components while others are co-factors of several enzymes. They are required in various metabolic, pathways & so the deficiency results in stunted growth, chlorosis, necrosis or other specific symptoms.
10. NPK are the three basic nutrients essential for plant growth.
11. The minerals are taken up by the roots through passive or active absorption.
12. Nitrogen, an essential nutrient cannot be taken in by the plants unless fixed into various compounds.
13. Nitrogen fixation is primarily by symbiotic bacteria - Rhizobium or by free living cyanobacteria.
14. The nitrifying bacteria convert ammonia to nitrites and then to nitrates, which are more suitably absorbed by the plants.
15. The process of photosynthesis takes place in green leaves, so referred as the food factories of plants.
16. In Heterotrophic nutrition organisms depend on other plants and animals for their food.
17. **Parasite-** Organism that lives for its food on other living plants or animals.
18. **Saprophyte-** A plant organism that lives for its food on dead organic matter.
19. **Symbiotic-** Two organisms that live together for mutual benefit.
20. **Carnivorous plants-** Those plants that derive some or most of the nutrition's by trapping and consuming insects and other small animals.

Advanced Worksheet

LEVEL 1

Single Correct Answer Type (S.C.A.T.):

1. **The process by which green plants prepare their own food is known as:**
   (A) Photosynthesis
   (B) Respiration
   (C) Symbiosis
   (D) None of these

2. **Human being can be categorised as:**
   (A) Heterotrophs
   (B) Autotrophs
   (C) Parasites
   (D) Saprotrophs

3. **A plant that has both autotrophic and heterotrophic mode of nutrition is:**
   (A) Pitcher plant
   (B) Rhizobium
   (C) Amarbel
   (D) Sundari plant

4. **What is the ultimate source of energy for all living organisms?**
   (A) Water energy
   (B) Wind energy
   (C) Solar energy
   (D) Chemical energy

5. **Tiny pores present on the surface of leaves through which gaseous exchange occurs are called:**
   (A) Stomata
   (B) Guard cells
   (C) Food holes
   (D) Gas holes

6. **Study the diagram of agaricus (mushroom) shown below. Based on the structure of this organism, what is its mode of nutrition?**

   (A) Autotrophic
   (B) Saprophytic
   (C) Parasitic
   (D) Symbiotic

7. **Green pigment present in the leaves is called _____.**
   (A) Haemoglobin
   (B) Globulin
   (C) Albumin
   (D) Chlorophyll

8. **During photosynthesis plants:**
   (A) Take oxygen and release carbon dioxide.
   (B) Take carbon dioxide and release oxygen
   (C) Take carbon dioxide but do not release oxygen
   (D) Take oxygen but do not release carbon dioxide

9. During photosynthesis:

(A) Solar energy is converted into chemical energy

(B) Solar energy is converted into mechanical energy

(C) Chemical energy is converted into mechanical energy

(D) Bio energy is converted into chemical energy.

10. The raw materials for photosynthesis are:

(A) CO_2, water

(B) CO_2, O_2, H_2

(C) N_2, water

(D) O_2, water

11. The end products of photosynthesis are:

(A) Carbohydrates, Oxygen

(B) Carbohydrates, Hydrogen

(C) Carbohydrates, Water vapours

(D) Carbohydrates, Oxygen and Water vapours

12. Which one of the following is a parasite?

(A) Lichen

(B) Cuscuta

(C) Pitcher plant

(D) Rhizobium

13. Which of the following class of organisms belongs to saprotrophs?

(A) Fungi

(B) Algae

(C) Lichens

(D) Bryophytes

14. Which one of the following is a pair of symbiotic organisms?

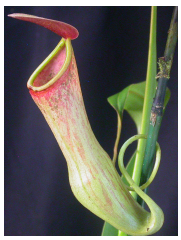
(A) Lichens

(B) Rhizobium and a legume

(C) Cuscuta

(D) Both (A) & (B)

15. Which of the following is an insectivorous plant?

(A)  (Pitcher plant)

(B)  (Cactus plant)

(C)  (Bamboo plant)

(D) All of these

16. Insectivorous plants eat insects to fulfil their needs of:

(A) Energy

(B) Nitrogen

(C) Phosphorous

(D) Potassium

17. Which one of the following products is made by the plant during the process of photosynthesis?

(A) CO_2

(B) $C_6H_{12}O_6$

(C) H_2O

(D) All of these

18. What is the compound that plants use to absorb the energy from light?

(A) Carbon Dioxide

(B) H_2O

(C) DNA

(D) Chlorophyll

19. Cuscuta is:

[BHU 81; CPMT 1994; BVP 2000]

(A) Total root parasite

(B) Total stem parasite

(C) Partial stem parasite

(D) Epiphyte

20. Viscum is: **[AFMC 2004]**

(A) Partial root parasite

(B) Partial stem parasite

(C) Total root parasite

(D) Total stem parasite

21. Santalum album is:

[BHU 1982; JIPMER 1987; DPMT 2002]

(A) Partial root parasite

(B) Partial stem parasite

(C) Total stem parasite

(D) Total root parasite

22. Biggest flower (Rafflesia) belongs to a plant which is:

[CBSE PMT 1999]

(A) Partial stem parasite

(B) Partial root parasite

(C) Total stem parasite

(D) Total root parasite

23. Botanical name of Venus Fly Trap is:

[BHU 1989; CET Chd. 2002]

(A) Aldrovanda

(B) Dionaea

(C) Utricularia

(D) Nepenthes

24. One of the following in an insectivorous plant:

[BHU 1988; AFMC 1996]

(A) Balanophora

(B) Orobanche

(C) Rafflesia

(D) Drosera

25. Drosera and Sarracenia are: **[BHU 1987]**

(A) Symbiotic

(B)Carnivorous

(C) Parasitic

(D) Chemoautotrophic

26. Heterotrophic nutrition is present in: **[CPMT 1985]**

(A) Vallisneria

(B) Pistia

(C) Drosera

(D) Opuntia

27. Plants obtaining food from other plants by means of haustoria are: **[AFMC 1984, 85; CPMT 1995]**

(A) Symbionts

(B) Parasites

(C) Hydrophytes

(D) Saprophytes

28. Insects captured by carnivorous plants partially meet their requirement of: **[CPMT 1989, 91]**

(A) Organic matter

(B) Enzymes

(C) Water

(D) Nitrogen

29. Which is not an insectivorous plant? [CET Chd. 1997]

(A) Dionaea

(B) Dischidia

(C) Drosera

(D) Pinguicula

30. Which one of the following is a parasitic plant? [Kerala 2002]

(A) Drosera

(B) Cuscuta

(C) Nepenthes

(D) Utricularia & Water Hyacinth

31. What does the given image represent?

(A) Bacterial growth

(B) Algal growth

(C) Fungal growth

(D) Moss

32. The correct equation for photosynthesis is:

(A) $CO_2 + H_2O \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$

(B) $6CO_2 + 6H_2O \xrightarrow[chlorophyll]{light} C_6H_{12}O_6 + 6O_2$

(C) $7CO_2 + 8H_2O \rightarrow C_6H_{12}O_6 + 5O_2 + 6H_2O$

(D) $5CO_2 + 10H_2O \xrightarrow[chlorophyll]{sun\ light} C_6H_{12}O_6 + 6O_2 + 7H_2O$

33. Select the correct statement.

(A) Sun is the ultimate source of energy for all living organisms

(B) Leaves are the food factories of plants

(C) Small tiny pores on the surface of leaves are the stomata

(D) All of the above

34. Rhizobium bacteria convert free nitrogen into:

(A) Soluble nitrogenous compounds

(B) Insoluble nitrogenous compounds

(C) Does not convert

(D) Both (A) and (B)

35. Choose the leafless and rootless parasitic plant that derives its nutrition from a host plant that is living:

(A) Venus flytrap

(B) Cuscuta

(C) Drosophyllum

(D) None of the above

36. When the guard cells _____ stomata open and when they _____stomata close.

(A) Shrink, Swell

(B) Close, Open

(C) Swell, Shrink

(D) Open, Close

37. Pitcher plant: Hair:: Cuscuta:

(A) Leaves

(B) Climbing root

(C) Tentacles

(D) Sucking root

38. _____ percent of water absorbed by plants is used in photosynthesis.

(A) 1

(B) 2

(C) 3

(D) 4

39. Which of the following is not a parasite?

(A) Cuscuta

(B) Rafflesia

(C) Lichen

(D) Viscum

LEVEL 2

Analytical Approach Type (A.A.T.):

40. Fungi which are edible and used as vegetable:

(i) Yeast

(ii) Penicillium

(iii) Mushroom

(iv) Bread mold

(A) i and iii

(B) iii and iv

(C) iii only

(D) ii and iii

41. Choose the option which demonstrates the example of symbiosis.

(i) Algae and fungus

(ii) Fungus and rhizobium

(iii) Algae and rhizobium

(iv) None of the above

(A) (i) only

(B) (i) & (iii)

(C) (ii) & (iv)

(D) (i), (ii) & (iv)

42. In desert plants, the leaves are modified into:

(i) Stems

(ii) Spines

(iii) Fungi

(iv) Roots

(A) (i) only

(B) (i) & (ii)

(C) (ii) only

(D) (iii) & (iv)

43. Which of the following grows in nitrogen deficient soil?

(i) Venus fly trap

(ii) Sundew

(iii) Pitcher plant

(iv) Sucking root

(A) (i) only

(B) (i) & (iv)

(C) (i), (ii) & (iii)

(D) (iv) only

Matrix Matching Type (M.M.T.):

SET - I

COLUMN-I

44. Cuscuta

45. Mistletoe

46. Utricularia

47. Mycorrhiza

COLUMN-II

(A) Partial parasite

(B) Total parasite

(C) Insectivorous

(D) Fungi

(E) Algae

SET - II

COLUMN-I

48. Photosynthesis

49. Saprophyte

50. Parasite

51. Algae and fungus

COLUMN-II

(A) Viscum

(B) $C_6H_{12}O_6$

(C) Symbiosis

(D) Monotropa

Assertion Reason Type (A.R.T.):

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

52. **Assertion(A):** The organisms which use an autotrophic mode of nutrition do not need to depend on others for food and nutrition.

Reason(R): In autotrophic mode of nutrition organisms obtain their nutrition from non-green plants, animals, etc.

53. **Assertion(A):** Factors which affect photosynthesis are light, temperature, carbon dioxide and water.

Reason (R): Rate of photosynthesis increases at low temperature and in presence of light.

54. **Assertion(A):** Life on earth is not possible without photosynthesis.

Reason(R): The life of all organisms directly or indirectly depends upon the food made by plants.

55. **Assertion(A):** Parasitic plants and insectivorous plants derive nutrients from others.

Reason(R): All animals, fungi, bacteria etc, cannot prepare their own food and they directly or indirectly depend upon green plants for their nutrition.

56. **Assertion(A):** Mushrooms are example of symbiotic plants.

Reason(R): Symbiotic plants live together and benefit each other.

57. **Assertion(A):** Insectivorous plants are heterotrophic.

Reason(R): Insectivorous plants do not have chlorophyll.

Statement Type (S.T.):

(A) Statement-I is correct while statement-II is incorrect.

(B) Statement-II is correct while statement-I is incorrect.

(C) Both statements are correct.

(D) Both statements are incorrect.

58. **Statement-I:** The only organisms that can make their own food are plants.

Statement-II: Autotrophic is a mode of nutrition.

59. **Statement-I:** Photosynthesis is a process by which plants prepare their own food.

Statement-II: Carbohydrates are simple chemical substances.

60. **Statement-I:** Cuscuta is a parasite.

Statement-II: Cuscuta is a yellow tubular structure that can be seen twining around stem and branched of a tree.

Figure Based Questions (F.B.Q.):

61. Which of the following is correct about the desert plants?

(A) It has spine-like leaves

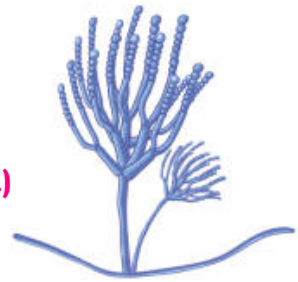
(B) The spine-like leaves can take water from the atmosphere easily

(C) The plants cannot carry out the process of photosynthesis

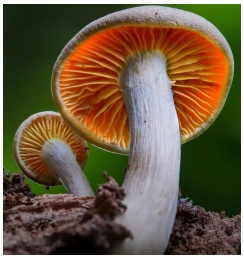
(D) None of the above is correct

62. Which of these can prepare its food?

(i)



(ii)



(A) (i) only

(B) (ii) only

(C) Both (i) and (ii)

(D) Neither (i) nor (ii) Directions

63. This plant is an example of:

Pitcher plant

(A) Saprophyte

(B) Insectivore

(C) Parasite

(D) Fungi

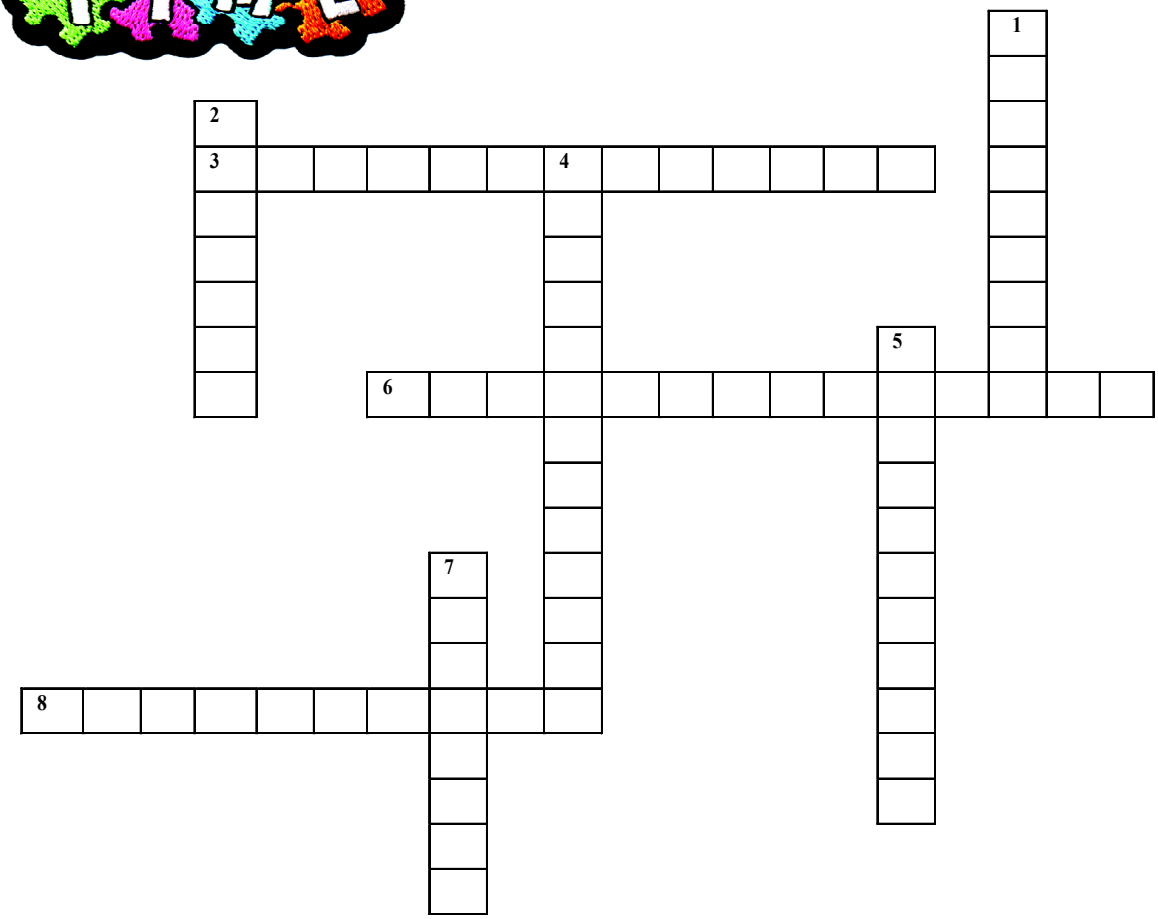
64. What does the image represents?

(A) Chlorophyll

(B) Rafflesia

(C) Cuscuta

(D) Venus flytrap(Dionaea)



***Across*: (→)**

3. Loss of water from the surface of the leaves.
6. Process which helps the plant to prepare their own food.
8. Cell surrounding the stomata

***Down*: (↓)**

1. These prepare food by using water, carbon dioxide, and minerals.
2. Tiny pores present on the surface of leaves.
4. Plants that feed on insects.
5. Green pigments present in plants.
7. Energy source for photosynthesis.

Aim: To know how a green leaf produces food - (photosynthesis).

Materials required:

A leaf from a silver geranium or a coleus plant, a double boiler, a solution of dilute iodine (iodine mixed with water), a small amount of alcohol, a saucer, a forceps or an old kitchen spoon. For this experiment, you will have to use the kitchen stove, but be sure to get your mother's permission first.

Procedure:

Fill the bottom of the double boiler with hot water and bring it to a boil. Place a geranium or a coleus leaf in the top of the double boiler and cover it well with alcohol. Remember, though, since alcohol burns quickly, you must never put a container of alcohol directly over a flame!

Set the top of the double boiler over the boiling water in the bottom pan. After a few minutes-as soon as the leaf loses its coloration-turn off the flame. Then, using your forceps or spoon, remove the leaf and put it on a plate. (If the leaf is still green, return it to the top of the double boiler and heat a few minutes more.)

Wash the boiled leaf carefully under slow-running tap water. Lay it flat on the plate and pour dilute iodine over it. After a few minutes pour off the iodine and wash the leaf again in tap water. Clean the plate.

Observation:

The leaf has become either greyish or completely without pigment. But after it was treated with dilute iodine, it turned blue-black. The alcohol in which the leaf was boiled has turned green.

By boiling the leaf in alcohol, you removed its chlorophyll, or food-making substance. And later, when you treated it with dilute iodine, you tested it for the presence of starch.

Inference: Appearance of blue black shade when iodine is added to the starch will infer the presence of starch and the process of photosynthesis.