Worksheet 4 Subject: - Science Class: - VII Teacher: - Mrs. Harpreet Kaur

Name: _____ Class & Sec: _____ Roll No. _____ Date: 09.04.2020

Ch 1: Nutrition in Panlts Do all definitions, back exercises, part B and part C → Q1, 2, 3

1

Nutrition in Plants

NUTRITION AND ITS TYPES

You already know that all living organisms require food to

- grow
- repair the damaged parts of their bodies, and
- get energy to carry out life processes.

You also know that the components of food that are necessary for our body are carbohydrates, proteins, fats, vitamins and minerals. These are called nutrients. The process of taking in food by an organism and its utilization by the body is called **nutrition.**

The energy from food is obtained by two processes, i.e. nutrition and respiration.

The living world consists of organisms that show two kinds of nutrition—**autotrophic nutrition** and **heterotrophic nutrition.**

AUTOTROPHIC NUTRITION IN PLANTS

Green plants are able to prepare their own food from simple raw materials—carbon dioxide from the air, and water from the soil. Plants get the energy for preparing food from sunlight. This mode of nutrition where green plants make food themselves from simple substances is called **autotrophic** (auto = self; trophism = feeding) **nutrition.** Such plants are therefore called **autotrophs.**

The cells of green leaves and young stems of plants contain numerous green structures

IN THIS CHAPTER

NUTRITION AND ITS TYPES • AUTOTROPHIC NUTRITION IN PLANTS • HETEROTROPHIC NUTRITION • SAPROTROPHS • REPLENISHING NUTRIENTS IN THE SOIL

called **chloroplasts**. The chloroplasts are green because of the presence of a green pigment called **chlorophyll**. It is chlorophyll that traps energy from sunlight. Leaves take in carbon dioxide from the air through tiny pores called **stomata** (singular: stoma). These pores are located on the underside of the leaves. The stomata are surrounded by guard cells. The guard cells control opening or closing of stomata. The water is absorbed from the soil by the root hairs present in roots. The water and minerals absorbed by the plants are transported to leaves through xylem vessels that are like pipes. These pipes run through the root, stem, branches and leaves. You will read about these xylem vessels in higher classes.

Using the energy from the sun, a chemical reaction takes place in the green parts of the plant, in which carbon dioxide and water are converted into food in the form of glucose. Oxygen is released in the process.

$$\text{carbon dioxide} + \text{water} \xrightarrow[\text{sunlight}]{\text{chlorophyll}} \text{glucose} + \text{oxygen}$$

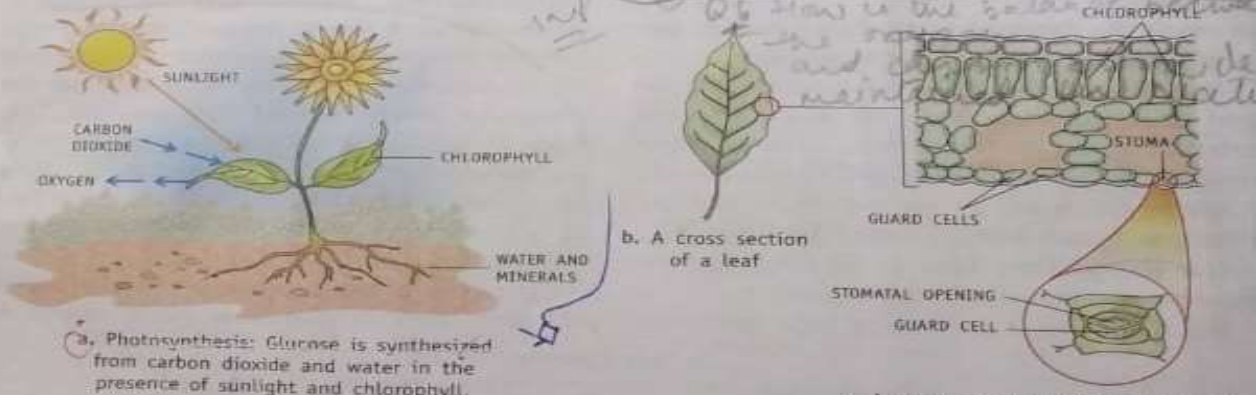
Since the synthesis of food occurs in the presence of sunlight, it is called **photosynthesis** (photo = light; synthesis = combination of components). Thus, photosynthesis combines the non-living components of the environment—water and carbon dioxide—in the presence of sunlight to form food. The food synthesized by the green leaves is transported to the other parts of the plant by the stem. In most plants, glucose is converted into starch and stored in leaves, stems, roots, etc.

IT'S A FACT!

Water helps to keep a plant rigid and upright. Each plant cell has an elastic cell wall around it. The cell takes up water until the cell wall can stretch no more. The cell is then rigid—like a bicycle tyre when it has been filled with air, or a blown-up balloon.

On hot, dry days plants may lose too much water. Then they droop. For large plants such as trees and shrubs this kind of support is not enough. They develop wood—rigid fibres which can support the weight of the big branches.

The food that plants make is used not only by themselves but also by the entire living world. Besides, as you already know, photosynthesis helps to maintain the balance between oxygen and carbon dioxide levels in the atmosphere. Therefore, in the absence of photosynthesis, life would have been impossible.



a. Photosynthesis: Glucose is synthesized from carbon dioxide and water in the presence of sunlight and chlorophyll.

b. A cross section of a leaf

c. A stoma surrounded by guard cells

FIG. 1.1

ACTIVITY 1 (Experimental investigation): To test a leaf for starch

Pluck a leaf from a plant which has been exposed to sunlight. Boil it for about five minutes in water to soften it. Place it in a test tube containing alcohol. Place the test tube in a beaker of water and warm the water gently until the alcohol begins to boil. (Caution: Do not allow the water in the beaker to boil.) The alcohol will dissolve the chlorophyll and the leaf will lose its green colour (Fig. 1.2).

Wash the leaf in warm water to remove the alcohol. Now spread the leaf out flat on a white tile and pour iodine solution on it. Remove the leaf from the iodine and wash it with water. Hold it up against the light. You will observe that parts of the leaf become blue-black. These parts of the leaf have starch in them.

FIG. 1.2 Testing a leaf for starch

The simplest method of testing whether photosynthesis has taken place is to find out if starch is present in a leaf.

ACTIVITY 2 (Experimental investigation): To show that light is necessary for photosynthesis

Take a potted plant and destarch its leaves by keeping it in dark for 2 days. Take a black paper and cut a simple 'L' shape in it by using a stencil. Cover one leaf with this paper. Leave the set up in sunlight for 4–6 hours.

Detach the leaf and test it for presence of starch. You will observe that only the part of the leaf that could get sunlight through the cut out design as well as the other exposed parts of the leaf turn blue-black showing the presence of starch (Fig. 1.3).

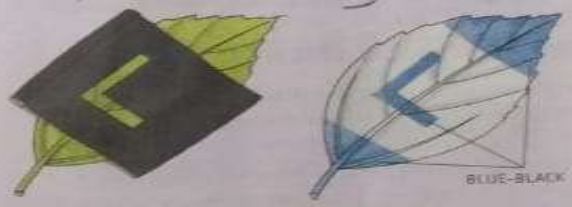


FIG. 1.3 Light is necessary for photosynthesis.

Another simple experiment can be carried out to show that rate of photosynthesis is affected by light (Fig. 1.4).

ACTIVITY 3 (Experimental investigation): To show that rate of photosynthesis is affected by light

Fill a beaker three-quarters with water. Put some *Hydrilla* plants in it. Cover the plants with a glass funnel. Carefully invert a test tube full of water over the stem of the funnel. Keep the arrangement in sunlight. You will find bubbles of a gas escaping from the leaves of the plant. Keep the plant away from sunlight now. You will observe that the number of bubbles have decreased in the shady place.

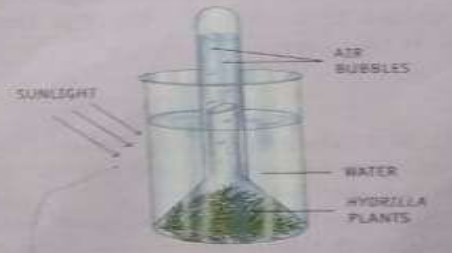


FIG. 1.4 Rate of photosynthesis is affected by light

HETEROTROPHIC NUTRITION

Animals and non-green plants, such as fungi and bacteria, cannot prepare their own food. They depend directly or indirectly on green plants for their nutrition. This mode of nutrition is called **heterotrophic nutrition.** Animals and non-green plants are known as **heterotrophs.**

Herbivorous animals depend directly on plants for their nutrition. Carnivores depend on other animals, which in turn depend on plants (Fig. 1.7). Thus, when you eat meat, you are indirectly depending on food prepared by plants. You know that green plants get the energy to prepare food from the sun. Thus, the sun is the ultimate source of energy for all living organisms.

Heterotrophic nutrition in plants

Some non-green plants live in or on other living organisms and derive their food from them. For example, dodder is a plant that sucks food from another plant using root-like structures. Such plants are called **parasites.** The plant from which a parasite gets its food is called a **host.** Some parasitic plants like mistletoe plant (Fig. 1.8), which grow on trees such as mango or *mahua*, have green leaves and can synthesize their food. They take water and minerals

FIG. 1.8 Mistletoe plant

from the host plants. They are known as **partial parasites.**

The plant kingdom also has plants that consume insects. The Venus flytrap and pitcher plant catch insects by ingenious methods. They are known as **insectivorous plants.** In the pitcher plant, a leaf becomes modified to form a pitcher-like structure with a lid. Inside the pitcher there are hairs pointing downwards. When an insect enters in the pitcher plant, the lid closes to trap the insect, and it gets entangled in the hair. The cells of the pitcher plant secrete digestive juices to digest the insect.

Venus flytrap and pitcher plant grow in soil that is not so rich. They use the nutrition obtained from insects to supplement the food they prepare by photosynthesis.

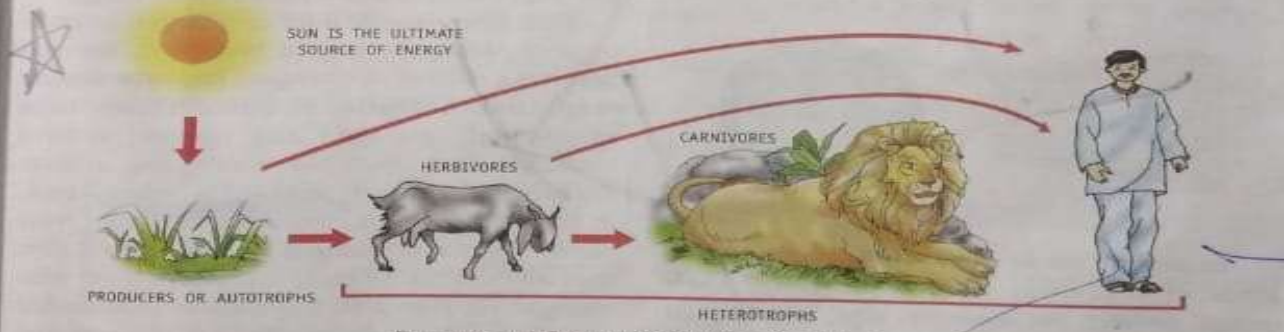


FIG. 1.7 The flow of energy in a food chain

Activity 4 (Experimental investigation): Chlorophyll is necessary for photosynthesis

The leaves of plants, such as *Coleus* and croton, are partly green and partly non-green. They are known as variegated leaves (Fig. 1.5.) Chlorophyll is present only in their green portions. Select such a leaf from a plant that has been exposed to sunlight for a few hours and draw its outline on a sheet of paper. Indicate the green and non-green areas on the drawing. Test the leaf for starch. Compare the parts stained blue-black with the drawing. Which parts of the leaf turn blue-black? Why does the non-green portion not show the presence of starch?

Fig. 1.5 Chlorophyll is necessary for photosynthesis.

Activity 5 (Experimental investigation): Carbon dioxide is necessary for photosynthesis

Take a destarched potted plant. Take a conical flask and put some potassium hydroxide into it. Potassium hydroxide absorbs the carbon dioxide. Insert one leaf into this conical flask through a split cork (Fig. 1.6). Leave the plant in sunlight for few hours. After few hours take out this leaf from conical flask and remove it from the plant. Take another leaf from the same plant. Test both these leaves for presence of starch. You will observe that the leaf from the conical flask does not turn blue-black while the one that was exposed to atmospheric air turns blue-black. This shows that carbon dioxide is necessary for photosynthesis.

Fig. 1.6 Carbon dioxide is necessary for photosynthesis.

Synthesis of food other than carbohydrates by plants

Carbohydrates that plants synthesize during photosynthesis are made up of carbon, hydrogen and oxygen. These are used to synthesize other components of food such as proteins and fats. Proteins contain nitrogen. Though air contains large amounts of nitrogen, plants cannot absorb this nitrogen directly. They get nitrogen in two ways.

- Soil contains certain bacteria called *Rhizobium* that can convert atmospheric nitrogen into water-soluble compounds. Plants absorb these compounds along with water to get nitrogen.
- Farmers add fertilizers rich in nitrogen to the soil. These are absorbed by plants.

ORAL QUESTIONS FOR FORMATIVE ASSESSMENT

1. If a new organism is discovered and it is found that it can make food for itself from simple non-living substances found in nature, what will you classify it as—an autotroph or a heterotroph? Give reasons.
2. The absence of which of these will not affect photosynthesis—oxygen, carbon dioxide, water, chlorophyll, light? Give reasons.
3. Do you expect the intensity of light to affect the rate of photosynthesis?

Saprotrophs

Some non-green plants live on dead and decaying plants and animals, and derive their food from them. Examples are mushrooms and other fungi, and bacteria. They secrete digestive juices on the dead and decaying matter. This converts the solid matter into a liquid. They then absorb the nutrients from this liquid. This method of getting nutrients from dead and decaying matter in the form of a liquid is known as saprotrophic nutrition.

Fungi and bacteria that use this mode of nutrition are known as saprotrophs or saprophytes.

Spores of fungi are always floating around in the air. They start germinating when they land on wet and warm things. Fungi grow on shoes, clothes, pickles and other articles in warm and humid weather.

Activity 6 (Information gathering)
Compare a mushroom with a green plant. What differences and similarities do you find?

Activity 7 (Experimental investigation): To grow fungi
Take a slice of bread. Sprinkle some water on it and leave it in a moist place for 2–3 days. Observe with a magnifying glass. Can you see white, green or brown patches of thread-like growth on the bread? This is a fungus.

Fig. 1.9 Fungi growing on bread

In another mode of nutrition, two different kinds of organisms work together for their mutual benefit. For example, alga, which is an autotroph, and fungus, which is a saprophyte,

Fig. 1.10 Lichen

live together in lichen (Fig. 1.10). The fungus supplies water and minerals to the cells of the alga, while the alga supplies food to the fungus. Such a mutually beneficial relationship is called symbiosis.

REPLENISHING NUTRIENTS IN THE SOIL

Plants absorb nutrients from the soil. Therefore, the amount of nutrients in the soil goes on decreasing. In a forest, these nutrients get naturally replenished by decaying of dead plants and animals. However, on a farm these nutrients have to be added to the soil in the form of manure and fertilizers. These manures and fertilizers contain plant nutrients such as nitrogen, potassium and phosphorus. A farmer knows which nutrients are crucial for which crops and adds manures and fertilizers accordingly.

Most crops require a lot of nitrogen to make proteins. After the crop is harvested, the soil becomes deficient in nitrogen. You have already read that bacteria *Rhizobium* can take atmospheric nitrogen and convert it into a soluble form that the plants can absorb. *Rhizobium* cannot make its own food. It therefore lives in the roots of leguminous plants like gram, peas and moong where it gets food and shelter. In turn, it provides them with nitrogen. It thus has a symbiotic relationship with leguminous plants. We get most of the

pulses from leguminous plants. Farmers know that they do not need to add nitrogenous fertilizers in the soil in which leguminous plants are grown.

ORAL QUESTIONS FOR FORMATIVE ASSESSMENT

1. A tiger does not eat plants, so it does not depend on plants for food. Is the statement true? Justify your answer.
2. All plants are autotrophic. Do you agree? Give reasons.
3. In a forest, trees keep taking nutrients from the soil. Therefore, after sometime, the nutrient level will become so low that growth of trees will suffer. Do you agree? Give reasons.
4. Plants need nitrogen to make proteins. Can they absorb nitrogen from the atmosphere?

NOW YOU KNOW

- Green plants are autotrophs.
- Green plants use water, carbon dioxide and sunlight to prepare their food during photosynthesis.
- Energy for photosynthesis is obtained from sunlight trapped by chlorophyll.
- All non-green plants and animals are heterotrophs.
- Non-green plants are parasites, saprophytes or insectivorous.

NEW WORDS

AUTOTROPHS—organisms that can make their food from simple non-living substances

HETEROTROPHS—organisms that directly or indirectly depend on green plants for nutrition

PARASITES—organisms that live in or on other living organisms and derive their food from them

SAPROTROPHS—organisms that live on dead plants and animals and derive their food from them

SYMBIOSIS—the mode of nutrition where two different organisms work together for their mutual benefit

FOR FORMATIVE AND SUMMATIVE ASSESSMENT

A. MULTIPLE-CHOICE QUESTIONS: Choose the most appropriate answer.

1. The life process/processes that provides/provide energy is/are
   a. nutrition. b. respiration.
   c. both nutrition and respiration. d. response to stimuli.
2. Which of these are autotrophs?
   a. all plants b. green plants c. all animals d. unicellular organism
3. Which of these is not necessary for photosynthesis?
   a. carbon dioxide b. chlorophyll c. light d. nitrogen

4. Which of these elements is needed in addition to carbon, hydrogen and oxygen to make proteins?
   a. nitrogen b. phosphorus c. potassium d. calcium
5. Which of the following gets absorbed from the atmosphere during photosynthesis?
   a. oxygen b. water vapour c. carbon dioxide d. nitrogen
6. Organisms that live in or near the host and obtain their nutrition from the host are called
   a. saprophytes. b. autotrophs. c. heterotrophs. d. parasites.
7. Partial parasites are
   a. green plants. b. non-green plants.
   c. either green or non-green plants. d. neither green nor non-green plants.
8. Which of these is a saprophyte?
   a. venus flytrap b. mushroom c. pitcher plant d. dodder

B. VERY SHORT-ANSWER QUESTIONS: Give one-word answers.

1. Living organisms that cannot make their own food are called
2. The structures in cells that contain chlorophyll are called
3. What does 'photo' in photosynthesis refer to?
4. Which bacteria in the soil can convert atmospheric nitrogen into soluble compounds?
5. What type of plant is *Cuscuta*?
6. What do you call a mutually beneficial relationship between two living organisms?
7. Name one organism that gets its food from dead and decaying matter.
8. When iodine is added to starch, it becomes in colour.
9. What is the ultimate source of all the energy needs of our body?
10. Saprophytes are green in colour. True or false?
11. Some green plants are also heterotrophic in nature. True or false?
12. Which cells control the opening and closing of stomata?

C. SHORT-ANSWER QUESTIONS: Answer in a sentence or two.

1. What is nutrition?
2. What are 'stomata'? Where are they normally found?
3. Write down the chemical equation for manufacture of food in green plants.
4. What factors are essential for photosynthesis to take place?
5. How does an insectivorous plant absorb nutrients from an insect trapped by it?
6. Why is nitrogenous fertilizer not added in soil in which leguminous plants are grown?
7. How does a saprophyte digest its food?

D. LONG-ANSWER QUESTIONS: Answer in about 50 words.

1. Differentiate between autotrophs and heterotrophs, giving two examples of each.
2. How will you test a leaf for starch? Mention any precautions you will take.
3. How do plants get nitrogen to synthesize proteins?

4. All animals—whether herbivores, carnivores or omnivores—depend on plants for their food. Discuss.
5. Explain the following with the help of an example for each:
   a. parasitic nutrition b. symbiosis c. saprotrophic nutrition
6. Why are manures and fertilizers added to the soil in a farm?
7. Distinguish between parasites and partial parasites in plants, giving one example of each.

HOTS Questions: Think and answer.

1. We make our own food in the kitchen. This means that humans are also autotrophs. Do you agree? Give reasons.
2. Why can't animals make food from carbon dioxide, water and sunlight, like plants do?
3. The pitcher plant and Venus flytrap are green plants that can photosynthesize. Why do they need to feed on insects?
4. Plants do not have a digestive system like us. Why do they not need a digestive system?

FOR FORMATIVE ASSESSMENT*

In the Library—Research Project

Hydroponics is a method of growing plants without soil. Instead of soil, plants are grown in mineral nutrient solutions in water. Terrestrial plants may be grown with their roots in the mineral nutrient solution only or in an inert medium, such as gravel, mineral wool or coconut husk.

Find out more about hydroponics, especially about how you can yourself grow plants in this way.

My Virtual Library—Research/Activities on the Internet

- ❒ Visit ncert.in/sc-cce-7 and click on LINK 1 to learn about nutrients that plants need.
- ❒ Visit ncert.in/sc-cce-7 and click on LINK 2 to find a quiz on plant nutrition.
- ❒ Visit ncert.in/sc-cce-7 and click on LINK 3 to find a slideshow on nutrition in plants.

Beyond the Classroom—Field Trip

Visit a greenhouse in your town or city. See and find out how plants are grown there. Also find out how light, temperature, water and carbon dioxide are regulated.

TEACHER'S NOTES

- Explain to children the difference between making of food by plants and making of food in the kitchen—that plants make food from non-living inorganic substances available in the environment, whereas we 'cook' dead parts of living things in the kitchen to make our food.
- Explain that though we refer to non-green plants such as mushrooms as 'plants', many scientists classify only green plants (which have chlorophyll that enables them to make their own food) as 'plants' and mushroom and other non-green plants as 'fungi'.

*For more tasks see Page 55