photosynthesis. Glucose is stored in the form of starch in the leaves. The food formed by the leaves of the plants is transported to the different parts of the plants for utilisation and storage as per need.

FactAce

7E Extend

Apart from leaves, photosynthesis also occurs in other parts of the plant, such as green branches, sepals and green stems. Plants in deserts, such as cactus, have spine-like leaves to minimise waterloss by transpiration. They have green stems to carry out photosynthesis.

Activity 1

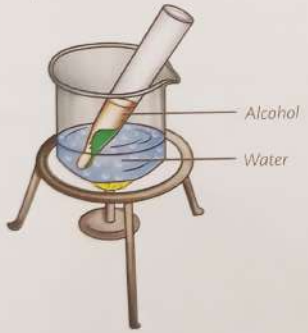
Scientific Proficiency — Procedural fluency

Aim: To show that leaves contain starch

Materials required: Green leaf, water, alcohol, burner, tripod stand, beaker, iodine solution, test tube

Procedure: Take a green leaf and boil it in water in the beaker to soften it. Place the softened leaf in a test tube and pour some alcohol in it. Now, put the test tube in the beaker containing water and let it heat on the flame for 2–3 minutes. Boiling the leaf in alcohol removes the chlorophyll from the leaf.

Now, take out the leaf from the test tube carefully and wash it with water. Using a dropper, put a few drops of iodine solution on the leaf. Observe what happens.



As the leaves prepare food for the plant and store it, they are called **kitchen of the plants**.

Conditions Necessary for Photosynthesis

The conditions necessary for the process of photosynthesis are:

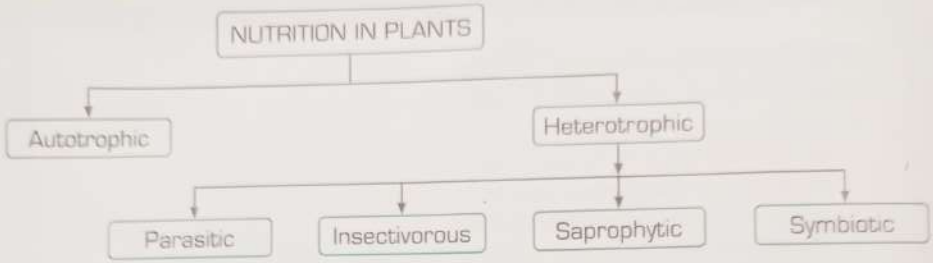
Chlorophyll: This is the green pigment present in the leaves of the plants. This pigment is located in the chloroplasts of plant cells.

pigment: a substance whose presence in plant or animal tissues produces a characteristic colour

Tip for the Teacher Students can be told why a water bath is used for heating alcohol.

All organisms require food and energy for their survival. Therefore, nutrition is also required by all organisms, including plants.

Plants obtain their nutrition through different modes. The mode of nutrition in plants can be broadly categorised into **autotrophic** and **heterotrophic modes of nutrition**. Here, *auto* means 'self' and *trophism* means 'to eat'. Similarly, *hetero* means 'another' and *trophism* means 'to eat'.



AUTOTROPHIC NUTRITION

All green plants prepare their own food by the process of photosynthesis, and hence are said to have autotrophic mode of nutrition. Plants are therefore called ***autotrophs***.

As the food is produced in the presence of sunlight (*photo*: light; **synthesis** : combining together), the process is called **photosynthesis**. In other words, photosynthesis is a process by which plants use sunlight, carbon dioxide, and water to produce glucose and oxygen.

$$6CO_2 + 6H_2O \xrightarrow{\text{In the presence of light, chlorophyll}} C_6H_{12}O_6 + 6O_2$$

Carbon dioxide — Water — Glucose — Oxygen

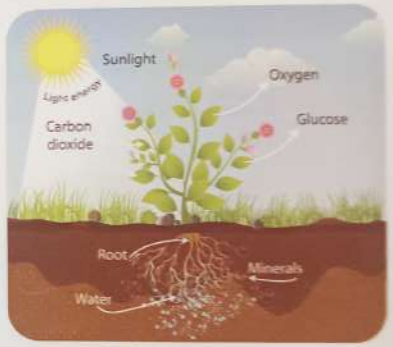


Fig. 1.1 Photosynthesis

Green plants contain a pigment called **chlorophyll**, that gives green colour to the plants. Chlorophyll traps sunlight, and stomata take in carbon dioxide from the atmosphere. The roots of the plants absorb water and minerals from the soil. During photosynthesis, chlorophyll absorbs light energy, which is then used in a series of reactions to convert carbon dioxide and water into glucose and oxygen. Glucose and oxygen are the products of

FactAce 7E Extend

Chlorophyll is primarily found in the leaves of plants; however, you can also find it in the stem and fruits of plants. The complete body of small plants like algae have chlorophyll, and their entire body takes part in the process of photosynthesis.

synthesis: the formation of chemical compounds by carrying out the reaction of simple materials

1 Nutrition in Plants

Learning Objectives

After completing this chapter, I will be able to:

- describe the types of nutrition in plants.
- list examples of autotrophic and heterotrophic plants.
- describe the process of photosynthesis.
- identify the various types of heterotrophic plants.
- learn how nutrients are replenished in the soil.

What I Know

7E Engage

Give one word for the following:

1. Process by which green plants prepare their food .....
2. This pigment traps sunlight in plants .....
3. Element fixed by *Rhizobium* .....
4. Structure present for exchange of gases in plants .....
5. Gas evolved during photosynthesis .....

You might have heard people say that a child is not getting proper nutrition and, thus, he or she is weaker as compared to other children of his or her age. Hence, our elders advise us to eat nutritious food to stay fit. What is meant by nutritious food? Why should we include different fruits and vegetables in our diet?

NUTRITION IN PLANTS AND ITS TYPES

***Nutrition** is the mode of taking food by an organism and utilising the food for its growth and development.* In this process, the food we eat is broken down into simpler components from which we get the energy to perform basic life processes, that is, to survive, grow and reproduce.

In Activity 3, the part covered with black paper strip did not turn blue-black because of the absence of starch. As the leaf was covered with black paper strip, it did not receive sunlight and hence did not contain starch.

Water and Minerals: The roots of plants absorb water from the soil and transport it to the other parts through a network of tubes called **xylem**. Carbon dioxide combines with water in the reaction to produce the food, that is glucose, along with oxygen gas. The food is then transported through special conducting tubes called **phloem** to different parts of the plant.

Go Green

21st Century Skills — Environmental literacy

Scavenger Hunt—Greenhouse

Visit a greenhouse. Find out the answers to the following questions.

1. How do plants grow in a greenhouse?
2. Find and name:
   a. a plant with large leaves
   b. a flower in your favourite colour
   c. a plant with spines

Checkpoint 1

Assessment for Learning

INT

Fill in the blanks.

1. Nutrition in plants can be broadly categorised into ..... and ..... .
2. ..... are the tube-like structures that transport water from the soil to all parts of the plant.
3. ..... is used to decolourise the leaf.
4. Plants are also called ..... as they make their own food.
5. ..... and ..... are the products of photosynthesis.

HETEROTROPHIC NUTRITION

Plants that cannot prepare their own food and depend on other organisms for their nutrition are known as ***heterotrophs****. This mode of nutrition is called* ***heterotrophic nutrition****.* This mode of nutrition can be further categorised into—parasitic, insectivorous, saprophytic and symbiotic nutrition.

Let us discuss the different types of heterotrophic nutrition in detail.

Activity 2

Scientific Proficiency | Procedural fluency | ANM

Aim: To show that carbon dioxide is necessary for photosynthesis

Take a potted plant with long leaves. Keep the plant in a dark room (for about three days) to destarch the leaves.

Take a glass jar, put some potassium hydroxide in it and close it with a split cork. Potassium hydroxide will absorb all the carbon dioxide present inside the jar.

Insert a leaf through the cork so that half of the leaf is outside the bottle and other half inside the bottle. Do not let the leaf break. Keep the plant in sunlight for about 4–5 days.

After 4–5 days, remove the jar and pluck the leaf from the plant. Wash the leaf and test it for the presence of starch. Test both the part of the leaf inside the jar and the part that was outside for the presence of starch. This will show a clear contrast between the two parts.

Observation: You will observe that the part of the leaf which was inside the jar, did not turn blue-black after adding iodine, whereas the other half turned blue-black after adding iodine.

Conclusion: This shows that the part of the leaf inside the bottle did not photosynthesise in the absence of carbon dioxide.

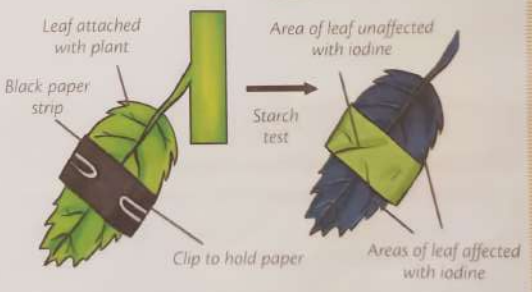
Sunlight: Sunlight is necessary for the process of photosynthesis.

Activity 3

Scientific Proficiency | Procedural fluency

Aim: To show that sunlight is necessary for photosynthesis

Procedure: Take a potted plant and keep it in a dark place for 2–3 days to destarch the leaves. Cover a part of one leaf of the plant with a black paper strip for 5–6 hours. Make sure you cover both the sides of the leaf. Now, place this plant in sunlight for 3–4 hours. Pluck the selected covered leaf and remove the paper strips from it. Now, boil the leaf in alcohol as in Activity 1 and test it for presence of starch by dropping a few drops of iodine on the leaf.



Observation: You will observe that the part covered with paper strip did not show any colour change, whereas the green parts changed their colour to blue-black.

Conclusion: This activity shows that sunlight is necessary for photosynthesis.

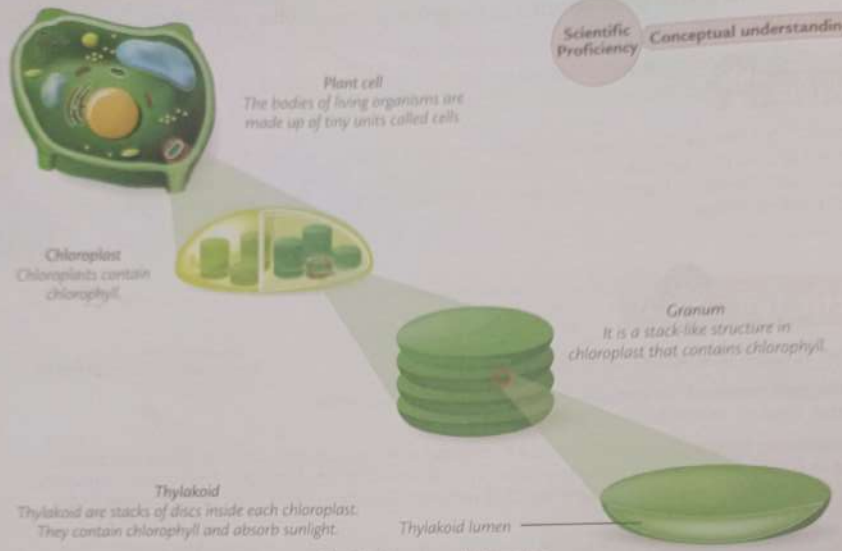


Fig. 1.2 Structure of chloroplast

Carbon dioxide: The carbon dioxide gas present in the atmosphere enters the leaves through small openings called **stomata** (*singular*: **stoma**). Each stoma consists of two guard cells and a stomatal opening.

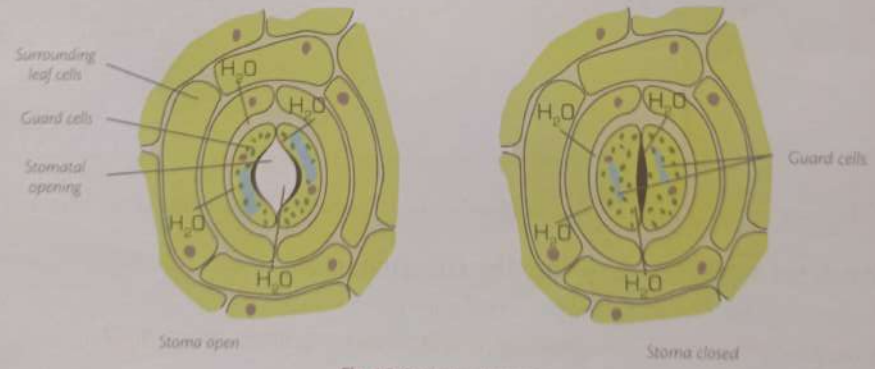


Fig. 1.3 Structure of stomata

a fungus that is a saprotroph. Bullhorn *Acacia* trees and certain species of ants, Rhizobia (a group of soil bacteria) that colonise the roots of legumes to form root nodules are some other examples of symbiosis.

Checkpoint 2

Assessment for Learning | 7E Evaluate

Name the type of heterotrophic nutrition found in the following plants.

1. Pitcher plant — Insectivorus plant
2. Mushroom — Saprotrophs
3. Dodder plant — parasites x Insectivorrs plant
4. Mistletoe — Parasitic
5. Lichen — Symbosis

HOW ARE NUTRIENTS REPLENISHED IN THE SOIL?

We know that the plants absorb nutrients and water from the soil. It is a continuous process. So, the amount of nutrients in the soil decreases. As a result, farmers add fertilisers to the soil to maintain the proportion of nutrients in the soil. Additionally, farmers use techniques such as crop rotation and composting to help maintain soil fertility naturally.

FactAce 7E Extend

Nitrogen is an important factor for plant growth. The need for nitrogen may vary from plant to plant. Trees and shrubs have a relatively low requirement of soil nitrogen.

The bacterium known as *Rhizobium* lives in the roots of leguminous plants such as grams, peas and beans. It converts atmospheric nitrogen into nitrogenous forms that can be absorbed by plants. Finally, the soil becomes rich in nitrogen and more fertile. In return, the plant provides food and shelter to the bacteria. This is an excellent example of a symbiotic relationship.

Keywords

SVID

Autotroph: An organism that makes its own food
Photosynthesis: The process by which green plants synthesise glucose and release oxygen using carbon dioxide and water, in the presence of sunlight (with the involvement of green pigment, chlorophyll)
Heterotroph: An organism that cannot make its own food and obtains it from other sources
Parasite: An organism that lives on another organism (host) and benefits by deriving nutrients at the expense of its host
Insectivorous: Feeding on insects, worms, and other invertebrates
Saprotrophs: Fungi or other microorganisms that live on dead or decaying organic matter
Symbiotic: Organisms that live together for mutual advantage

Pitcher plant has its leaves modified into pitcher-like structures. These pitchers contain hairs that entangle the insects that enter. The pitcher secretes digestive juices that help in digestion of insects.

Bladderworts have pear-shaped bladder structures in their leaves. These act as trapdoors for insects.

Sundew plant leaves have tentacles. Drops of mucilage (a sticky substance) are present at the ends of tentacles. When any insect sticks to the mucilage, it gets trapped and is eventually digested.

a. Venus flytrap

b. Pitcher plant

c. Bladderwort

d. Sundew

Fig. 1.6 Insectivorous plants

Saprotrophs

*The plants that live on dead and decaying organic matter and derive nutrients from them are called **saprophytic plants** or **saprotrophs**.* Saprotrophs are usually whitish but some plants can have brightly-coloured flowers, often with no leaves at all. They often live in deep shades of tropical forests. They secrete digestive juices on dead and decaying matter to dissolve them and absorb the nutrients. Indian pipe is an example of a saprotroph.

It increces humidity

Fig. 1.7 Mushrooms

Fig. 1.8 Bread mould

HOTS

Why do our shoes get spoiled during the rainy season?

Symbiosis

In **symbiotic** nutrition, organisms develop mutual relationship with other organisms to obtain nutrients. In this way, both the organisms help each other. The organisms involved in this type of relationship are known as **symbionts** and this relationship is known as **symbiosis**. Lichens are a perfect example of symbiotic relationship. In a lichen, an alga that is an autotroph lives in association with

Fig. 1.9 Lichens

Parasites

Some plants derive their nutritional requirements from another living organism. Plants which exhibit this type of nutrition are called **parasitic plants**. Parasitic plants live in or on the body of another living plant called the **host** that provides nourishment to them. Parasitic plants penetrate the host plant's conductive system (xylem and phloem) with the help of their modified roots known as **haustoria**. They are capable of absorbing water and nutrients from the host plant. *Cuscuta*, commonly known as dodder, is a yellowish plant that is found intertwined on the green plants. Australian Christmas tree, dwarf mistletoe and corpse flower are some other examples of parasitic plants.

FactAce 7E Extend

Rafflesia is a parasitic plant that has the biggest flower in the world.

In a parasitic relationship, only the parasitic plant is benefitted. It harms the host plant by slowing down its growth and thus causing a heavy damage to the host plant.

There are some parasitic plants that make their own food, but depend on other plants for water and other nutrients. These plants are called *partial parasites*. Mistletoe is an example of a partial parasite.

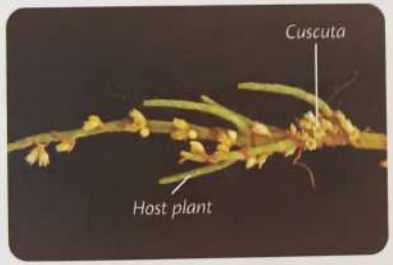


Fig. 1.4 *Cuscuta* (*Amarbel*)

Fig. 1.5 Mistletoe

Insectivorous Plants

Some plants grow in soil that is deficient in essential nutrients (such as nitrogen). These plants feed on insects to meet their nutritional requirements and are called ***insectivorous plants***.

Insectivorous plants have special structures to trap and digest organisms. They are green in colour, and can prepare their own food, but behave as insectivores to fulfil their nitrogen requirement.

Venus flytrap, many types of pitcher plants, bladderwort (*Utricularia*) and sundew plant are some examples of insectivorous plants.

The leaves of **Venus flytrap** are modified to trap insects. Short and stiff hairs are present on the inner surface of leaves. The leaves snap shut when any insect touches the hair. After trapping the insect, the leaves secrete digestive enzymes to break it down.

VID

3. *Utricularia* is an example of a/an _____ plant.
4. _____ is a process of making food by the plants.
5. Plants absorb carbon dioxide from the _____ and water from the soil with the help of their root hairs.

E. Write two examples of the following.

1. Autotrophic plants
2. Parasitic plants
3. Saprophytic plants
4. Insectivorous plants
5. Symbionts
6. Host plants (of parasites)

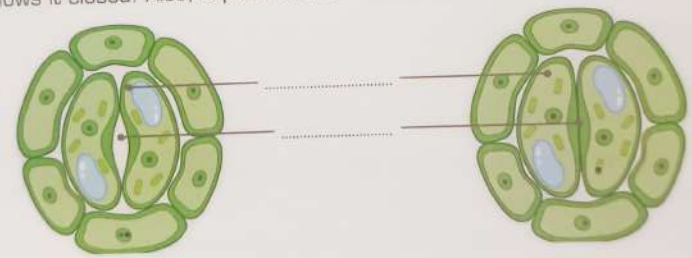
F. Match the following.

1. Photosynthesis	a. Modified roots
2. Green pigment	b. Insectivorous
3. Haustoria	c. Nutrients
4. Bladderworts	d. Glucose
5. *Rhizobia*	e. Chlorophyll
6. Fertilisers	f. Symbiont

INT

G. Observe and Infer.

Label the diagram given below and identify which diagram shows the stoma open and which shows it closed. Also, explain the importance of stomata.



_____ _____
_____ _____
_____ _____

II. Assessment of Learning

Answer the following questions.

A. Short Answer Questions.

1. What is nutrition?
2. What are the different types of nutrition in plants?
3. What is saprophytic nutrition?
4. List the different types of heterotrophic nutrition.

3. Which of the following is a symbiont?

a. Lichen ✓ b. Sundews

c. Corpse flower d. Mistletoe

4. Which of the following is not a requirement for carrying out photosynthesis?

a. Carbon dioxide b. Water

c. Sunlight d. Thunder ✓

5. Which of the following is not a product of photosynthesis?

a. Oxygen b. Glucose

c. Carbon dioxide ✓ d. None of these

6. Which of the following is the network of tubes that transport water from roots to other parts of the plants?

a. Phloem b. Branches

c. Leaves d. Xylem ✓

B. State whether the following statements are True or False.

INT

1. Plants which can prepare their own food by the process of photosynthesis are known as heterotrophs. F
2. Farmers add fertilisers to the soil to maintain the proportion of nutrients in the soil. T
3. *Rhizobium* bacteria convert atmospheric argon into argon salt for the soil. F
4. Saprophytic plants secrete digestive juices on dead and decaying matter to dissolve them and absorb their nutrients. T

C. Unscramble the letters to find the answers.

1. Composite of algae and fungi (ENILHCS)
2. The plants which derive their nutritional requirements from another living plant or animal (AICPTIARS)
3. The plants that have special structures to trap the organisms (UIVSCTSIEONRO)
4. The nutrition in which organisms develop mutual relationship with other organisms to obtain nutrients (TSICYBOIM)
5. The plants which cannot prepare their own food and depend on other organisms for their nutrition (CTETEOHPRRHIO)

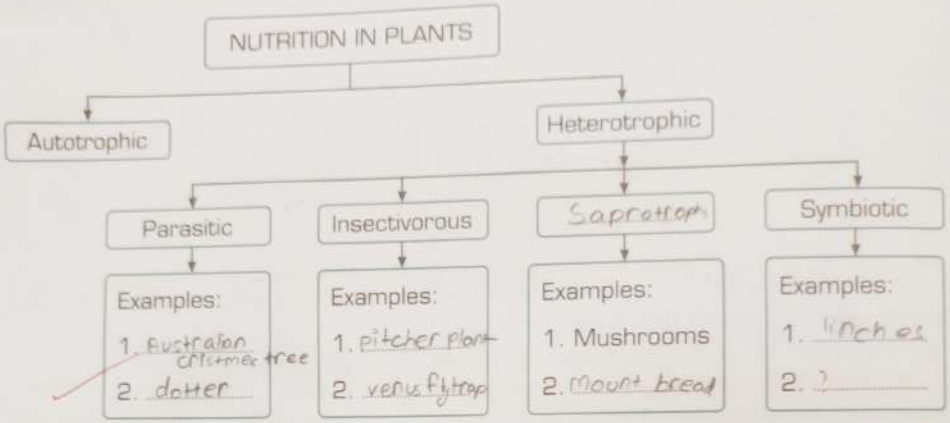
D. Fill in the blanks.

INT

1. ..... is the mode of taking food by an organism and utilising it for their growth and development.
2. ..... is an insectivorous plant that has pear-shaped bladder structure in its leaves.

Now I Know

Let us now summarise the key concepts of this chapter by completing the concept map given below.



What I Have Learnt

7E Evaluate

INT

I. Assessment for Learning

A. Tick (✓) the correct answer.

1. Organisms which cannot prepare food for themselves are known as:
   - a. autotrophs ☐
   - b. heterotrophs ☑
   - c. parasitic ☐
   - d. symbiotic ☐
2. Which of the following is an autotroph?
   - a. Dodder ☐
   - b. Sunflower plant ☑
   - c. Fungi ☐
   - d. Algae ☐

NUTRITION IN ANIMALS

When we talk about nutrition in animals, we refer to the process by which an animal obtains food, and the way the food provides energy and essential minerals to the animal for their growth, maintenance and to perform life **sustaining activities**. Animals and humans take food in solid form. Such a type of nutrition is generally called **holozoic** and involves the following five steps.

Ingestion → Digestion → Absorption → Assimilation → Egestion

Fig. 2.1 Processes involved in nutrition of animals

Ingestion: *The process of taking in food through mouth by humans or animals is called ingestion*. The method of ingestion may vary from one animal to another.

Digestion: *The process in which complex components of food are broken down into simpler substances is called* ***digestion***. The process of digestion is different among animals.

Absorption: *The process in which the nutrients from the digested food are passed to the blood, to be transported to other parts of the body is called absorption.*

Assimilation: *The process of utilising absorbed nutrients in living tissues is called* ***assimilation***. It fulfils the supply of oxygen, energy and nutrients in the living organisms.

Egestion: *The process in which the undigested food or waste materials are removed from the body is called egestion.*

Nutrition in *Amoeba*

Amoeba is a unicellular organism found in freshwater. It is irregular in shape and does not have a mouth to ingest food or a digestive system to digest it. It feeds on microscopic plants and animals through **pseudopodia**, also called **false feet**.

When near a food particle, *Amoeba* forms an arm-like or cup-like structure called a pseudopodium to ingest it. When the food is completely encircled by the pseudopodia, a small cavity, called **food vacuole**, is formed. The food vacuole contains several digestive enzymes which help to break the complex parts of the food into simple soluble molecules. The simple soluble food molecules get absorbed and assimilated in the body to obtain energy, growth and repair. The undigested food is thrown out from the body of *Amoeba* through the process of egestion.

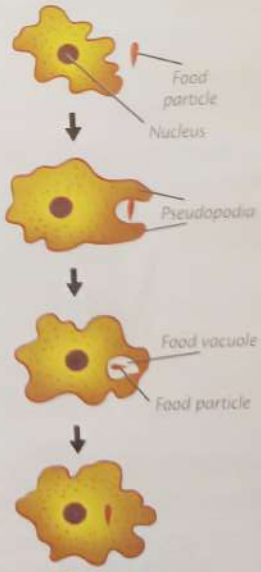


Fig. 2.2 Nutrition in *Amoeba*

sustaining activities: activities such as eating food and drinking water, which are important for the survival of living beings

2 Nutrition in Animals

Learning Objectives

After completing the chapter, I will be able to:

- describe the types of nutrition in animals.
- describe the process of nutrition in animals.
- learn how nutrition is carried out by *Amoeba*, *Hydra* and frog.
- identify the various organs of the human digestive system.
- understand the mode of nutrition in ruminants.

What I Know

7E Engage

Fill in the blanks.

1. There are ..... permanent teeth.
2. Different organs such as the mouth, stomach and intestines together make up the ..... system.
3. The food reaches the stomach through the .....
4. Undigested food passes into the .....
5. We should follow ..... eating habits.

Usually after we play or work hard, we feel hungry. This hunger gets satisfied only after we eat food. But, have you ever wondered why food is so important in our life? What would happen if there is no food? Can we survive without it?

We cannot survive without food for long. Our food contains important nutrients, such as carbohydrates, fats and proteins, that are essential for the growth and development of our body. Similar to human beings, animals also need food to survive. All animals require different nutrients to grow and live. *The process of taking in food and its utilisation in the body for growth and development is called* ***nutrition***.

5. Is oxygen a requirement or a product of photosynthesis? Explain.
6. Which is the main product of photosynthesis?
7. How do plants absorb carbon dioxide from the air?

B. Long Answer Questions.

1. Give a brief description of the process of synthesis of food in green plants.
2. Distinguish between a parasite and an insectivore. Give suitable examples.
3. What are the essential conditions for photosynthesis?
4. Explain symbiotic nutrition with the help of an example.
5. How can nutrients of the soil be replenished?
6. How can you show the presence of starch in leaves? Explain with the help of a diagram.
7. Chlorophyll and carbon dioxide are necessary conditions for plants to photosynthesise. How can you prove this? Explain each with the help of a diagram.

Enrichment Corner

HOTS

Scientific Proficiency · Adaptive reasoning

A. How does a pitcher plant trap insects?

B. Why do you think it is important to decolourise a leaf while checking for the presence of starch?

C. Symbiotic relationship can be seen in animals too. Think of any one example where symbiotic nutrition can be seen in animals.

D. Mushrooms do not have mouth parts like animals. They also do not contain chlorophyll like green plants. Then, how do they acquire nutrients?

Subject Connect

Integrated Pedagogy · Social Science

Explore your surroundings and gather information on heterotrophic plants. Tabulate your data using the following heads—Name of the heterotrophic plant, Type of the heterotrophic plant, Characteristic of the plant (any one).

Research/Activity

7E · Explore

A. Observe Bread Mould Growth

Take a slice of bread and moisten it with water. Leave it in a warm place for 2–3 days. Observe the bread slice and note down your observations every day for a week. Take pictures of the bread slice daily. Paste them in a scrapbook.

The milk teeth appear at the young age of 1 to 5. As we grow, these are gradually replaced by 32 **permanent teeth** (including 4 wisdom teeth). While this is typically true, not everyone develops all four wisdom teeth, and some people may have fewer or none at all. The teeth help in digesting the food by biting and chewing down the food into smaller digestible pieces.

Incisors are the front teeth that are used to bite the food. This is why they are also called **biting teeth**. There are 4 incisors in each jaw.

Canines are present adjacent to incisors on both sides of the jaw. They are used to tear the food and hence are called the **tearing teeth**. There are 2 canines in each jaw.

Fig. 2.9 Types of teeth

Premolars and **molars** are the next set of teeth that help in grinding and chewing of food. There are 4 premolars and 6 molars in each jaw.

Once the food is chewed, the tongue—a muscular organ, helps in pushing down the food inside the mouth. The food mixed with **saliva** is pushed down to the throat by the tongue. The **pharynx** or the throat helps in sliding down the food inside the body. It helps the food to reach the **oesophagus** (the food pipe).

Activity 2

Scientific Proficiency | Procedural fluency

Aim: To investigate the effect of saliva on the food

Materials required: two test tubes, boiled rice, iodine solution

Procedure: Take boiled rice in one test tube. Label it as test tube A. Chew some boiled rice and transfer the mixture from the mouth to another test tube, using a cotton bud. Label it as test tube B. Now, put 2–3 drops of iodine solution in both the test tubes. Observe what happens.

Observation: You will observe that the chewed rice, in test tube B, turned blue-black in colour.

FactAce

7E Explore

Tooth enamel is very hard and resistant to decay. That is why teeth are selectively preserved after death. Teeth of ancient humans have provided most useful information for studying the process of evolution.

Stomach

After the food is chewed and swallowed, a muscular, tube-like structure gently pushes the food towards the stomach. Its contractions, known as **peristalsis**, help to deliver the food to

evolution: a process in which something passes by degrees to a different stage

Tip for the Teacher The students can be told that teeth are made up of enamel, which is the white part of tooth, and is the hardest substance in the body.

Checkpoint 1

Assessment for Learning

7E Evaluate

Fill in the blanks.

1. A _____ has a long tube-like structure called proboscis.
2. _____ catches its food with the help of tentacles.
3. Amoeba develops long cup-like structures called _____ to catch its prey.
4. The process of taking in food is called _____.
5. _____ catches its food by cilia.

HUMAN DIGESTIVE SYSTEM

ANM

Like animals, humans also eat and digest their food through a process. The human digestive system helps to convert the food into nutrients, which are then used by the body for energy, growth and repair. The human digestive system is a complex network comprising several organs, including the mouth (or buccal cavity), oesophagus (food pipe), stomach, small intestine, large intestine, rectum, and anus. This system is also known as the alimentary canal or digestive tract. Let us study about these different parts in the human body which help in the process of digestion.

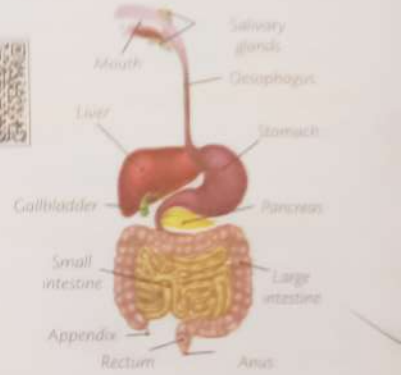


Fig. 2.7 The human digestive system

Mouth

The process of digestion starts in the mouth. The food is ingested through the mouth and the digestion begins as we start chewing it. Teeth help in breaking the food into small pieces which can be easily swallowed and digested. The saliva from the mouth contains enzymes, that break down the food into simpler substances. *The process of mixing of saliva with the food pieces is called* ***mastication.*** The saliva breaks the starch into simpler sugar compounds which is the first step of digestion.

Fig. 2.8 Set of human teeth

Teeth

Human beings need teeth to chew their food before it reaches the stomach. Human beings have four kinds of teeth—incisors, canines, molars and premolars. Each tooth is made up of a crown and some roots embedded in the gums. Only the crown remains visible in the mouth. *The first set of teeth (approximately 20 teeth) in human beings are known as* ***milk teeth.***

Nutrition in *Hydra*

Hydra is a multicellular organism that engulfs its food using the finger-like projections called **tentacles**, present around its mouth. During feeding, *Hydra* extends its body and tentacles to the maximum length (around 4–5 times of the length of the body) and catches the prey. The prey gets killed and is passed into the mouth. The digestive juices inside the body help in absorption of the digested food by the cavity walls. The food is then assimilated inside the cells.

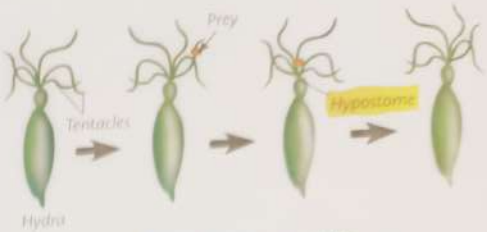


Fig. 2.3 Nutrition in *Hydra*

Nutrition in Frog

Frogs catch insects with the help of their sticky tongue. Their tongue is attached to the lower jaw and remains folded in the mouth. As soon as a prey comes near, the frog uses its tongue to catch it and then pulls it inside the mouth. This whole process takes place very quickly. Frogs have a well-developed digestive system which then helps to digest the prey with the help of digestive juices.

Nutrition in Other Organisms

A spider weaves a web in which the insects or preys get trapped. The spider digests the entangled insects by secreting digestive juices and ingesting them in the body of the prey.

Paramecium captures its food with the help of finger-like structures, called **cilia**, that are developed on their body.

A butterfly sucks the nectar from the flowers by using a tube-like structure, called **proboscis**, attached to its mouth. A mosquito also uses its proboscis to suck up the blood of animals and humans.

FactAce

Mosquitoes and butterflies live on liquid food only.


Fig. 2.4 Frog catching an insect

Fig. 2.5 *Paramecium*


Fig. 2.6 Mosquito sucking blood

Activity 1 7E Explore

Get up early on a Sunday morning and take a walk in a garden. Observe the various insects or animals such as butterfly, dog, lizard and grasshopper, that you may see in the garden. Watch how they eat their food. Note down your observations.

hypostome: a mouth part in some organisms, such as *Hydra*

You must have observed animals, such as cows and goats, swallowing food and then chewing it by bringing it back to the mouth. This partially digested food is called **cud**, and the animals are also known as **cud-chewing animals**. *The cud-chewing hoofed mammals, having a stomach divided into four (occasionally three) compartments, are called* ***ruminants****, and the process by which they take their nutrition is called* ***rumination***. These animals can digest cellulose as they have cellulose-digesting bacteria present in their gut.

FactAce

Some ruminants, like camels, have three stomach chambers instead of four.

Ruminants have a complicated digestive system characterised by the presence of four chambers—**rumen**, **reticulum**, **omasum** and **abomasum**.

The food is first swallowed and stored in the first chamber called the rumen. The food gets partially digested in the rumen and is called **cud**. The cud is then transferred to the second chamber, the reticulum. From reticulum, the cud returns to the mouth of the animal and then is thoroughly chewed.

Scientific Proficiency: Adaptive reasoning

HOTS

Grass is very rich in cellulose. Can human beings digest grass/cellulose?

Once the food is chewed, it gets swallowed for the second time and moves to the third chamber, called omasum, where water is absorbed from the partially digested food. The food from omasum is then pushed into the fourth chamber, abomasum, where the food is acted upon by the digestive juices. It is also called **true stomach**. The food is then passed into the small intestine where the final absorption of food takes place and the process of digestion ends. The wastes are finally egested.

Keywords

SVID

Ingestion: The process of taking in food
Digestion: The process of breaking of complex food particles into simple ones by action of enzymes, saliva, etc
Absorption: The process of transferring soluble nutrients from food into the body's fluids
Assimilation: The process where absorbed nutrients are used by the body for various functions
Bile: Dark green to yellowish-brown watery liquid produced by the liver
Ruminants: Cud-chewing hoofed mammals that have a four-chambered stomach to digest food by microbial actions
Cud: Partially digested food from the stomach of a ruminant that returns to the mouth to be chewed again

Assimilation

The food and the nutrients that are absorbed in the blood are transported to other parts of the body through the process called ***assimilation***. The glucose is broken down into carbon dioxide and water in the presence of oxygen in the cells to provide energy. Fatty acids and glycerol get accumulated under the skin and act as energy reservoirs of the body.

Egestion

The undigested food from the small intestine is passed to the long muscular tube called the **large intestine**. The food by now is in the semi-solid state. The process of digestion stops here. Large intestine absorbs water and other necessary nutrients from the undigested food and pushes it to the rectum. The waste is stored in the rectum in the form of faeces and is excreted out of the body through the anus. This process is called **egestion**.

Checkpoint 2

Assessment for Learning

7E Evaluate

INT

State whether the following statements are True or False.

1. The process of digestion begins in the mouth. — True
2. Assimilation of food takes place in the rectum. — True
3. The villi in small intestine help in the absorption of nutrients. — True
4. There are 6 premolars and 4 molars in each jaw. — false
5. The process of mixing of saliva with the food is called peristalsis. — True

NUTRITION IN RUMINANTS

Animals such as cows, goats, deer, buffaloes and giraffes are called **ruminants**.

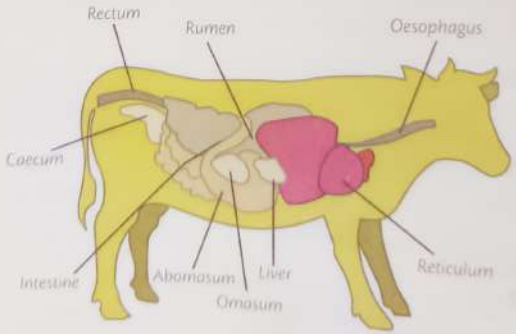


Fig. 2.12 Digestive system of a cow

the **stomach**. It has a flap known as **valve** which avoids backward movement of the food into the oesophagus.

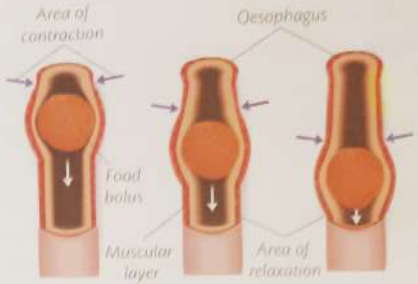


Fig. 2.10 Peristalsis

The stomach is a J-shaped, bag-like organ which acts as a mixer and grinder. The food that we eat stays there from a few minutes to a few hours depending upon the type of food that we eat. The stomach walls secrete hydrochloric acid, mucous, digestive juices having many enzymes which carry out the process of breaking down of the food. The hydrochloric acid kills the bacteria which enters along with the food and helps in the digestion of proteins present in the food. The mucous protects the inner lining and the digestive juices break the proteins into simpler substances, resulting in the partial digestion of food.

Absorption of Food

From the stomach, the partially digested food gradually moves into the small intestine.

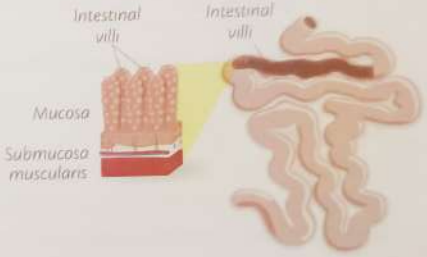


Fig. 2.11 Villi in small intestine

The small intestine is an approximately 20–25 feet long winding tube which is loosely coiled in the abdomen. The muscles of the small intestine mix the food with the digestive juices and secrete some juices of their own which help in further digestion. The liver, which is the largest gland, releases **bile**, and the pancreas releases enzymes which also help in the digestion of food. Bile is stored in the **gallbladder** and breaks the fats into simpler compounds which are easier to be absorbed by the body. The **pancreas** secretes **pancreatic juice** that aids in digestion of proteins called **amino acids**. Gallbladder is a pear-shaped, small-sized organ. It is located near the liver. It helps to store bile secreted by the liver.

Once the food is digested, it is then absorbed by thousands of small finger-like projections in the inner walls of the small intestine, called **villi**. These villi absorb the nutrients from the food and pass them into the blood capillaries.

Get it Right! 7E Elaborate

Bile is not a blue fluid. It is produced by the liver and is a dark green to yellowish-brown fluid. It helps in the digestion of lipids in the small intestine.

FactAce 7E Extend

Digestion involves digestive enzymes such as amylase, pepsin and trypsin. Amylase breaks down starch to sugar; pepsin and trypsin break down proteins into peptides; lipase breaks down fat, etc.

lipid: a type of fatty acid

6. There are 8 molars in the human mouth.
F. 6 molars

7. The food gets pushed down in the oesophagus through the process called peristalsis.
True

8. Egestion takes place through large intestine.
False.

C. Unscramble the letters to find the answers.

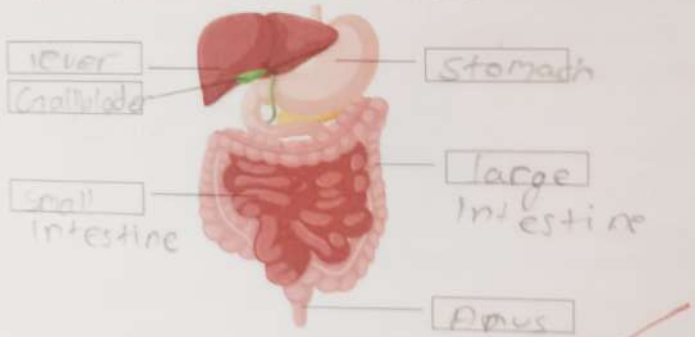
1. Bag-like structure in digestive system (MAOSTCH) STOMACH
2. White-coloured structures found in the mouth cavity (ETTHE) Theth
3. Dark green to yellowish-brown, watery fluid produced by liver (EIBL) BILE
4. Storage chamber for undigested food and body wastes (TCERUM) Rectum
5. The first chamber of the ruminant's digestive system (RNMUE) RUMENE
6. The organ which secretes pancreatic juices. (SAPNRCEA) PANCREYA

D. Fill in the blanks.

1. Holozoic nutrition is the process by which an animal obtains food for its growth and maintenance.
2. blood Assimilation fulfils oxygen and nutrients supply in the living organisms.
3. Digestion is the process of breaking down of complex substances into simpler substances.
4. *Amoeba* forms some arm-like structures known as pseudopodium
5. Tentacles are found in Hydra.
6. The process of absorption of food by the body is called absorption
7. The cud is stored in the rumen chamber until it returns to the mouth.
8. The absorption of food in ruminants occurs in abomasum / small intestine

E. Observe and Infer.

Label the given image. Also, answer the question that follows.



Which organ is responsible for mixing and churning food with gastric juices?
Stomach

2. Which of these processes is not involved in nutrition?

a. Egestion ☐ b. Circulation ☑

c. Digestion ☐ d. Assimilation ☐

3. Which of the following is a pear-shaped organ?

a. Gallbladder ☐ b. Rectum ☐

c. Pancreas ☑ d. Stomach ☐

4. Which organ is responsible for the secretion of bile?

a. Small intestine ☐ b. Pancreas ☐

c. Gallbladder ☐ d. Liver ☑

5. In which of the following organs (of human beings), does the assimilation of food occurs?

a. Small intestine ☑ b. Large intestine ☐

c. Gallbladder ☐ d. Stomach ☐

6. The front teeth in humans are called:

a. molars ☐ b. incisors ☐

c. premolars ☐ d. canines ☐

7. The process through which the food is taken in is called:

a. digestion ☐ b. absorption ☐

c. egestion ☐ d. ingestion ☑

8. A bag-like structure in *Amoeba* in which the food is digested:

a. vacuole ☑ b. gallbladder ☐

c. intestine ☐ d. stomach ☐

INT

B. State whether the following statements are True or False. Correct the false statements.

1. *Amoeba* is a multicellular organism.

F. Unicellular organisms

2. Oesophagus is a J-like structure in the human digestive system.

F. Food pipe

3. Anus is the last part of the digestive system.

True

Write Complete Sentence

4. Enzymes secreted by pancreas help to break down protein, fat and carbohydrate molecules existing in the food we eat.

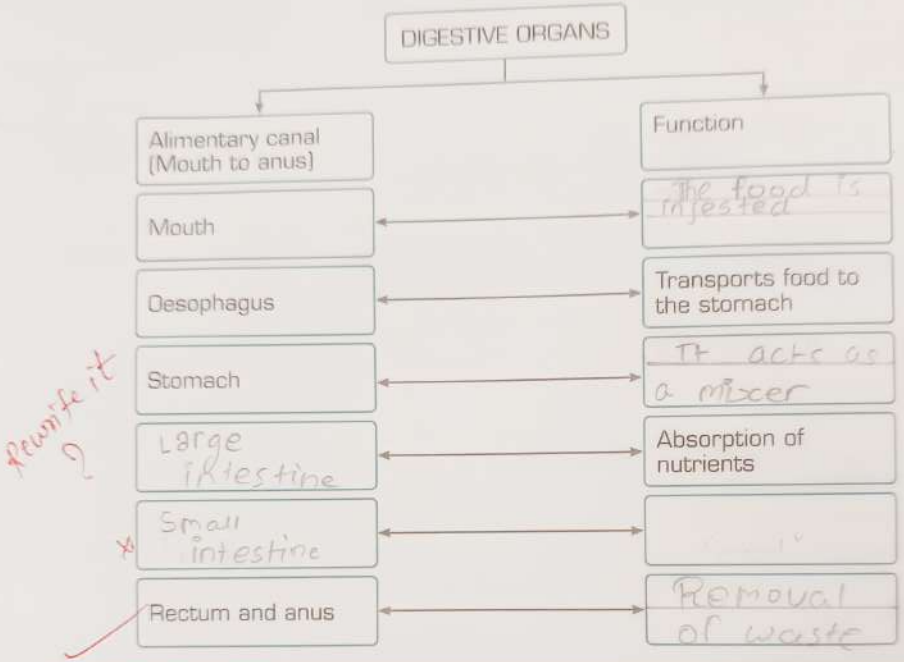
True

5. Saliva is secreted by gallbladder.

F. Salitents

Now I Know

Let us now summarise the key concepts of this chapter by completing the concept map given below.



What I Have Learnt

7E Evaluate

INT

I. Assessment for Learning

A. Tick (✓) the correct answer.

1. Which of the following is not a ruminant?

   a. Cow ☐ b. Deer ☐

   c. Giraffe ☐ d. *Amoeba* ☑

moves from the system to its surroundings or vice versa. The SI unit for heat is the joule (J), and the calorie is a non-SI unit. If we put warm and cool objects together, heat is transferred from the warm object to the cool object until both the objects have the same temperature. This stage is known as **equilibrium stage**. The hotness or coldness of a body is measured in **temperature**. The hotter an object is, the higher is its temperature. Temperature is mostly measured in degree Celsius (°C).

Effects of Heat

What happens to vegetables when you boil them in water? What happens when you iron your clothes with a hot electrical iron?

When things are heated, changes such as an increase in temperature, change of state and a chemical change happen. Let us take one example of each type.

FactAce 7E Extend

Are heat and energy different or the same concepts? Heat is a form of energy that can be transferred from one place to another.

- When we boil milk, it remains normal for some time. However, after some time, the temperature of the milk increases and reaches the boiling point.
- As a result, the milk starts to boil. This shows that heat increases the temperature of a substance.
- Heat causes change in the state of matter. For example, when butter is heated, it melts. Similarly, when liquid water is heated, it changes to vapour (gas).
- Is the burning of wood into charcoal a physical or chemical change? Burning of wood is a chemical change as new substances like carbon dioxide, water vapour, etc. are formed, which cannot be changed back to their previous state of matter.
- Hence, sometimes heating brings about permanent chemical changes.

EXPANSION IN MATTER

Another important effect of heat is that it results in **expansion** of different substances. Heating a substance causes its molecules to move. The greater the heat, the faster is the movement of the particles. The particles move away from each other and thus result in the expansion of substances.

The expansion of substances as an effect of heat is called **thermal expansion**. This property is applied while making railway tracks. Railway tracks are made of metals like steel, which expand when heated. The gaps thus give them space to expand and prevent any accident.

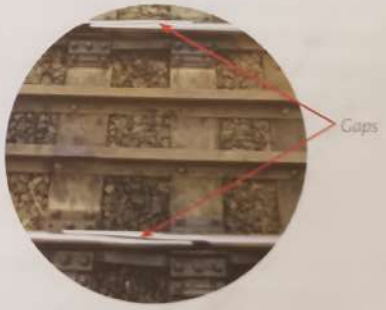


Fig. 3.1 Gaps in railway tracks

Why do you think glass breaks when you pour hot water in it? 7E Elicit

3 Heat and Temperature

Learning Objectives

After completing this chapter, I will be able to:

- recall the definition of heat.
- learn how heat is transferred through various ways.
- describe the various types of temperature scales.
- compare the various types of temperature scales.
- solve numerical problems based on temperature scales.

What I Know

7E Engage

Fill in the blanks.

1. Ice cream melts faster in .....
2. We wear thick woollen clothes in ..... weather.
3. Water in a swimming pool feels ..... on a chilly morning.
4. Soup is usually served ..... in restaurants.
5. The ..... of a refrigerator is colder than the ..... temperature.

We wear woollen clothes during the winter season and prefer to eat hot food and drinks. The Sun is the only natural source of heat and light. Why do we need heat?

WHAT IS HEAT?

Count Rumford and James Prescott Joule performed various experiments and explained that **heat** is a form of energy. We often describe different substances as hot or cold. Hot and cold are relative terms. It means that something is considered as hot when it is compared to something which is colder. *Heat is a form of energy that spontaneously*

Tip for the Teacher The following question can be asked—when water is stirred vigorously in a mixer, it becomes warm. Which form of energy is it? Also, SI and CGS units can be explained to students.

II. Assessment of Learning

Answer the following questions.

A. Short Answer Questions.

1. What is the difference between absorption and assimilation?
2. How does *Hydra* capture its food?
3. How does *Amoeba* ingest the food?
4. How does a frog capture its prey?
5. How many types of teeth are there in humans?
6. Name the processes involved in the digestion of food in humans.
7. What is the role of pharynx in the digestive system?
8. What is rumination?

B. Long Answer Questions.

1. How is nutrition carried out in *Hydra* and frog?
2. Draw a well-labelled diagram to depict nutrition in *Amoeba*.
3. Write the role of the small intestine in the human digestive system.
4. What happens to the undigested food in the human body?
5. Write about the role of stomach in the human digestive system.
6. Explain the digestive system in the ruminants with a well-labelled diagram.

Enrichment Corner

HOTS

Scientific Proficiency — Adaptive reasoning

A. Which type of carbohydrate can be digested by ruminants but not by humans? Explain the reason.

B. Is it possible for human beings to survive only on leafy vegetables and fruits? Justify the answer.

C. How do lizards and snakes trap their prey?

D. How is food obtained by a mosquito?

E. Do villi increase or decrease the surface area for absorption of food? What do villi contain—tissue or blood vessel?

F. Does *Amoeba* have an anus?

G. Where is the caecum located in the body of ruminants?

H. How do grass-eating animals digest cellulose?

Applications of Convection

It is on the basis of this property of heat transfer that:

- room heaters are placed on the floor.
- air conditioners are fitted near the ceiling of the room.
- exhaust fans are installed on the top window or near the ceiling of the kitchen.

Sea Breeze and Land Breeze

Convection can also be explained as a natural phenomenon that helps in maintaining a moderate temperature in the coastal regions. Land on the beach heats up faster than the sea during the day and cools down faster at night. This difference sets up a wind pattern, that is, during the day, the warm air above the land rises and is replaced by the cooler air from the sea. This is known as the **sea breeze.** At night, the warm air above the sea rises and the cooler air from the land takes its place. This is called the **land breeze**. Thus, an average temperature is maintained throughout the day on land.

(Arrows show direction of transfer of heat)

Fig. 3.2 Sea and land breeze

(***Note***: In Fig. 3.2, blue arrows represent cold air, while red arrows represent hot air.)

Radiation

We have seen that the conduction and convection of heat takes place in different mediums by the movement of molecules in them. Transfer of heat through radiation does not need a medium. Like light energy, heat energy can travel in waves called **electromagnetic waves**. Heat from the Sun reaches us through the process of radiation. In winter, you feel warm when you sit near a fire or room heater as heat from these sources reaches us through radiation. *The heat or energy that is transferred from one medium (source) to the other (receiver) is called* ***radiant heat***. All the objects radiate heat to their surroundings and receive heat from their surroundings. It is the fastest mode of transfer of heat.

Different objects absorb different amounts of radiant heat. The amount of radiant heat absorbed by a body depends on different factors. The colour of an object is one of the important factors. Dark colours such as black absorb more heat than light colours such as white. It is because of this fact that we are recommended to wear white and light-coloured clothes in summer and black or dark-coloured clothes in winter.

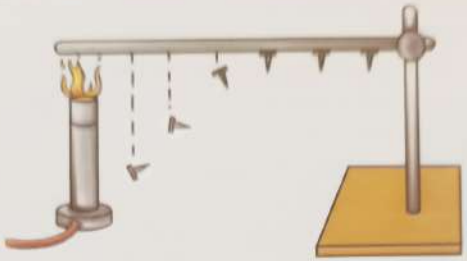
Activity 1

7E Explore ANM

Aim: To observe heat transfer in solids

Procedure: Fix 5–6 nails on a metal rod, in a line, with the help of wax.
Now, fix one end of the metal rod on a clamp stand and the other end on flame of a burner. Observe what happens to the nails. You will observe that the nails start falling one by one from the hotter end (end towards the burner flame).

Conclusion: This shows that heat transfers from hotter end to colder end in solids.



Conductors and Insulators

Substances that conduct heat are called **conductors** (for example, metals), while substances like wood, straw, clay, rubber, glass and plastic do not conduct heat very well and are called **insulators**. Air, water, wool, fur and bird feathers are some other examples of insulators.

Convection

Convection is the process by which heat is transferred in fluids (liquids and gases) through the movement of particles. In this process, the warmer particles move to cooler areas, while cooler particles move to warmer areas, creating convection currents that distribute heat throughout the fluid. A.4

Activity 2

Scientific Proficiency Procedural fluency

Aim: To observe convection in liquids

Fill a beaker with water and put on a tripod stand above a burner.

Do not light the burner.

Now, drop a few crystals of potassium permanganate in the beaker in a way that they fall close to one side of the beaker.

Observation: Now, light the burner and heat the beaker just under where the crystals have fallen.

The colour from the crystals start rising up to the top and then fall down to the other side of the beaker.

Conclusion: This shows that heat from the base of the water got transferred to the upper level as is evident from the movement of the colour from potassium permanganate crystals in the beaker.

Thermal expansion can be seen in different states of matter.

Solids	When a solid material like metal is heated, its particles move rapidly within their fixed positions and expansion takes place.
Liquids	Particles of liquids also expand on heating. Liquid mercury is filled in the thermometer based on this property. It expands and then contracts as per the temperature.
Gases	Gases also expand on heating. For example, when air is filled into a balloon, it expands.

Do all substances expand on heating? Is there any substance which contracts on heating?

TRANSFER OF HEAT

We know that heat is a form of energy that can be transferred from one medium to the other. Transfer of heat can take place through three ways—conduction, convection and radiation.

Get it Right! 7E Elaborate

Asbestos sheets are always preferred over iron sheets for roofing because asbestos is a poor conductor of heat.

Conduction

IVID

Conduction *is the process of transfer of heat from the hotter part of a body to the colder part through passage of energy from particle to particle without actual displacement of the particles.*

We know that matter is made up of tiny particles. In case of solids, particles are very tightly packed and cannot move around freely. However, they can vibrate about a fixed point. Conduction of heat energy can occur within a body or between two bodies when they are in contact with each other. However, the rate of conduction of heat is different in different materials. Some materials allow energy to flow easily while others do not.

Conduction of heat takes place when:

- the interacting objects are solid.
- the objects are in physical contact with each other.
- there is a temperature difference between the objects. Conduction cannot take place when the objects are at the same temperature.

HOTS Scientific Proficiency Adaptive reasoning

When the objects are at the same temperature, conduction of heat does not take place. Why?

Fahrenheit Temperature Scale

Fahrenheit temperature scale was invented by Daniel Gabriel Fahrenheit in 1714. It is denoted by °F. Fahrenheit thermometer has 180 equal parts. Freezing point of water is depicted as 32 °F and the boiling point of water as 212 °F on it. The difference between the two extreme points is divided into 180 degrees.

INTERCONVERSION BETWEEN THE SCALES

The temperature values obtained on different scales can be interconverted.

The expression which is used to convert Fahrenheit (F) scale to its Celsius (C) scale is:

$$C = \frac{5}{9}(F - 32)$$

The expression which is used to convert Celsius (C) scale to its Fahrenheit (F) scale is:

$$F = (\frac{9}{5} C) + 32$$

Numericals Based on Temperature Scale

Numerical 1: The temperature of hot water is measured to be 80 °C. How much will this temperature be in °F?

Solution: $F = (\frac{9}{5} C) + 32 = (\frac{9}{5} \times 80) + 32 = (9 \times 16) + 32 = 144 + 32 = 176$ °F

$\therefore$ 80 °C = 176 °F

Numerical 2: Convert 85 °F into ℃.

Solution: Formula to convert Fahrenheit (F) scale to Celsius (℃) scale is

$$C = \frac{5}{9}(F - 32) = \frac{5}{9}(85 - 32) = \frac{5}{9}(53) = 29.4$$

$\therefore$ 85 °F = 29.4 °C

TYPES OF THERMOMETERS

Different kinds of thermometers, such as laboratory, clinical, mercury, alcohol and digital thermometers, are commonly used today.

Laboratory Thermometer

A laboratory thermometer is used in the laboratories to measure temperature changes while performing different experiments. These thermometers can be used to measure high temperatures of liquids such as boiling water. The range of a laboratory thermometer is from –10 °C to 110 °C.

Fig. 3.5 A laboratory thermometer

Activity 4

Scientific Proficiency | Procedural fluency

Aim: To prove that hotness and coldness are relative terms

Procedure: Take 3 bowls and label them as A, B and C. Take warm water in bowl A, ice-cold water in bowl B and normal water in bowl C. Dip your right hand in bowl A and left hand in bowl B for about 2 minutes. Now, put both of your hands in bowl C.

Observation: You will observe that your right hand feels cold and left hand feels warm in the water in bowl C.

Conclusion: This shows that hotness and coldness are relative terms.

MEASURING TEMPERATURE

Activity 4 shows that the sense of touch is not an accurate way to measure temperature. Therefore, we need standard tools to measure temperature. Various devices are used to measure temperature of an object, such as thermometer, thermocouple, thermistors, Resistance Temperature Detector (RTD) and pyrometer. Thermometer is the device used to measure temperature by means of a substance (a liquid or a gas) filled in a graduated tube.

Temperature Scale

There are various types of scales to measure temperature. Two reference temperatures are chosen, mostly the melting point of pure ice and the boiling point of pure water, and the difference between these two temperatures is further broken down into a certain number of divisions called *degrees*. Based on this, we have three temperature scales—Celsius, Fahrenheit and Kelvin.

Celsius Temperature Scale

Celsius temperature scale was invented by the Swedish astronomer Anders Celsius (in 1742). It is denoted by °C. The melting point of pure ice is taken as 0 °C and the boiling point of pure water is 100 °C. Celsius thermometer has 100 equal parts. The difference between the two extreme points is 100 degrees.

Kelvin Temperature Scale

Kelvin thermometer scale was invented by Lord Kelvin in 1848. It is denoted by K. Kelvin thermometer has 100 equal parts. The expression which is used to convert Celsius (°C) scale to its Kelvin (K) scale is [K] = [°C] + 273.15.

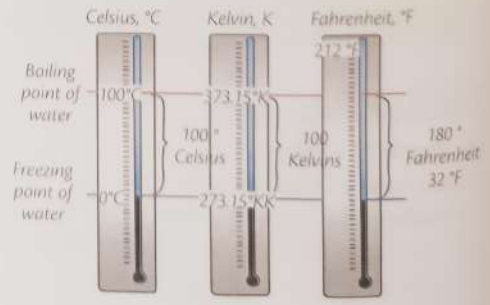


Fig. 3.4 Celsius, Kelvin and Fahrenheit scales

Tip for the Teacher The following terms—thermocouple, thermistors, Resistance Temperature Detector (RTD) and pyrometer—can be briefly explained to students.

Activity 3

Scientific Proficiency — Procedural fluency

Aim: To observe that dark colours absorb more heat

Procedure: Take two cans of the same size. Paint one can black and the other white. Fill equal amounts of water in each can and keep them out in the Sun for a day. Measure the temperature of water in each can using a thermometer.

Observation and Conclusion: You will observe that the temperature of water in the black can is higher than the water in the white can. This shows that dark colour absorbs more heat.

Applications of Radiation

Heat radiation also reflect like the light rays. This is why our room heaters have mirrors behind the heating coil, as they reflect the heat radiated by the coil to the front. A black metal sheet is fitted on a solar panel to maximise the heat absorption.

A thermos flask is designed to minimise heat loss through all the three modes of heat transfer. Insulating materials like plastic is used and vacuum is created to minimise conduction. Creation of vacuum reduces convection, and a highly reflective surface of the flask minimises radiation and the heat radiation are reflected back into the jar.

Fig. 3.3 A thermos flask

Checkpoint 1

Assessment for Learning — 7E Evaluate

Fill in the blanks.

1. The SI unit of heat is ..... .
2. The expansion of objects due to heat is called ..... .
3. The transfer of heat in solids is due to ..... .
4. ..... colours absorb more heat.
5. The transfer of heat in fluids takes place by ..... .

TEMPERATURE

The degree of 'hotness' or 'coldness' of a body or a place is called ***temperature***. One of the crudest ways of measuring this sensation is by our sense of touch, but it can sometimes be misleading. The terms 'hot' and 'cold' are relative terms, that is, a reference body is required with respect to which an object can be termed as hot or cold. Thus, we need an instrument to be accurate in measuring temperature.

What I Have Learnt

INT

I. Assessment for Learning

A. Tick (✓) the correct answer.

1. Which of the following thermometers is divided into 100 equal parts?
   a. Celsius and Fahrenheit ☐
   b. Fahrenheit and Kelvin ☐
   c. Kelvin and Celsius ☐
   d. Only Fahrenheit ☐
2. The boiling point of water is:
   a. 100 °C ☐ b. 90 °C ☐
   c. 95 °C ☐ d. 25 °C ☐
3. Which of the following expressions is used to convert Fahrenheit scale to Celsius scale?
   a. $C = \frac{5}{9}(F - 30)$ ☐ b. $C = \frac{5}{9}(F - 32)$ ☐
   c. $C = \frac{5}{9}(F - 31)$ ☐ d. $C = \frac{5}{9}(F - 33)$ ☐
4. Which of these changes is observed on heating?
   a. Change of state ☐ b. Chemical change ☐
   c. Expansion ☐ d. All of these ☐
5. Which of these involves the transfer of heat from one medium to another by the movement of fluids?
   a. Conduction ☐ b. Radiation ☐
   c. Convection ☐ d. Diffusion ☐

B. State whether the following statements are True or False. Correct the false statements.

INT

1. Mercury expands for a wide range of temperatures.
2. Conduction is the emission or transmission of energy (as waves or particles) through a travel medium.
3. C = 9/5 (F – 32)
4. Celsius temperature scale was invented by Daniel Gabriel Fahrenheit.

Checkpoint 2

Assessment for Learning

Identify the following.

1. It is used to measure body temperature. _____
2. It is used to measure temperature while performing experiments. _____
3. He discovered the Fahrenheit scale. _____
4. The measure of hotness or coldness of a body. _____
5. This thermometer consists of a thermistor. _____

Keywords

SVID

Heat: A form of energy that spontaneously moves from the system to its surroundings, and vice versa

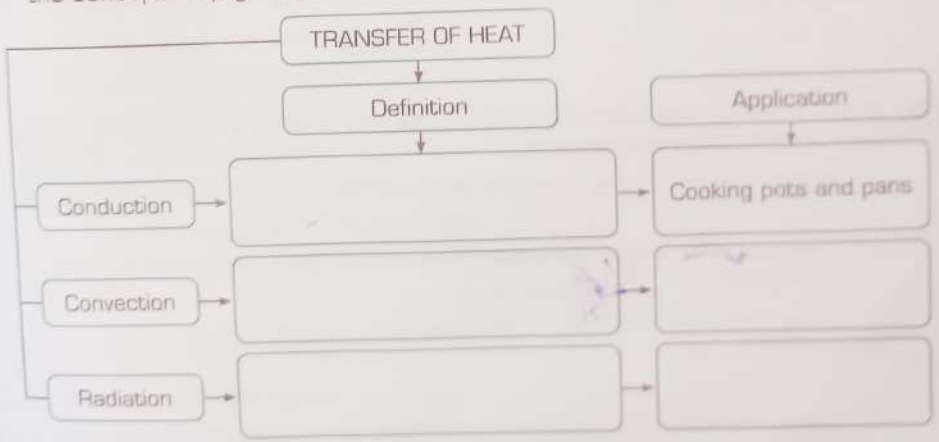
Temperature: The degree or intensity of hotness or coldness of a body or environment

Conduction: Direct transmission of heat, electricity or sound through a substance

Convection: The movement caused within a fluid (liquid or gas) due to the transfer of heat.

Now I Know

Let us now summarise the key concepts of this chapter by completing the concept map given below.



The laboratory thermometer is a long glass tube containing mercury in its bulb. As it is dipped in a hot object, the mercury from the bulb rises up the tube.

While reading a thermometer, some precautions must be taken.

- Ensure the thermometer is thoroughly cleaned before use.
- Never hold the thermometer from its tip.
- Hold the thermometer straight in the liquid and do not tilt it.
- While reading, the thermometer should be placed at the eye level.

Clinical Thermometer

A clinical thermometer is a small-sized medical thermometer with finely standardised range to check the temperature of the patient (during fever). It consists of a long glass tube filled with mercury at one end.

The normal human body temperature is 37 °C; it can fluctuate between 35 °C to 42 °C. Hence, the clinical thermometers have the range 35 °C to 42 °C. On the Fahrenheit scale, the values range from 94 °F to 108 °F.

Fig. 3.6 A clinical thermometer

Mercury Thermometer

Mercury is used in the thermometers as it is a metal that remains liquid at wide ranges of temperatures. It melts at −38.87 °C and boils only at 356.58 °C. It is easy to see mercury due to its silver-grey colour and has a good rate of expansion for wide range of temperatures.

Alcohol Thermometer

Alcohol is cheaper and less harmful than mercury and can measure up to −115 °C. But it cannot exceed 78 °C, and therefore has a disadvantage.

Digital Thermometer

These days, body temperature is measured using digital thermometers. Instead of mercury, they consist of a 'thermistor' and another small device, which measures the body temperature and displays it on the liquid crystal display (LCD) in digits. The digits indicate the temperature of the body.

Fig. 3.7 A digital thermometer

3. Explain expansion in solids, liquids and gases by giving one example each.
4. Convert the following:
   - 120 °F into °C
   - 150 °C into °F
5. Give any five examples showing heat changes in your surroundings.
6. Describe how heat is transferred in liquids with the help of an activity. What is the process called?
7. Write an activity to show conduction.
8. Describe how heat causes expansion. Give examples.
9. Make a concept map on the 'Types of thermometers'.

Enrichment Corner

HOTS

Scientific Proficiency

E Evaluate

) through

C. Unscramble the letters to find the answers.

INT

1. A form of energy that can be transferred from one place to another (AEHT)
2. A small-sized medical thermometer (NILCACLI)
3. The unit used to measure temperature based upon an absolute scale (NELIKV)
4. The Swedish astronomer who invented the Celsius scale (DNSARE)
5. This thermometer has 180 equal parts (EHRENAFHTI)

D. Define the following.

1. Heat
2. Temperature
3. Convection
4. Insulator
5. Radiation

E. Observe and Infer.

Look at the given pictures and identify the primary method of heat transfer involved (conduction, convection, or radiation).

1. 
Warming your hands by the campfire

2. 
A metal spoon getting hot in a cup of tea

3. 
Heat from the Sun warming the Earth

II. Assessment of Learning

Answer the following questions.

A. Short Answer Questions.

1. What is 100 °C marked on the Fahrenheit scale?
2. At what temperature does the Celsius scale show equal value as the Fahrenheit scale?
3. Draw a well-labelled diagram of a Celsius scale.
4. What do you understand by convection?
5. Who were the inventors of Fahrenheit and Kelvin scale?
6. Why can't we measure heat by touching an object?
7. Which property of a solid is employed when it is used for making the handle of a pressure cooker?

B. Long Answer Questions.

1. Describe the various types of temperature scales.
2. What are the ways to transfer heat?

What I Have Learnt

INT

I. Assessment for Learning

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   a. Change of state ☐ b. Chemical change ☐
   c. Expansion ☐ d. All of these ☐

5. Which of these involves the transfer of heat from one medium to another by the movement of fluids?
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   c. Convection ☐ d. Diffusion ☐

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