Wizz World of SCIENCE

GRADE 5



Aligned with Single National Curriculum

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PREFACE

Wizz World of Science for grades I to 7 has been conceptualized, penned, composed and designed by professionals and educators who have vast experience of dealing with subject of science in the past. Our books lie well within the frameworks defined by National Curriculum. The newly introduced National Assessment Framework (NAF), that is now an integral part of National Curriculum Framework (NCF) has been particularly incorporated in Wizz World of Science Series to make sure that basic purpose of this initiative regarding policy and practice level to improve quality of education is actually met. The quality of education has been further made sure with holistic and cognitive approach that identifies specific areas of learning and development that a today's student requires. The series:

- Guides students in a very simple way how to solve the cognitive tasks by creating a comfortable zone.
- Encourages students to practice and apply concepts.
- Involves students in interactive exercise and activities.
- Help students to create a natural space for thinking through well-planned activities.

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- Available at economical prices keeping in view the recent economic melt down domestically.
- Based on well-planned activities and systematically developed exercises.
- Helpful for students to develop the 21st century life skills for a bright future.

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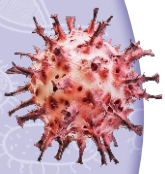
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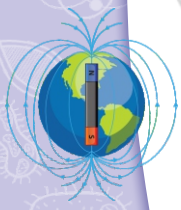
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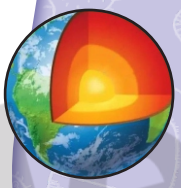
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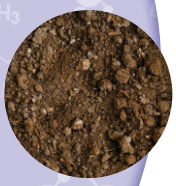
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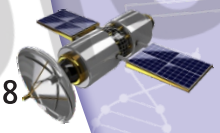
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UNIT 1

Structure and Function Of Human Body Systems

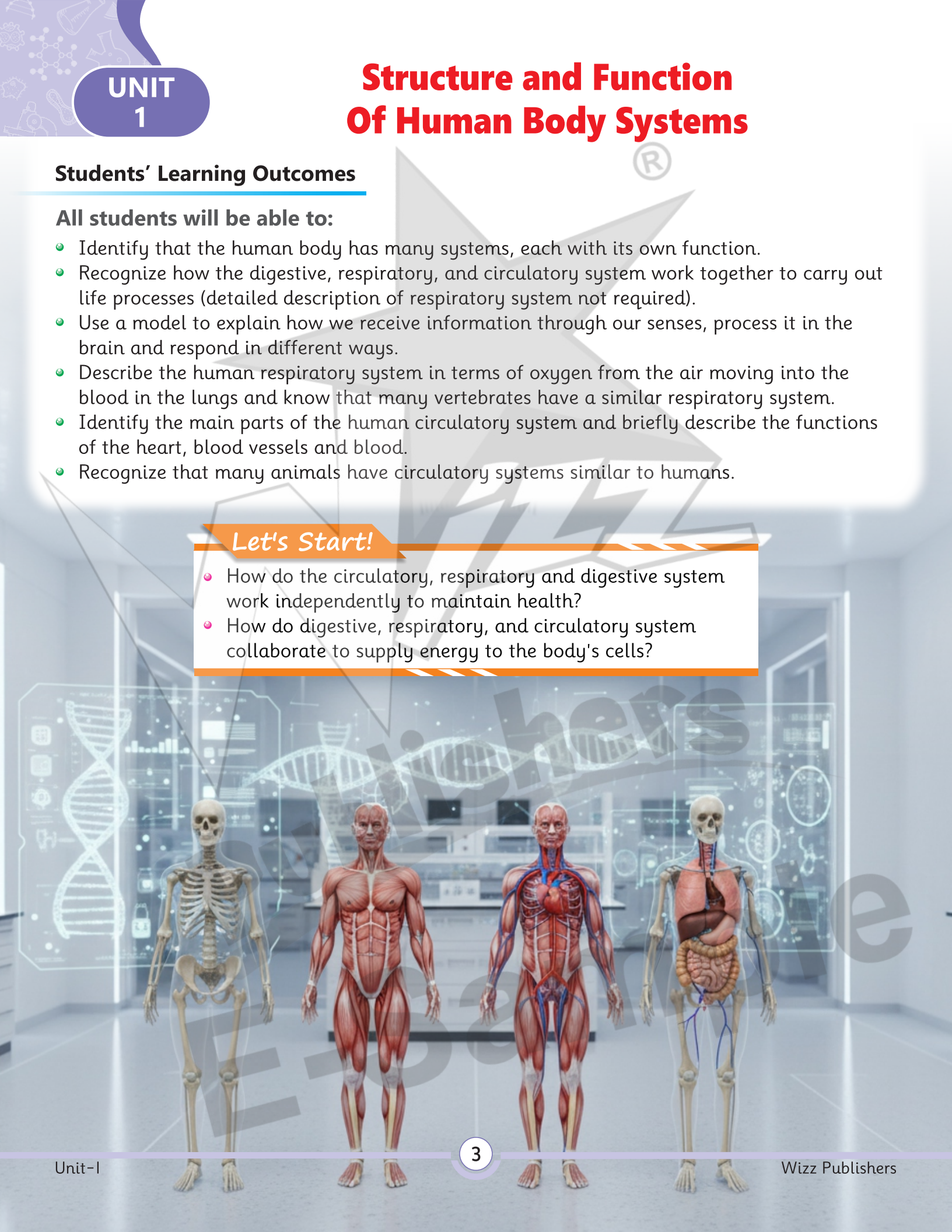
Students' Learning Outcomes

All students will be able to:

- Identify that the human body has many systems, each with its own function.
- Recognize how the digestive, respiratory, and circulatory system work together to carry out life processes (detailed description of respiratory system not required).
- Use a model to explain how we receive information through our senses, process it in the brain and respond in different ways.
- Describe the human respiratory system in terms of oxygen from the air moving into the blood in the lungs and know that many vertebrates have a similar respiratory system.
- Identify the main parts of the human circulatory system and briefly describe the functions of the heart, blood vessels and blood.
- Recognize that many animals have circulatory systems similar to humans.

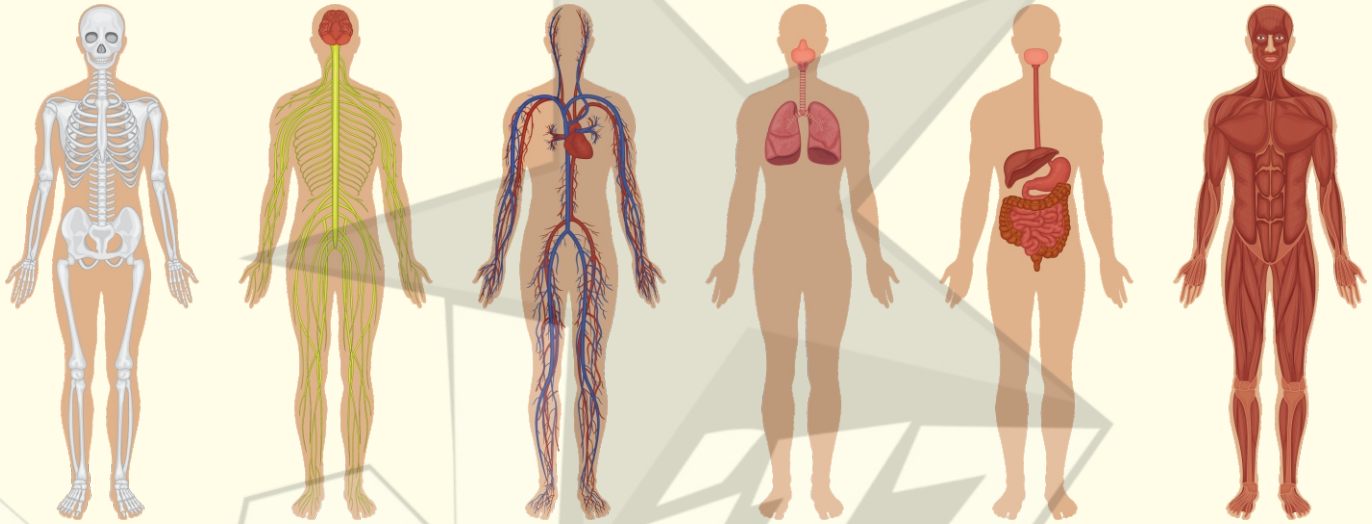
Let's Start!

- How do the circulatory, respiratory and digestive system work independently to maintain health?
- How do digestive, respiratory, and circulatory system collaborate to supply energy to the body's cells?



Can you identify the following systems of human body using the word bank?

Respiratory system, Skeletal system, Musculo-skeletal system, Digestive system, Circulatory system, Nervous system.

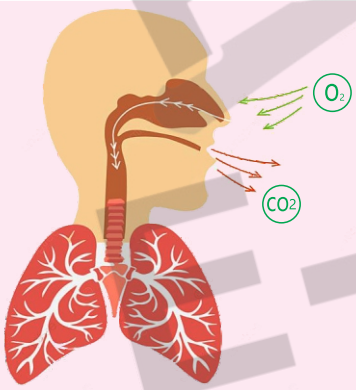


Look at yourself, you will notice that the human body is like a complex machine made of different systems. Each system has a special job, but all of them work together to keep us healthy.

The major systems of the human body and their functions are:

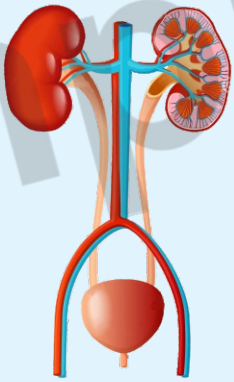
Respiratory system

Respiratory system takes in oxygen from the air and removes carbon dioxide.



Excretory system

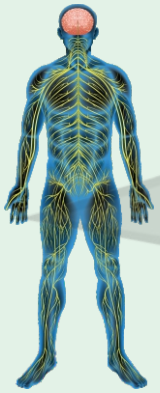
Excretory system removes wastes produced by the body's chemical processes.



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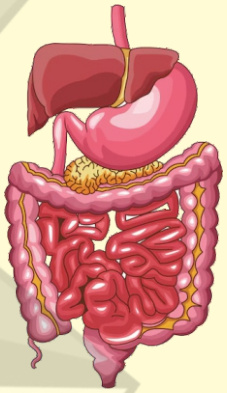
Nervous system

Nervous system controls everything you do. Nerves carry messages to and from the body, so the brain can understand and respond.



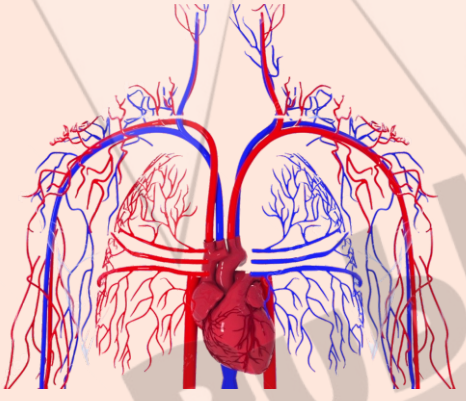
Digestive system

Digestive system breaks down food into small particles and releases nutrients.



Circulatory system

Circulatory system pumps blood throughout the body.



Musculo-skeletal system

Musculo-skeletal system provides structural support and movement to the body.



Integration of Systems in Life Processes

We have learned about the systems and their functions. But remember, these systems are integrated.

- The digestive system breaks down food into nutrients, which are passed into the blood.
- The circulatory system carries these nutrients to all parts of the body.

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- The respiratory system brings in oxygen through breathing. Oxygen is carried by the blood to body cells.
- Body cells use oxygen and nutrients to produce energy. During this process, they also produce carbon dioxide, with the blood it carries back to the lungs. From the lungs, carbon dioxide is exhaled.

Thus, the digestive, the respiratory and circulatory systems are closely link and depend on each other. For example, digestion would be of little value without the circulatory system to deliver nutrients.

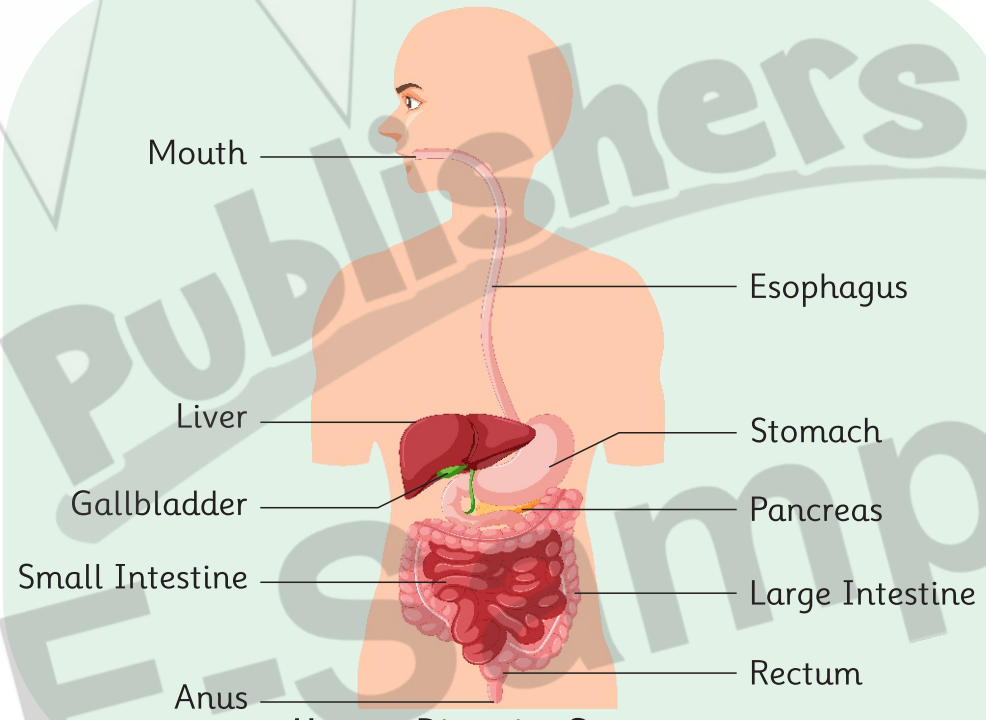
In this chapter we will discuss digestive, nervous, respiratory and circulatory system in detail.

a. Digestive System

All living things get energy from the food. Humans use this energy for growth and important life processes. But food must be changed into a form that the body can use. The process in which the food changes into energy is called digestion.

Let's Think Aloud

How living things get their energy from?



Human Digestive System

Publishers Example

Main Organs of the Digestive system are:

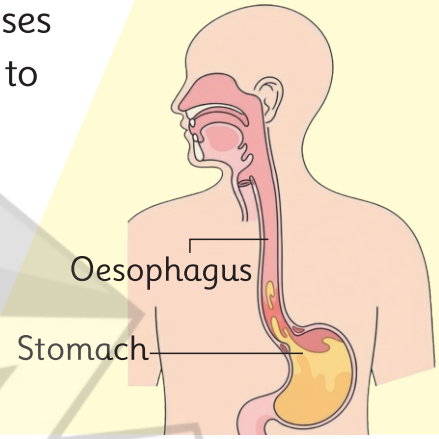
a. Mouth



Digestion begins here. Teeth chew the food. There are glands in the mouth which produce saliva. Saliva softens and moistens the food so it can be swallowed easily. The tongue mixes food with the saliva and pushes it into the oesophagus.

b. Oesophagus

Oesophagus or food pipe is a tube through which food passes to the stomach. The walls of the oesophagus move in waves to push food down the tube to the stomach.



c. Stomach

The stomach is a hollow muscular organ that produces gastric juice and acid. These churn food into a thick liquid called chyme. Starch and sugar digest quickly, staying in the stomach for only a few hours. Protein stays for three to five hours. Fats remain even longer, which is why fatty meals make us feel full for a longer time. The stomach slowly release small amounts of food into the intestine.

SciByte

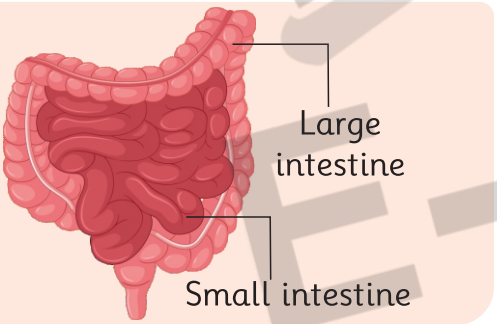
The platypus does not have a stomach.



d. Small Intestine

From the stomach, food is pushed into the small intestine. The small intestine is 22 to 25 feet long which is the longest part of the digestive system. Food stays here for several hours.

Small intestine is connected to two glands, the liver and pancreas.



The pancreas produces pancreatic juice which helps in digestion of carbohydrates and proteins, whereas, liver produces bile which help in digestion of fats. Digested food is absorbed into the blood through the wall of the small intestine and the rest food passes into the large intestine.

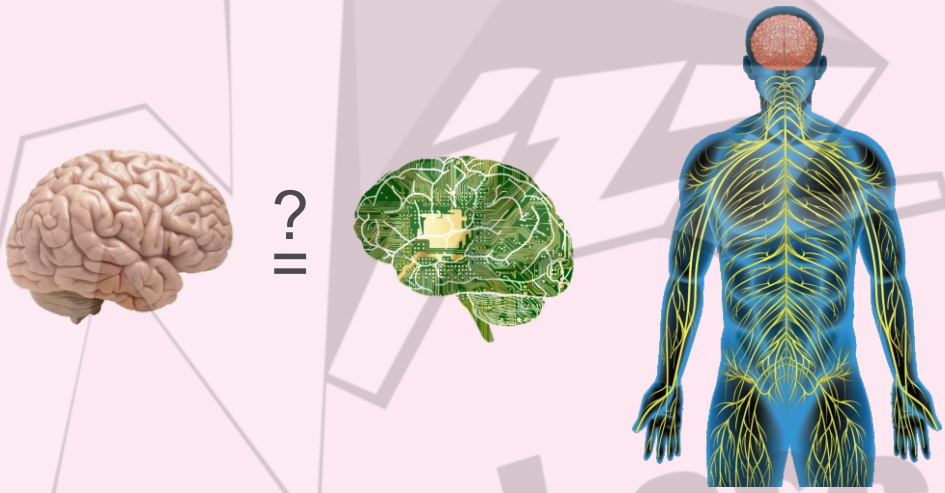
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e. Large Intestine

Not all the food is digested, some food, such as plant fibers cannot be digested. This undigested food passes into the large intestine (colon), where water is absorbed. Waste remain for 10 to 20 hours before leaving the body through the anus.

b. Nervous System

A computer is a complex machine that can perform many calculations in just a few seconds. But the human brain is even more complex and powerful than a computer. It controls everything we do i.e., how we think and feel, how we learn and remember, and how we move and talk. It also manages things we may not notice, like our heart beat and digestion.

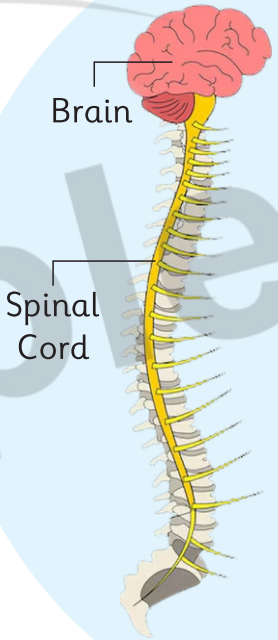


The vital organs of the nervous system are:

a. Brain

Humans constantly use their senses to gather information from their surroundings. But; how humans do it?

The brain is the central part of the body. It receives information from the senses through nerves, makes sense of it, and then send instructions back through the nerves. The brain uses the spinal cord as the main path way to send and receive massages.



b. Spinal Cord

The spinal cord runs from the brain down the back. It contains threadlike nerves that branch out to every part of the body.

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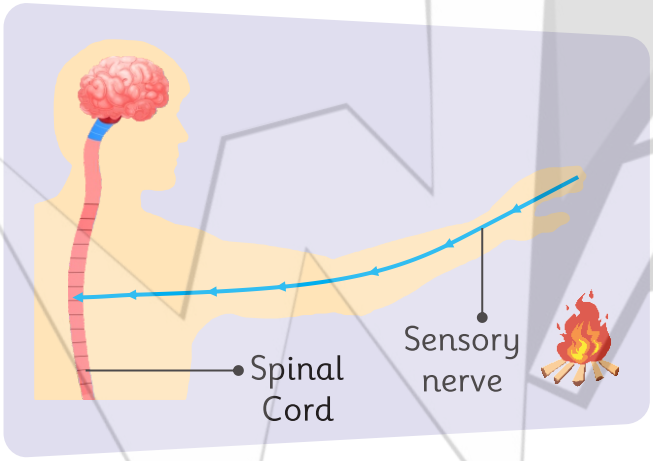
c. Nerves

Nerves spread throughout the body like a network of cables. There are two main types of nerves:

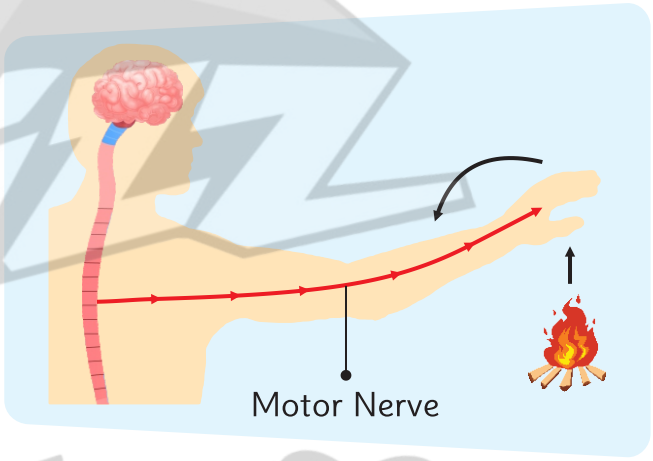
i. **Sensory nerves:** Sensory nerves carry information from the senses (eyes, ear, mouth, nose, skin) send to the brain and spinal cord.

ii. **Motor nerves:** Motor nerves carry messages from the brain and spinal cord to the muscles and organs.

For example, if you touch a hot stove, the sensory nerves in your hand quickly send a signal to the brain through the spinal cord. Brain immediately senses a message through motor nerves, telling your muscles to pull your hand away.



Sensory nerve tells spinal cord that flame is hot.



Spinal cord sends message through motor nerve to move hand.

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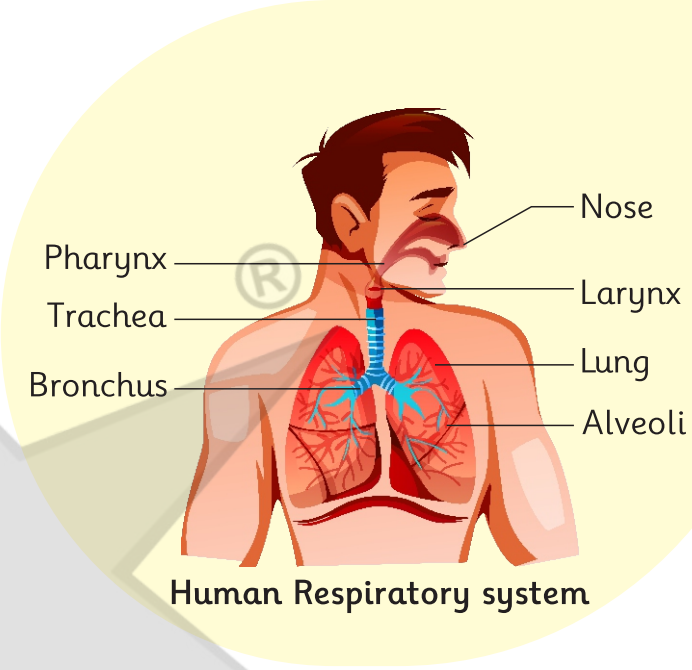
If the spinal cord is damaged, messages between the body and brain may not pass through. This can lead to the paralysis, meaning the person can not move certain parts of the body.

c. Respiratory System

When wood burns, it combines with oxygen in the air and releases energy as heat and light. Similarly in the human body, food combines with oxygen inside cells to release energy. This process is called respiration. Through respiration, cells use oxygen to release the energy stored in food.

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The human respiratory system includes two lungs and passage that lead to them. The passage includes the nose, throat (pharynx), larynx, trachea and bronchi.



Human Respiratory system

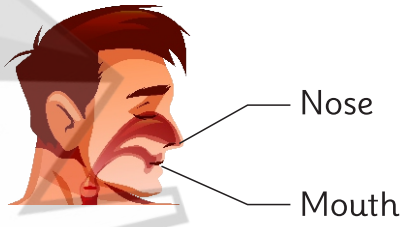


Let's Think Aloud

Do you know which organ help us to breathe?

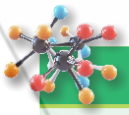
a. Nose or Mouth

When we inhale, air enters through the nose or mouth. Tiny hairs called cilia in the nostrils filter dust particles, protecting the lungs.



b. Throat or Pharynx

The two openings of the nasal cavity and the mouth meet at the point called pharynx or throat which is located at the back of the throat.



SciByte

The pharynx is part of both the digestive and respiratory system because it carries both food and air.



c. Larynx (Voice Box)

The upper part of the air way contains the voice box. The lower part contains the windpipe or trachea.

d. Trachea and Bronchi

The trachea divides into two tubes called bronchi, one leading to each lung.

e. Lungs

There are two lungs in the chest cavity. The lungs are spongy and pinkish in colour. The trachea branches into two main bronchi, which then repeatedly divided into smaller tubes called bronchioles. Bronchioles end in tiny air sacs called alveoli.

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Exchange of gases happen in the alveoli: oxygen enters the blood and carbon dioxide leaves the blood. Humans have about 600 million alveoli.

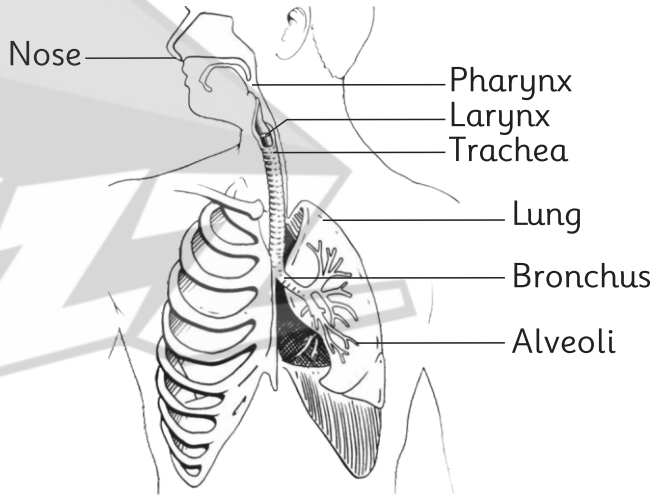


Let's Think Aloud

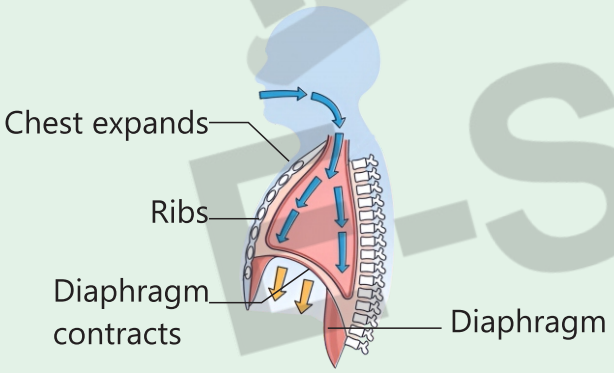
- Which bone protects lungs?
- Why left lung is smaller than right lung?

Working of Respiratory System

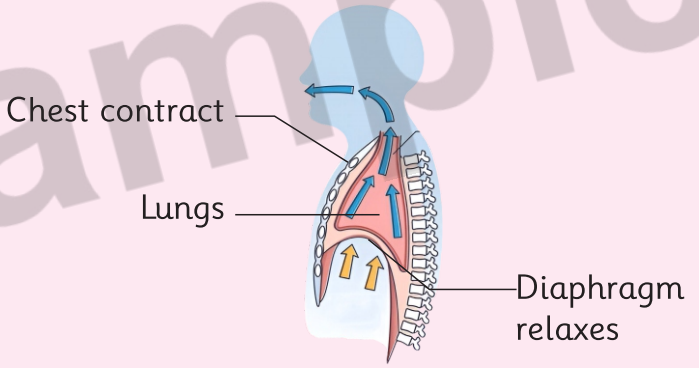
All living organisms need oxygen to survive. Lungs contract and expand to move air into and out of your body. So, how does the air get into your lungs? Moving of air in and out of the body is called breathing. The two structures that enable to breathe are the rib muscles and diaphragm. A sheet of muscles that separates the chest and the abdomen is called diaphragm.



When we breathe in, the diaphragm moves downward toward the abdomen, and the rib muscles pull the ribs upward and outward. This makes the chest cavity bigger and pulls air through the nose or mouth into the lungs.



When we breathe out, the diaphragm moves upward and the chest wall muscles relax, causing the chest cavity to get smaller and push air out of respiratory system through the nose or mouth.



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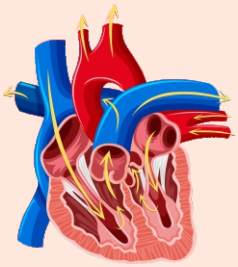
Many vertebrates have a respiratory system similar to humans. Few examples are dogs, cats, dolphin and whales.

d. Circulatory System

Place your hand on your chest, do you feel the "lubb-dubb" sound. What do you think it is? It is your heart, which is a pumping organ of your body. Heart is responsible for the movement of the blood around the body and it is called circulation. Our circulatory system is composed of:

a. Heart

The heart is a cone shaped organ that is located in the chest just beneath the two lungs. It is about the size of a fist. Heart is a muscular organ that pumps blood throughout your body. The heart has two pumps that lie side by side and work together to push blood to all body parts. The right pump is separated from the left pump by a muscular wall. The heart consists of four chambers.



Internal heart

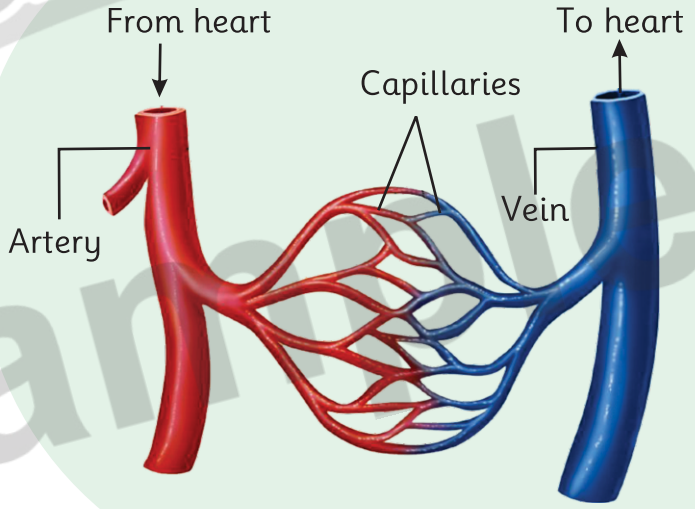
b. Blood vessels

Blood travels through a network of tubes called blood vessels. There are three main types: arteries, veins and capillaries.

i. **Arteries:** Arteries are blood vessels that carry blood away from the heart. The walls of the arteries are thick and elastic to handle high pressure, when the heart pumps blood.

ii. **Veins:** Veins are blood vessels that carry blood back to the heart. They have thin walls and often contain valves that prevent blood from flowing backward.

iii. **Capillaries:** The capillaries are the smallest blood vessels. They form a network in all parts of the body. The exchange of materials such as oxygen, carbon dioxide, glucose and nutrients etc., takes place between blood and body cells through the capillaries.



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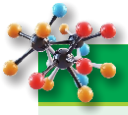
c. Blood

Blood is the fluid that flows through this network. It is made up of red blood cells, white blood cells, plasma and platelets.

Working of Circulatory System

To stay alive, the body needs a constant supply of blood. The heart beats about 60 to 100 times per minute pushing blood throughout the body. The heart pumps oxygen rich blood through arteries to all parts of the body.

The cells use the oxygen and release carbon dioxide and waste materials. The veins carry this oxygen poor blood back to the heart. The heart then sends the blood to the lungs, where it picks fresh oxygen and gets rid of carbon dioxide. This cycle repeats over and over again, keeping the body alive and healthy.



SciByte

The human circulatory system moves blood in only one direction and is called double circulatory system, because blood passes through the heart twice during one complete circuit.



Activity Time!

Research and list some ways to keep your heart healthy.

Vertebrates too have circulatory system which is similar to humans. Following are few examples.



2 chamber



3 chamber

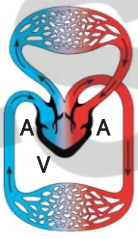


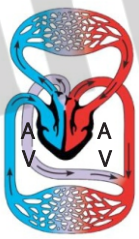
3 chamber

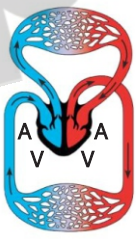


4 chamber









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What have you learnt?

- The human body has several organ systems such as, digestive system, respiratory system, circulatory system, skeletal system, muscular system and nervous system etc.
- The digestive, respiratory and circulatory system work together to carry out life processes.
- Respiration is the process where oxygen combines with food to release energy.
- The lungs, nose, throat, trachea and bronchi are key organs in gas exchange.
- Breathing is the process of moving air in and out of the lungs for gas exchange.
- The diaphragm is a sheet of muscle that separates the chest and abdomen.
- The circulatory system transports oxygen, carbon dioxide, nutrients, water and minerals throughout the body.
- The heart, blood vessels and blood are the main parts of the circulatory system.
- The cone shaped heart is located in the chest between the two lungs.
- Arteries, veins and capillaries are types of blood vessels.
- Blood is made up of plasma, red blood cells, white blood cells and platelets.

Exercise

1 Choose the correct option.

i. Which of the following is responsible for the elimination of waste from the body?

a Respiratory system
b Digestive system
c Excretory system
d Nervous system

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ii. Tick the odd one.

a Lungs – Bronchi – Alveoli – Pharynx

b Brain – Blood – Blood vessels

c Oesophagus – Stomach – Small Intestine – Anus

d All of them

iii. To send messages, the brain uses a particular path called:

a Spinal cord

b Sensory nerves

c Motor nerves

d Blood vessels

iv. The process in which the body changes food into a form that it can use is called:

a Digestion

b Reproduction

c Respiration

d Circulation

v. The walls of the stomach churn food into a thick liquid called _____ due to action of digestive juices.

a Chyme

b Saliva

c Bile Juice

d Pancreatic Juice

vi. The small intestine is_____ to_____ feet long.

a 22 -25

b 21-25

c 23-25

d 20-25

vii. Which of the following organs help in breathing?

a Stomach

b Lungs

c Heart

d Kidneys

viii. When you inhale, your lungs:

a Expand

b Become hard

c Contract

d Become spongy

ix. Which type of blood vessel carry blood away from the heart?

a Veins

b Arteries

c Capillaries

d Arteries and veins

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x. Identify the function of cilia:

a. Filter out dust and other particles that enter the nose.

b. Break down food to release nutrients.

c. Carry messages to and from the body.

d. Pump blood through the body.

xi. The heart is a pump, usually beating about _____ to _____ times per minute.

a. 60-100

b. 80-100

c. 70-100

d. 90-100

xii. When you breathe in air, you bring oxygen into your lungs and give out:

a. Oxygen

b. Hydrogen

c. Carbon monoxide

d. Carbon dioxide

2 Fill in the blanks.

i. The nervous system controls all the _____ of the boy.

ii. The spinal cord runs from the _____ through the back.

iii. The _____ are the blood vessels that bring blood back to the heart.

iv. The _____ helps the lungs to expand and contract.

v. We breath in oxygen through our _____.

3 Write "T" for true and "F" for false against each statement.

i. The heart is the part of circulatory system. _____

ii. The lungs help us to digest food. _____

iii. The brain is the control centre of the body. _____

iv. Bones are part of the muscular system. _____

v. Blood Carries oxygen and food to different part of the body. _____

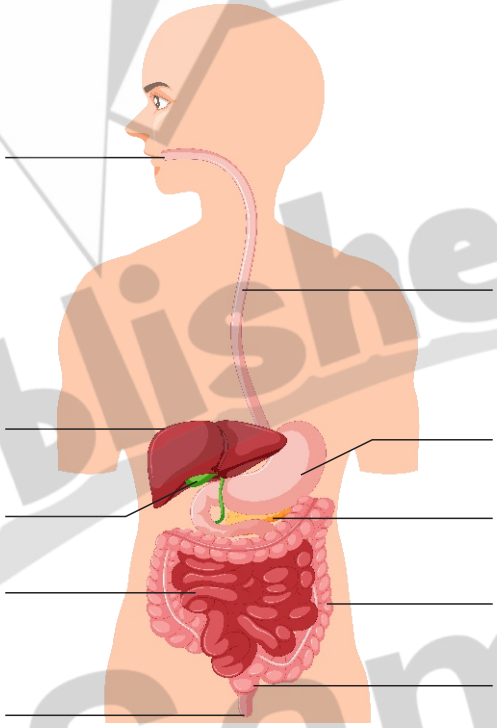
vi. The stomach breaks down the food we eat. _____

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4 Match the given organs with their functions.

Organ	Function
Nose	Exchange of gases takes place.
Lung	Muscle that helps in breathing.
Diaphragm	Transport air to and from the lungs
Trachea	Allow air to enter.

5 Label the human digestive system and answer the following questions.



i. Identify the oesophagus and describe its function.

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ii. Which is the longest part of the digestive system?

iii. Write the names of glands that are attached to small intestine.

6 Write answers of the following questions.

i. Why is the heart called a pump?

ii. What is the role of diaphragm in breathing?

iii. Define circulation.

iv. Differentiate between sensory and motor nerves.

Sensory nerves	Motor nerves

v. Explain the role of mouth in digestion.

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vi. Explain the role of cilia in respiration.

vii. Differentiate between pharynx and larynx.

Pharynx	Larynx

viii. What is meant by double circulatory system?

ix. Write down tthe types of blood cells.

7 Write detailed answers to the following questions. (On note book)

i. Explain how respiratory system works in the human body.
ii. Explain the type and role of nerves in human nervous system.
iii. Explain blood vessels and their types.

Constructed Response Questions

i. Why is breathing so important?
ii. What is contained in exhaled air?

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UNIT 3

Ecosystem

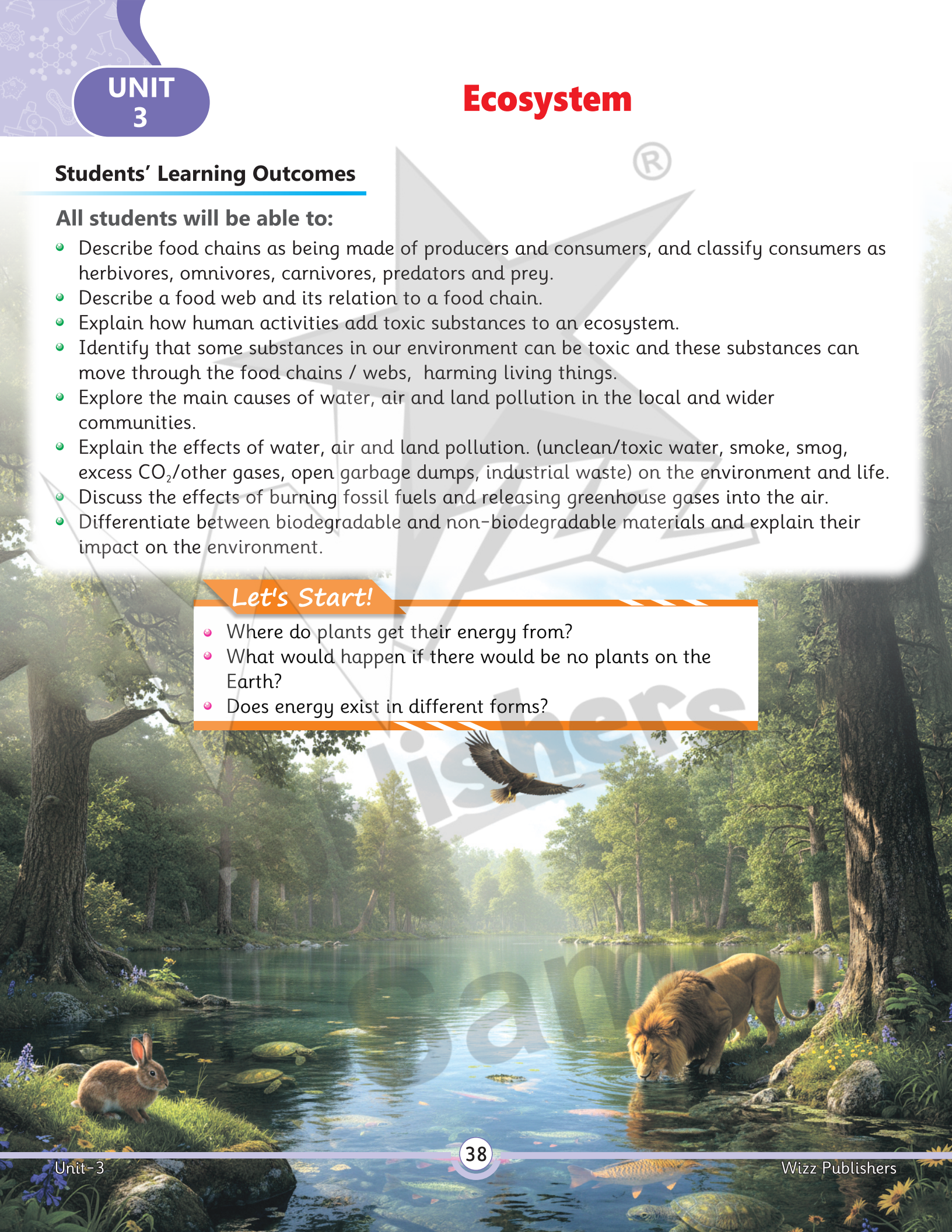
Students' Learning Outcomes

All students will be able to:

- Describe food chains as being made of producers and consumers, and classify consumers as herbivores, omnivores, carnivores, predators and prey.
- Describe a food web and its relation to a food chain.
- Explain how human activities add toxic substances to an ecosystem.
- Identify that some substances in our environment can be toxic and these substances can move through the food chains / webs, harming living things.
- Explore the main causes of water, air and land pollution in the local and wider communities.
- Explain the effects of water, air and land pollution. (unclean/toxic water, smoke, smog, excess CO_2/other gases, open garbage dumps, industrial waste) on the environment and life.
- Discuss the effects of burning fossil fuels and releasing greenhouse gases into the air.
- Differentiate between biodegradable and non-biodegradable materials and explain their impact on the environment.

Let's Start!

- Where do plants get their energy from?
- What would happen if there would be no plants on the Earth?
- Does energy exist in different forms?



Energy



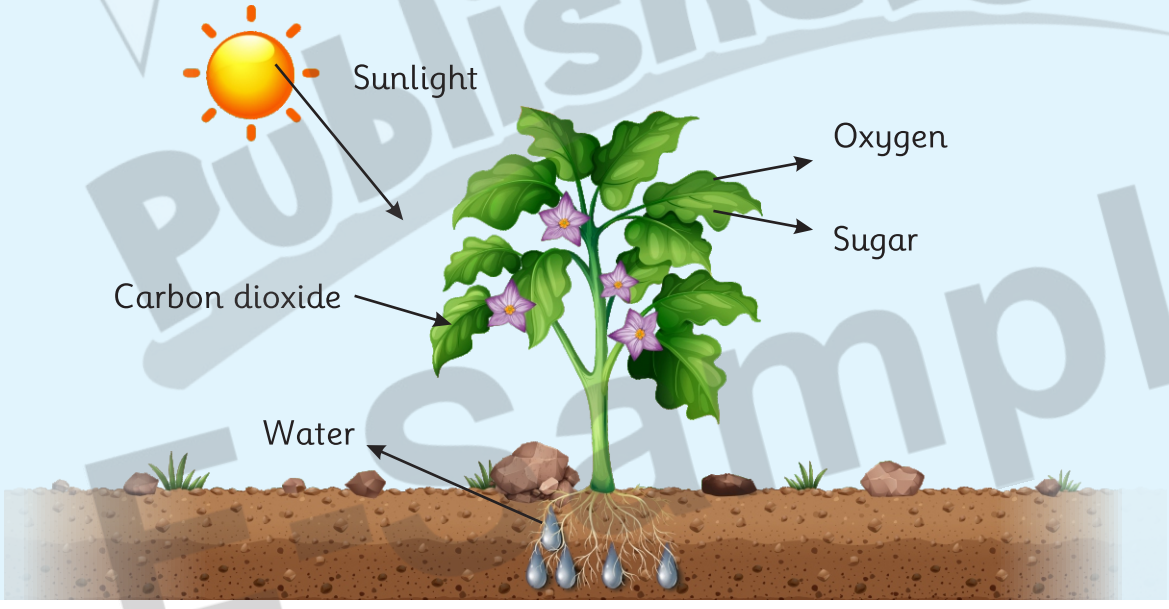
Energy is defined as the ability to do work. When we observe our surroundings, we can see energy at work all the time, from moving vehicles to growing plants.

All living organisms need energy to grow, move and carry out life processes. This energy comes from the Sun and it passes from one living organism to another through food.

Like, humans and animals, plants are also living organisms, but how do plants get energy?

Plants make their own food using simple substances like carbon dioxide (CO_2) and water (H_2O) in the presence of sunlight and chlorophyll. This process is called photosynthesis.

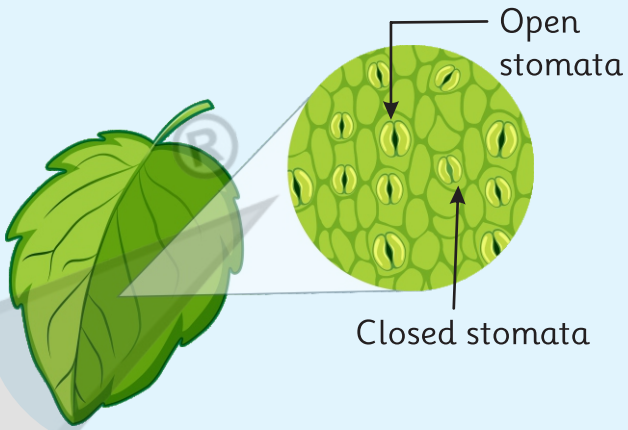
Without plants there would be no food on Earth. Plants do not eat food like animals or humans, they make their own and provide food for others. The food made by plant is glucose, which is a type of sugar. Hence, green plants are called producers, because they produce their own food.



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How do plants make their food?

Leaves are called the powerhouse of a plant because they absorb sunlight for photosynthesis. There are tiny openings on the surface of the leaf, called stomata, which we cannot see with the naked eye. Air goes into a leaf through these tiny openings.



Plants absorb sunlight through their leaves which provides the energy for photosynthesis. Water is absorbed through roots and travel to the leaves. Chlorophyll, the green pigment in leaves, helps trap sunlight. All these combine to produce glucose, which is stored in the plants fruits, roots or stems.

When animals or humans eat plants, they consume their stored energy. During digestion, glucose is broken down to release energy for body functions.






The energy flows from the Sun → plants → animals → humans

All the animals and humans are dependent on plants for food either directly or indirectly.

Consumers

Different animals have different diets, and therefore we put them into different groups on the basis of their diets as plant eaters, meat eaters and both plant and meat eaters.





Animals cannot make their own food. They eat plants or other animals to get energy. Therefore, they are called consumers.

Consumers are classified into three groups based on their diet.

a. Herbivores (Plant eaters)

These animals eat only plants or parts of plants. They have flat teeth for grinding food. Examples: Cow, horse, elephant, deer and rabbit.






b. Carnivores (Meat eaters)

These animals eat only meat. They have sharp teeth and claws to catch and tear flesh. Examples: Lion, wolf, crocodile and eagle.






c. Omnivores (Plant and Meat eaters)

These animals eat both plants and meat. Examples: Human, bear, hen, pigeon and crow.






Decomposers



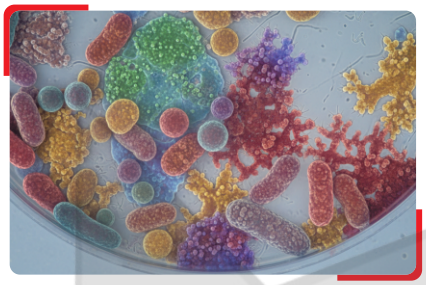
Let's Think Aloud

What is the only chain we can eat?

Decomposers are living organisms that breakdown dead plants and animals. They return nutrients to the soil, helping plants grow again. Decomposers are called natural recyclers because they complete the food chain by returning energy and matter to the environment.

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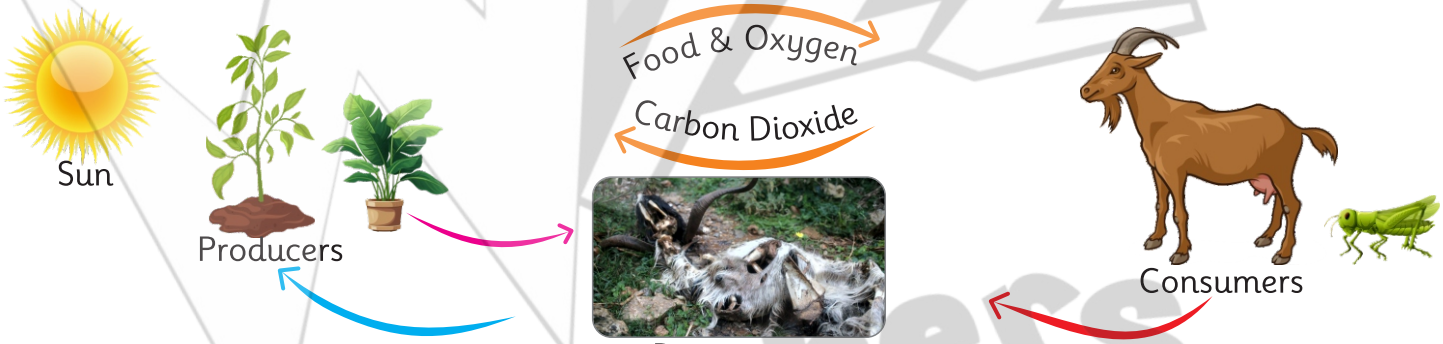
Examples of decomposers are worms, bacteria, and fungi.


Interdependency of Living Things in an Ecosystem

Every living plant and animal needs energy to survive. Plants depend on soil, water and sunlight. Animals depend on plants as well as other animals for energy.

In an ecosystem, plants and animals all depend on each other to live. This dependency can be explained through food chain or food web.



Producers, consumers and decomposers

Food Chain

A food chain shows how energy passes from one living thing to another in an ecosystem. It always starts with a producer (plant) and ends with a consumer or decomposer.

For example: Grass→Rabbit→Snake→Eagle

- The rabbit eats the grass.
- The snake eats the rabbit.
- The eagle eats the snake.
- When the eagles dies, decomposers, breakdown its remains and return nutrients to the soil for plants to use again.

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Animals that eat plants are called primary consumers or herbivores.



Animals that eat other animals are called secondary consumers or carnivores.



If a carnivore eats another carnivore, it is called a tertiary consumer.



Decomposers eat decaying matter and help put nutrients back to the soil for plants.

Links of the Food Chain

Observe the following food chain carefully and notice that it has different links. Each link represents an organism that depends on another for food. These links are named based on what the organisms eats and how it contributes to the flow of energy in the ecosystem.

SciByte

Al-Jahiz, a scientist from the 9th century, was the first to introduce the concept of food chains.

Let's Think Aloud

What would the world be like if there were no decomposers on Earth?

Activity Time!

Complete the food chains with these animals: rabbit, grasshopper and eagle. Identify animals that are part of each chain.

Chain A: _____

Chain B: _____

Chain C: _____

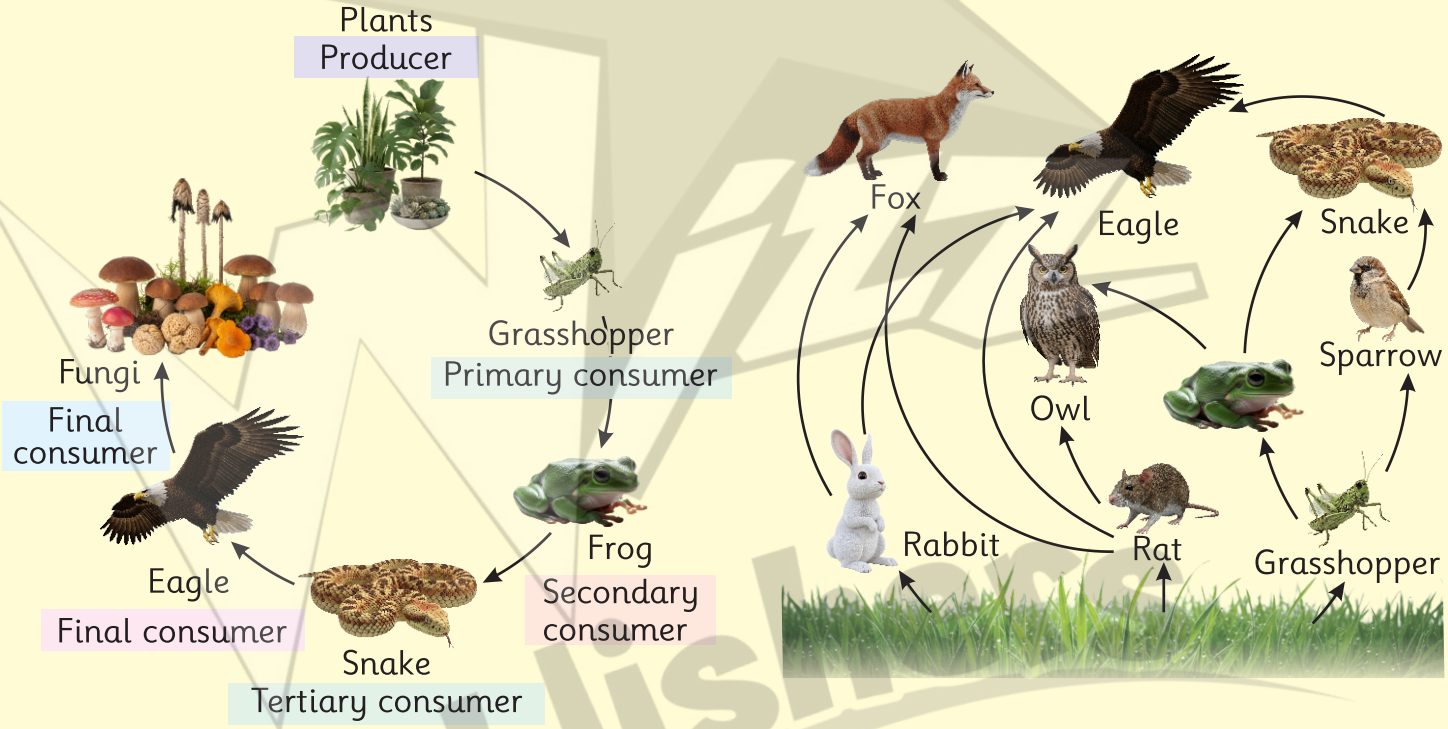
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Food Web

Animals in an ecosystem do not eat the same food everyday. For example, you might have rice today and salad tomorrow. Similarly, a wild cat might eat a mouse one day and a rabbit the next.

When one animal from a food chain interacts with animals from another food chain, they form a food web.

A food web is a large and complex network of many interconnected food chains in an ecosystem.



In every ecosystem there are many food chains and most plants and animals are part of several of them. When we draw all the food chains together, they form a food web, showing how energy and nutrients pass through the environment.

What happens if the food web is disturbed?

Humans are dominant consumers on Earth and their activities often disturb food webs. Activities such as pollution, habitat destruction, overhunting, fishing and industrialization disrupt natural food chains.

All living things in an ecosystem depend on each other to survive. When one specie becomes extinct, the entire food web is affected. Just like touching one

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part of a spider's web makes the whole web shake, a change in one population affects all the others connected to it. Therefore, every living thing in an ecosystem depends on the others for survival.

Energy Flow and Loss at Each Trophic Level

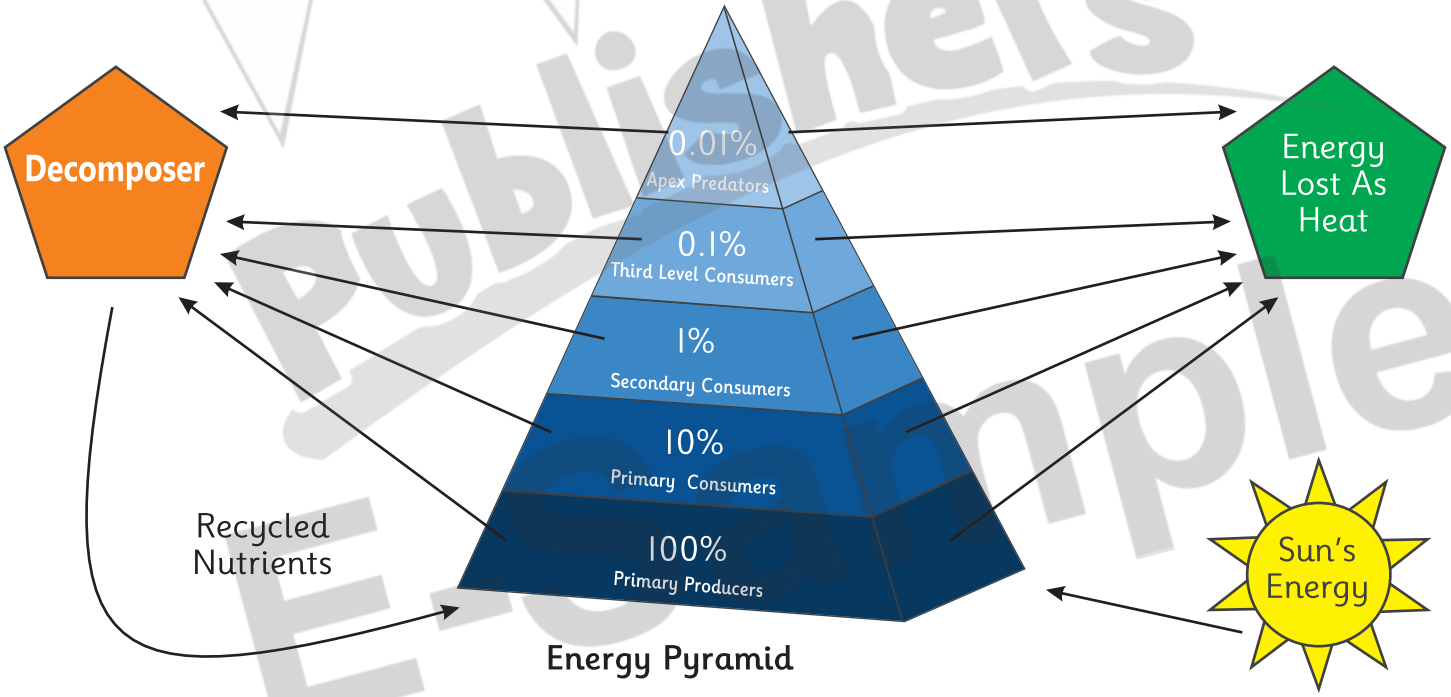
We know that all the energy in a food chain originally comes from the Sun. Plants capture this energy through photosynthesis and all other living organisms depend on plants for energy.

Let's Think Aloud

Can an ecosystem exist with only one food chain?

Each level in a food chain is called a trophic level. Scientists use this term to describe how energy moves through an ecosystem. The five main trophic levels are:

Level 1: Plants (producers)
Level 2: Animals that eat plants (primary consumers as herbivores)
Level 3: Animals that eat herbivores (secondary consumers as carnivores)
Level 4: Animals that eat carnivores (tertiary consumers as carnivores)
Level5: Animals that eat tertiary carnivores (quaternary consumers, carnivores)



Energy Pyramid

Look at the energy pyramid, you will see, as we move from bottom to the top of food chain, the amount of energy available decreases. Each level receives only 10% of the energy from the level below it, the rest 90% is lost to the environment as heat. That is why top predators are fewer in number, there is not enough energy left to support large populations at higher levels.

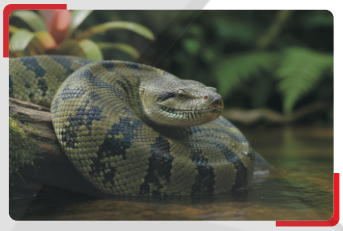
Each trophic level has an important link to the other. If any link is broken, it affects the entire food chain. Let's understand this through an example:



Grass



Rabbit



Snake



Eagle

If we remove the rabbit from the food chain, the snake loses its food source. Even without rabbits, the snake population decreases. As snakes decline, the eagle, which depend on snakes for food, will also suffer. Eventually, the entire food chain collapses because energy cannot flow smoothly between organisms.

SciByte

A prey is an animal that is hunted by a predator for food.



A predator is an animal that hunts, kills and eat other animals for food.

Did you ever hear about Yellowstone National Park?

The Yellowstone National Park in the United States was established in 1872. Wolves along with other predators, like bears, were hunted regularly. Humans figured that they were helping other animals, like deer and elks, eliminating their predators (wolves, bears).



In 1926, the last wolf at Yellowstone was killed. Unfortunately, the result of eliminating

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wolves was not what they thought it would be. Without their natural predator, the population of elk continued to increase and grazed their landscape, killing young bushes and trees. This in turn caused other species like squirrels to drop in population.

As early as the 1930s, scientists were worried about the decline of Yellowstone National Park, and they decided to re-introduce wolves in 1995. This simple act caused an unbelievable effect that saved Yellowstone National Park.

So, the lesson to be learned from this example is, removal of one species of the food chain may collapse the whole ecosystem.

Activity Time!

Using the following organisms: Grasshopper, fox, bird, snake, hawk, green plants, frog, insects, and rabbit. Draw and label:

- A simple food chain
- A food web showing these animals are connected.

Effects of Human activities on Ecosystem

Human activities have caused serious environmental problems, polluting natural resources and disrupting natural ecosystems. Among the major human activities: deforestation, urbanization and agricultural practices are the key ways in which humans have greatly changed ecosystems.

a. Deforestation

Deforestation is the large scale clearing and cutting of forests and trees. Deforestation reduces soil quality and causes soil erosion, which is the wearing away of soil by wind, water, or other natural agents. Trees naturally remove carbon dioxide from the atmosphere during photosynthesis. When forests are cut down, less CO_2 is absorbed, leading to an increase in greenhouse gases. This results in higher temperatures on Earth's surface and contributes to climate change.



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b. Urbanization



Urbanization means the conservation of natural or rural areas into cities and towns. As cities expand, habitats are destroyed, causing loss of wildlife and imbalance of ecosystem. Construction of roads, buildings and heavy traffic in natural areas leads to habitat fragmentation and often causes death or displacement of wildlife.

c. Agricultural Practices



Modern agricultural practices can have many negative effects on the environment. Farm runoff is a major cause of water pollution, carrying fertilizers, pesticides, phosphates, animal wastes and other harmful substances into streams and lakes. The pollution blocks sunlight, harms aquatic plants and disrupt aquatic ecosystems needed for photosynthesis.

Other harmful human activities include:

- Polluted water running into rivers, lakes, seas or oceans, killing fish and plants.
- Factories dumping waste material into water bodies.
- Oil spills from tankers, which harm fish, seabirds and sea animals.
- Pesticides and fertilizers entering in food chains and poisoning animals that consume affected prey.

Environment and Pollution



The environment is the natural world surrounding all living things. It influences the growth and survival of every organism. When unwanted or harmful materials are introduced into the environment, it becomes polluted. Anything that damages or contaminates the environment is called a pollutant.



Let's Think Aloud

What would happen if farmers use polluted water for airrigation?

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Kinds of Pollution

There are different kinds of pollution. The major types are:

i. Air pollution

Air pollution is the release of harmful gases and particles into the Earth's atmosphere. These contaminants cause serious health issues.

Following are few causes that contribute to air pollution:





- Burning fossil fuels
- Mining operations
- Exhaust gases from industries and factories

The effects of air pollution vary based on the kind of pollutant. But generally, the impact of air pollution ranges from:



- Increased risk of respiratory illness and cardiovascular problems
- Increased risk of skin diseases
- May increase the risk of cancer
- Global warming
- Acid rain
- Ozone depletion
- Hazards to wildlife

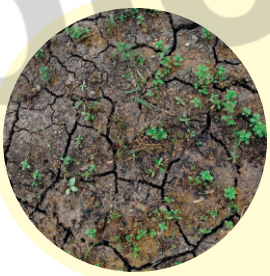
ii. Soil pollution

Soil pollution is also called soil contamination. Soil pollution refers to the removal of land due to the presence of chemicals or other man-made substances in the soil. Some of the common causes of soil pollution are:





- Improper industrial waste disposal
- Oil Spills
- Acid rain which is caused by air pollution
- Mining activities
- Intensive farming and agrochemicals (like fertilisers and pesticides)
- Industrial accidents



Effects of soil pollution include:

- Loss of soil nutrients, which renders the soil unfit for agriculture.

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- Impacts the natural ecosystem residing in the soil.
- Effects vegetation due to the high concentration of chemical in the soil.

iii. Water pollution

When toxic pollutants are introduced into water bodies such as lakes, rivers and seas, it is called water pollution. These contaminants are generally introduced by human activities like improper sewage treatment and oil spills.

Other significant causes of water pollution include:

- Dumping solid wastes in water bodies.
- Disposed of untreated industrial sewage into water bodies.
- Human and animal wastes.
- Agricultural runoff containing pesticides and fertilisers.

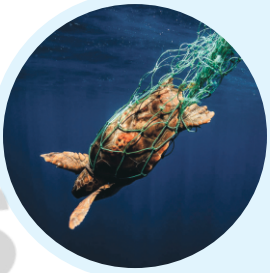




The effects of water pollution are very obvious in our environment. Furthermore, toxic chemicals can bioaccumulate (gradual accumulation of substances, such as pesticides or other chemicals, in an organism) and these chemicals can travel up the food chain, and ultimately reaching humans.

Effects of water pollution include:

- Disruption of the ecosystem
- Threats to marine life
- Increased risk of water-borne diseases
- Increases toxic chemicals (such as mercury) in water bodies



SciByte

In 1932, the city of Minamata, Japan suffered severe mercury poisoning due to industrial waste dumped into the bay. Mercury accumulated in fish and when people ate these fish, they developed serious neurological disorders, a tragic reminder of how pollution travels through food chains.

iv. Noise pollution

Noise pollution refers to the excessive amount of noise in the surrounding that disrupts the natural balance.

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Noise pollution has several contributors, which include:

- Industry-oriented noises such as heavy machines, mills, factories, etc.
- Transportation noises from vehicles, aeroplanes, etc.
- Construction noises
- Noise from social events (loudspeakers, firecrackers, etc.)
- Household noises (such as mixers, TV, washing machines, etc.)





Noise pollution has now become very common due to urbanisation and industrialisation. Noise pollution can bring adverse effects such as:

- Hearing loss
- Sleeping disorders
- Hypertension (high BP)
- Communication problems

SciByte

Any sound above 85 decibels is considered noise and can be harmful to hearing.



Fossil Fuels

- Fossil fuel are natural substances from the remains of plants and animals buried under heat and pressure for millions of years.
- They include coal, oil and natural gas and used for energy production.
- However, fossil fuels are non-renewable, meaning they cannot be replaced once used.



Coal oil Gas

Effects of Burning Fossil Fuels

Fossil fuels have the following disadvantages.

- Burning petroleum and coal releases harmful gases such as carbon monoxide, nitrogen oxides and sulphur dioxide. These gases react with moisture in the air to form acid rain, which damages building, crops and aquatic life.
- Burning of fossil fuels increases atmospheric temperature. This warming of Earth's atmosphere called green house effect, contributing to climate change, a serious environmental issue.

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SciByte

By the early 1990's, tens of thousands of lakes in Norway, Sweden and Canada were destroyed by acid rain.

Biodegradable and Non-biodegradable Materials

Biodegradable Materials



Biodegradable materials are substances that decompose naturally through the action of microorganisms.

Examples include: Food waste, paper, leaves and other natural wastes. Microorganisms break down complex substances into simpler organic matter which eventually fade and mix in the soil. The whole process is natural which can be rapid or slow. Therefore, the environmental issues and risks caused by biodegradable wastes are low.

Non-Biodegradable Materials



Non-biodegradable material do not decompose easily and remain in the environment for a long time.

Examples include: Cans, metals, and chemicals for agricultural and industrial purposes. They are the main cause of air, water and soil pollution and diseases like cancer.

Impact of Non-biodegradable Waste



Every year, billions of tons of waste are produce from home, factories and farms.

This waste pollutes land, air and water and releases greenhouse gases like methane and carbon dioxide.

When non-biodegradable substances are ingested by animals, they can cause serious health problems or even death.

Let's Think Aloud

Can you tell how biodegradable substances affect the environment?

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What have you learnt?

- Animals and humans depend on plants for food either directly or indirectly, so they are called consumers.
- Consumers that eat only plants or parts of plants are called herbivores.
- Consumers that eat only meat are called carnivores.
- Consumers that eat both plants and meat are called omnivores.
- Decomposers are living organisms that eat decaying matter (like dead plants and animals). They are also called natural recyclers.
- A food chain shows how each living organism gets its food and how energy passes from one to another.
- Each level of a food chain is called a trophic level.
- Deforestation means cutting down trees and destroying forests which harm habitats and change ecosystems.
- Urbanization means turning more land into cities and reducing farmland and forests.
- The natural world that surrounds a living thing is called its environment.
- Pollution occurs when harmful materials enter the environment. These harmful materials are called pollutants.
- Air pollution is the release of harmful gases or particles into the Earth's atmosphere.
- Soil pollution happens when chemicals or waste materials deposit on land.
- Water pollution happens when toxic substances enter rivers, lake and seas.
- Noise pollution refers to excessive sounds that disrupt natural balance.
- Fossil fuel are natural substances formed from remains of dead plants and animals under heat and pressure.
- Biodegradable materials can be broken down by bacteria or natural organisms.
- Non biodegradable materials cannot be broken down naturally and contribute to long term pollution.

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Exercise

1 Choose the correct option.

i. The ability to do work is called:

a Energy
b Distance
c Power
d Speed

ii. The process by which plants make their food is known as:

a Respiration
b Photosynthesis
c Excretion
d Transpiration

iii. Plants makes their food in the form of:

a Glucose
b Fructose
c Sodium chloride
d Lactose

iv. Bacteria and fungi are:

a Consumers
b Producers
c Decomposers
d Carnivores

v. What are the products of photosynthesis?

a Glucose and oxygen
b Glucose and carbon dioxide
c Water and oxygen
d Water and carbon dioxide

vi. Which of the following are called natural recyclers?

a Decomposers
b Producers
c Consumers
d None of them

vii. Choose the correct food chain:

a Plant→rabbit→snake→eagle
b Eagle→rabbit→plant→eagle
d Plant→eagle→snake→rabbit
c Plant→rabbit→eagle→snake

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viii. The ratio of energy lost between two trophic levels is about:

a 90%. b 100%.

c 95% d 105%

ix. Anything that harms the environment is called a:

a Pollutant b Microorganisms

c Pollution d Germs

x. If all plants would die, what would happen to the food web?

a Nothing would happen

b Only plants would suffer

c Animals would have more food

d The food web would collapse

2 Fill in the blanks.

i. Animals who eat only plants are called _____.

ii. _____ means increase in the population of cities.

iii. Any sound above _____ is considered.

iv. Serval food chains in an ecosystem overlap to form a network called _____.

v. The series of eating and being eaten among organisms is called _____ .

3 Sort the following into herbivores, carnivores and omnivores.



Herbivore	Carnivore	Omnivore

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4 i. Look at the food chain. If the locust is removed from the chain, what would happen to the rest of the food chain? Explain in your own words.



ii. Use the food chains below to create a food web in the given space.

Lettuce → Rabbit → Fox → Hawk

Grass → Lizard → Fox → Grasshopper

Lettuce → Grasshopper → Lizard → Hawk

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5 Identify biodegradable and non-biodegradable waste and sort them accordingly.


Paper waste


Food leftover


Fruit peels


Glass waste


Toxic waste



Domestic waste


Plastic waste


Metal waste

Biodegradable waste	Non-Biodegradable waste

6 Write answers of the following questions.

i. How do plants make their own food?

ii. How are living things dependent on each other?

iii. Which human activities can affect an ecosystem?

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iv. What is the importance of plants in an ecosystem?

v. Identify the following organisms and write their role in an ecosystem?



vi. What is global warming?

vii. Differentiate between biodegradable and non biodegradable materials.

Biodegradable materials	Non biodegradable materials

viii. Differentiate between predator and prey.

Predator	Prey

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ix. Define pollution. Name the types of pollution.

x. What is acid rain?

7 Write detailed answers to the following questions. (On note book)

i. Define food chain. Draw any two food chains.
ii. What is soil pollution? Write down the effects of soil pollution.
iii. How does the consumption of fossil fuels affect the environment?
vi. Define non-biodegradable materials and their impact on the environment?

Constructed Response Questions

i. How can you protect your environment?
ii. Explain the role of conservationists. What can you do to protect ecosystems?
iii. Conduct a waste analysis survey in your school.

Suggested questions for survey:

- How many classrooms have a paper recycling bin?
- How many classrooms collect junk materials for model making?
- Does the school have a compost bin?
- Does the school encourage refillable bottles?
- Are students asked to bring unpacked lunch (without wrappers)?
- Does the school separate recyclable and non-recyclable litter?
- Ask students to present the data using bar charts and tables.

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- Design an information leaflet about toxic substances and the problems they cause.
- Plan an awareness campaign to reduce the use of toxic materials and save the ecosystem.
- The problem with burning fossil fuels is that it causes pollution and increase global temperature. Suggest solutions to generate power with less pollution.



Objective: To design and test a simple water filtration model.

Resources:

- Plastic bottle
- Cotton balls
- Glass
- Scissors
- Rice
- Coffee filters
- Dirt
- Rubber band
- Water



Instructions:

- Cut the bottom off the plastic water bottle.
- Mix 1 cup of dirt with 1 cup of water. Stir and let sit for 5 minutes.
- Crumple a coffee filter and place it inside the top of the bottle.
- Add 6 cotton balls on top of that. Pour a cup of rice on top of the cotton balls.
- Place another coffee filter over the bottle opening and fasten it with a rubber band.
- Turn the bottle upside down into the glass. Slowly pour the dirty water into the bottle and observe how the filter cleans it.

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UNIT 5

Light and Sound

Students' Learning Outcomes

All students will be able to:

- Identify natural and artificial sources of light.
- Distinguish between luminous and non-luminous objects.
- Identify transparent, translucent and opaque objects.
- Demonstrate that sound can travel through different states of matter at different speeds.
- Describe the structure and explain the mechanism of sound conduction through the human ear.
- Describe the intensity of sound.
- List the harmful effects of noise on human health.
- Explain the role of humans in reducing noise pollution.

Let's Start!

- Can an object be both luminous and non-luminous at different times?
- Can an object change from being transparent to translucent or opaque?
- Why do we hear underwater differently than in the air?



Publishers Sample

Switch off the lights in your room and try to read the text below:



Can you read it clearly. Probably not, because there is darkness which means absence of light.

Light



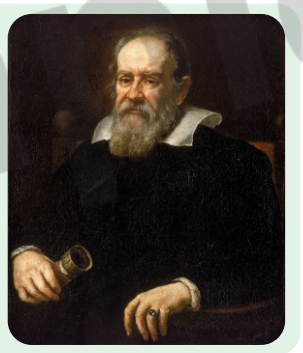
Light help us see the things around us. When we switch on the light, we can read and move easily.

Light is a form of energy that enables us to see. It comes from a source, reflects off objects and enters our eyes. Our brain processes this information, allowing us to see the world.

SciByte

Galileo Galilei was an Italian scientist who created a telescope that had thirty times more magnification than others of his time.





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Sources of Light

Sources of light are divided into two categories:

a. Natural Light Sources



Sources that emit their own light are called natural light sources. The Sun is the major natural source of light for Earth. It is a big ball of fire where powerful reactions at the center produce heat and light energy.

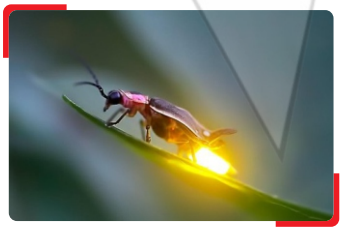
The Moon also appears bright but it does not produce light itself. It only reflects the light of the Sun.



Let's Think Aloud

Can you name any natural phenomena that emit light?

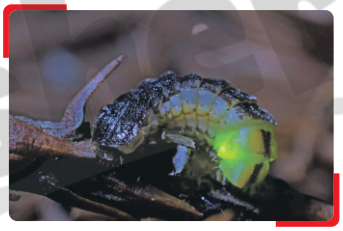
Some living things can also produce light. This process is called bioluminescence. It happens because of chemical reactions inside the organism. Examples include: Fireflies, jellyfish, glow-worm, some deep-sea plants and microorganisms.



Firefly



Jellyfish



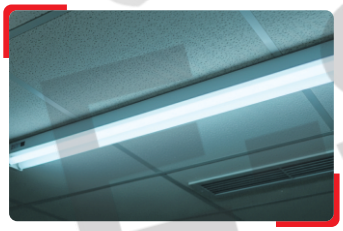
Glow-worm



Deep-sea plants

b. Artificial Light Sources

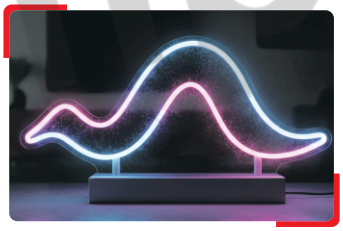
Light can be produced artificially. Examples of artificial light sources include candle, incandescent lamp, fluorescent tube light, electric bulb and neon lights.



Fluorescent tube light



Electric bulb



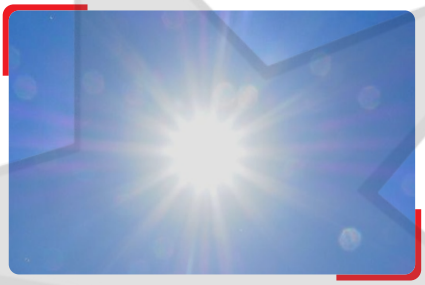
Neon lamp

Publishers Sample

Do you know the difference between luminous and non-luminous objects? Let's understand with a very simple example.

i. Luminous Objects

Objects that produce their own light are called luminous objects. Examples of luminous objects are candle torch, stars and the Sun.


ii. Non-Luminous Objects

Objects that do not produce their own light and only reflect light from other sources are called non-luminous objects. Non-luminous objects do not have their own light and they simply reflect the light of others. Examples of non-luminous objects are mirror, ball, Moon, and the Earth.





Transparent, Opaque and Translucent Objects

Non- luminous objects can be grouped based on how light passes through them:

a. Transparent objects

Transparent objects allow light to pass through completely. We can see clearly through them. Object which is on the other side of the transparent object is clearly visible. Examples include: Clear glass, clear plastic, lens, diamond and water, etc.







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b. Opaque objects

Opaque objects do not allow light to pass through. We cannot see through them and they form a dark shadow. Examples include: Mirror, apple, brick, cup, wall and wooden door, etc.







c. Translucent objects

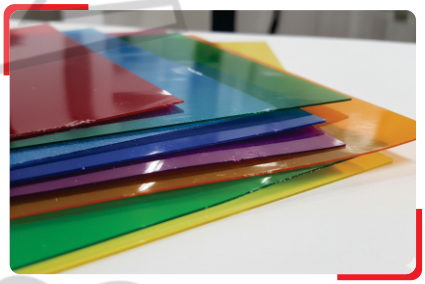
Translucent objects allow light to pass through partially. We cannot see clearly through them and they form faint shadows. Examples include: Tracing paper, tinted glass and coloured plastic sheets, etc.



Let's Think Aloud

Why transparent objects do not form shadows?



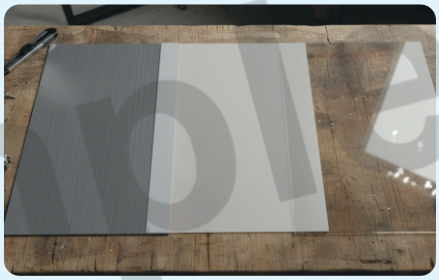


Activity Time!

Objective: To observe how light passes through transparent, translucent and opaque objects and how it affects visibility.

Resources:

- Three objects (aluminium sheet, coloured plastic sheet, transparent plastic sheet)
- Flashlight



Instructions:

- Label the three objects as A, B and C.
- Take three objects which are mentioned in the resources.
  - ✓ Object A – Aluminium sheet
  - ✓ Object B – Coloured plastic sheet

Publishers Sample

✓ Object C – Transparent plastic sheet

- Shine the flashlight on each object and observe the shadows.

Observations:

- Object A forms a dark shadow which shows it is an opaque object.
- Object B forms a blurred shadow which shows it is a translucent object.
- Object C does not form a shadow which shows it is a transparent object.

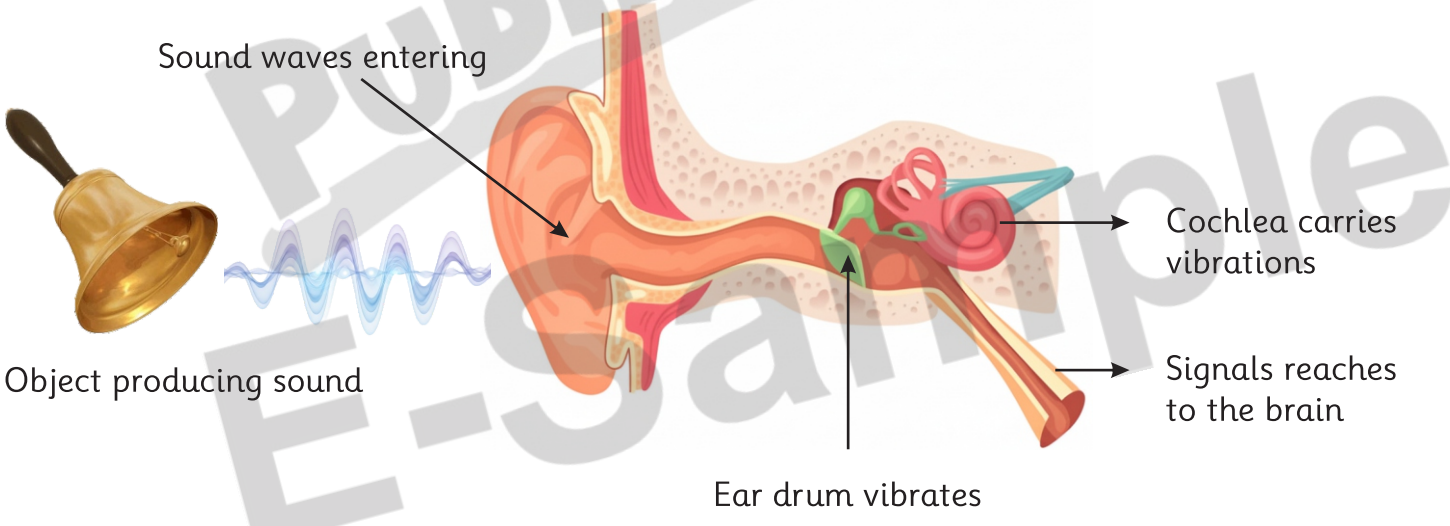
Sound

SciByte

The scientific study of sound waves is called acoustic.

Tap gently on a table. What do you hear? Sound is produced when something vibrates. Vibration means a quick back and forth or up and down movement about a fixed point. For example, when music plays on a speaker, the cone of the speaker vibrates, moving in and out and produces sound waves. These waves travel through the air, reach our ears and are interpreted by the brain as sound. How sound travels through the human ear?

- Sound waves enter the outer ear and pass through the ear canal to the eardrum.
- The eardrum vibrates and sends these vibrations to three tiny bones in the middle ear.
- These bones connect the vibrating ear drum to the inner ear.
- The final bone touches a spiral-structure called the cochlea, which is filled with liquid and tiny hair cells. As the fluid moves, the hair cells send signals to the brain, which interprets them as sound.



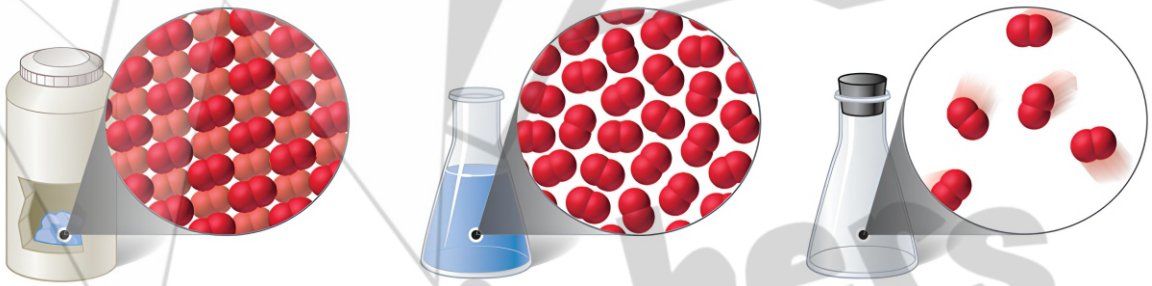
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SciByte

Astronauts use radio devices to communicate in space, because there is no air. Sound cannot travel through a vacuum, it needs a medium like air, water or solids.

Speed of Sound in different States of Matter

Sound travels at different speed in different mediums. It moves fastest in solids, slower in liquids and slowest in gases. In solids atoms are closely packed and have strong intermolecular forces between them. So, when a solid is projected by the vibrations the solid particles that are closer to each other pass the vibration to the next medium. Moreover, the speed of sound in liquid is less then solids and much less in gases then solids because in gases the molecules are far apart from each other. The speed of sound in solids is 5 times greater than in liquids and 15 times greater than in gases.



Solid Liquid Gas

Medium / Material	Speed of Sound
Solid (Iron)	5,000 m/s
Liquid (Water)	1,480 m/s
Gas (Air)	340 m/s

SciByte

Dogs can hear sounds that humans cannot. This is why they are used for security and rescue purposes.

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Intensity of Sound

The intensity of sound determine how the loud or soft sound is. If the intensity of sound is high, it is known as the loudness of a sound. If the loudness of sound increases, the intensity also increases. Loud sounds are unpleasant and make us uncomfortable and we called them noise. Examples include: Banging of hammer, loud speakers and horn of a car.



Banging of hammer



Loud speaker



Horn of a car

If the intensity of a sound is small, it is called soft sound. Playing of piano, bird chirping and wind blowing are considered soft sounds.



Piano



Wind



Bird chirping

Let us understand with the help of an example. When you are on a bus station waiting for the arrival of the bus, you may have noticed that the sound of the horn is not as loud and cannot affect your ears. As the bus comes closer to you, the sound of the horn becomes louder. This is because the intensity of sound varies with respect to its distance. When the distance between sound source and the listener is large, the intensity of sound will be less and vice-versa.





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Harmful Effects of Noise on Human Health

- According to the World Health Organization (WHO), noise is the second largest cause of health problems, after air pollution.
- Loud noise can cause hearing damage or even permanent hearing loss.
- Continuos noise can disturb sleep and cause stress.
- Since the ear is connected to the brain, excessive noise can affect brain function.

Preventive Measures To Reduce Noise Pollution

- Avoid using horns un-necessarily while driving.
- Setup factories and industries away from residential areas.
- Avoid using loud speakers during events.
- Use silencers in vehicles, engines and appliances.
- Watch TV or listen to music at a low volume.







What have you learnt?

- Light and sound are forms of energy.
- Objects that emit light are called sources of light.
- Natural sources emit light naturally. Artificial sources are man-made.
- Luminous objects produce their own light. Non-luminous objects reflect light from other sources.
- Objects which allow some light to pass through them are translucent objects.
- Objects which completely allow light to pass through them are transparent objects.

Wizz Publishers ® Sample

- Objects which completely allow light to pass through them are transparent objects.
- Objects which do not allow light to pass through them are opaque objects.
- Sound is produced by vibrations and travels through solids, liquids and gases.
- Vibration means quick back and forth or up and down movement about a certain point.
- Sound moves fastest in solid and slowest in gases.
- The speed of sound is much greater in solids then in liquids and gases.
- The intensity of sound determines its loudness.
  Unpleasant or unwanted sounds are called noise.

Exercise

1 Choose the correct option.

i. _____ means moving quickly back and forth about a fixed point.

a Vibration
b Propagation
c Reflection
d Refraction

ii. Which of the following is a natural source of light?

a LED bulb
b Fluorescent bulb
c Neon lamp
d Sun

iii. Which of the following objects make a darker shadow?

a Opaque
b Transparent
c Translucent
d None of them

iv. Unwanted sound is called:

a Noise
b Music
c Vibration
d Intensity

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v. Sound cannot travel through:

a Vacuum
b Liquid
c Solid
d Gas

vi. The dark patch formed when light is blocked called:

a Patch
b Shadow
c Glow
d Halo

vii. The intensity of sound waves determines the _____ of sound.

a softness
b sharpness
c loudness
d all of them

viii. The objects which emit their own light are called _____objects.

a non-luminous
b luminous
c transparent
d opaque

ix. The speed of sound in liquid (water) is:

a 343 m/s
b 1480 m/s
c 2000 m/s
d 5120 m/s

x. Which of following are examples of opaque objects?

a Wood, brick
b Frosted glass, Mirror
c Glass, Paper
d Air, Water

2 Underline the correct word.

i. Striking a ball hard makes a _____ sound. **Loud / Soft**

ii. Unpleasant sound is called _____. **Noise / Music**

iii. Coloured glass is an example of _____ object. **Transparent / Translucent**

iv. If the intensity is small it is called _____ of the sound. **Softness / Loudness**

v. Sound cannot travel in _____. **Vacuum / Liquid**

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3 Fill in the blanks.

i. Light and sound are forms of _____.

ii. Spiral shaped structure in inner ear is called _____.

iii. Sound needs a _____ to travel.

iv. The speed of sound is _____ in solids than in liquids.

v. The object which cannot emit light is called _____ object.

4 Identify luminous and non-luminous objects from the following.



_____



_____



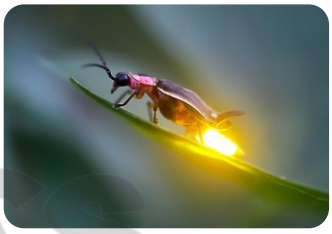
_____



_____



_____



_____

5 Write answers of the following questions.

i. Define light and sources of light.

_____

_____

_____

ii. Define intensity of sound.

_____

_____

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iii. Define noise and give three examples as well.

iv. Justify the statement that sound travels through solids faster than liquid.

v. Write any two effects of noise pollution.

vi. Differentiate between luminous and non-luminous objects.

Luminous objects	Non-luminous objects

vii. Differentiate between natural and artificial source of light.

Natural source	Artificial source

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6 Write detailed answers to the following questions. (On note book)

i. What are transparent, translucent, and opaque objects? Explain in detail with examples.
ii. How do we hear sound?
iii. How can we control noise pollution?

Constructed Response Questions

i. Why we see the image of anything in water?
ii. Why can we hear sounds better in a quiet room compared to a noisey street?



a. Which materials transmit sound the best?

Work with a partner. One person whispers a word through an object while the other listens with their ear against it. Put (✓) if you hear the word clearly or if not (×).

Objects	Word heard correctly (✓/×)

b. Find and list at least 5 objects around you. Classify them as opaque, translucent or transparent.

Materials	Transparent	Translucent	Opaque

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UNIT 7

Structure of the Earth

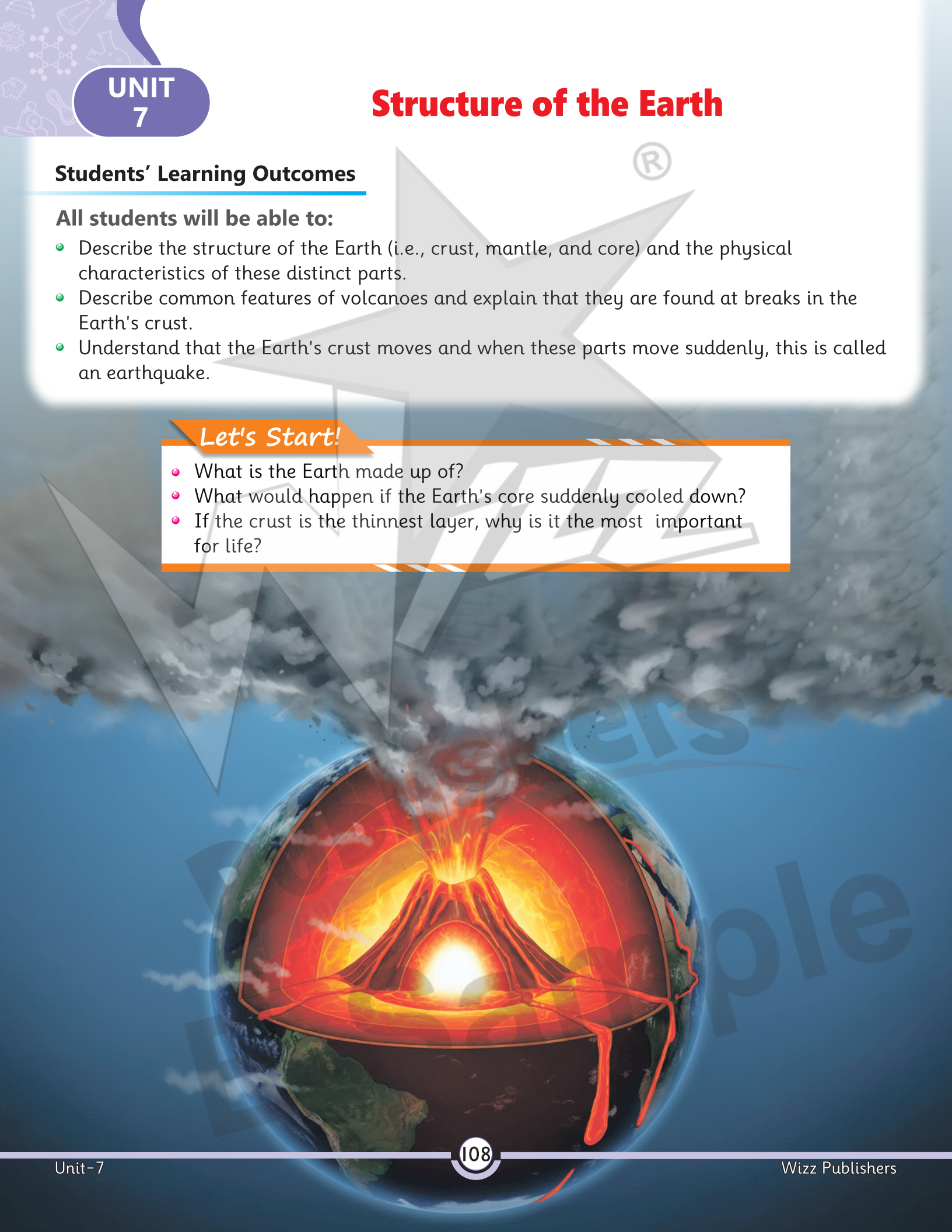
Students' Learning Outcomes

All students will be able to:

- Describe the structure of the Earth (i.e., crust, mantle, and core) and the physical characteristics of these distinct parts.
- Describe common features of volcanoes and explain that they are found at breaks in the Earth's crust.
- Understand that the Earth's crust moves and when these parts move suddenly, this is called an earthquake.

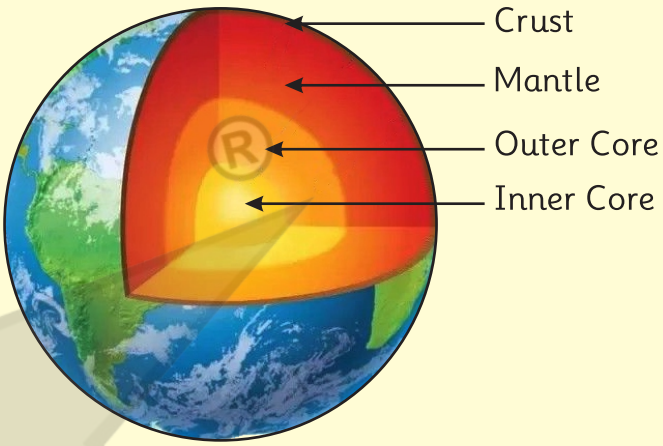
Let's Start!

- What is the Earth made up of?
- What would happen if the Earth's core suddenly cooled down?
- If the crust is the thinnest layer, why is it the most important for life?



The Earth is the third planet in the solar system and the only planet that supports life. Life on Earth depends on several factors such as suitable temperature, availability of water and food. The resources found on Earth and the energy from the sun are the basic needs for life to exist.

Although the Earth looks like a big solid rock, it is actually made up of several layers.



SciByte

Hundreds of years ago, many people believed that the Earth was flat. We know that the Earth is round, but it is not perfectly round. The North and South Poles are slightly flattened, making the shape of the Earth an ellipsoid.

Structure of the Earth

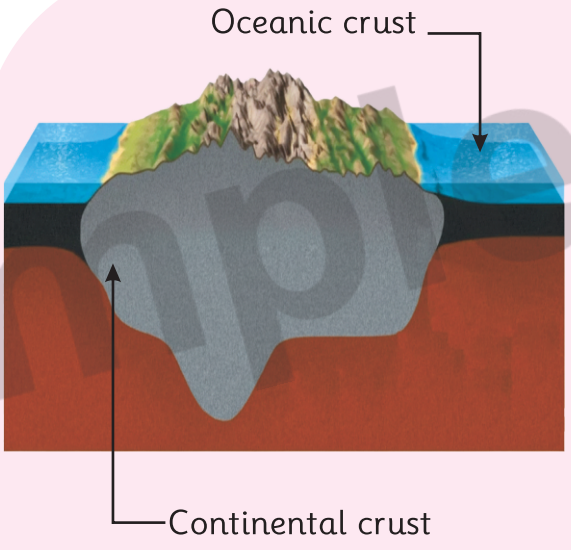
The Earth is made up of three main layers: Crust, Mantle and Core. These layers become denser as they move closer to the center of the Earth.

Let's discuss the physical characteristics of these layers:

a. Crust

The crust is the outermost layer of the Earth. It is like the shell of a hard-boiled egg, which is thin, cool and hard. This is the part of the Earth where we live. It is mostly made of rocks and minerals such as silica and aluminium. The crust makes up only 1% of the Earth's volume. The Earth's crust is divided into two types:

- Continental crust is found under the land, made mostly of rocks.
- Oceanic crust is found under the oceans, thinner but denser than continental crust.



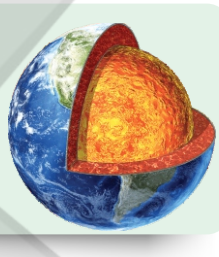
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b. Mantle

The mantle is the thick, hot layer located between the crust and the core. It makes up about 84% of the Earth's volume and contains minerals such as iron, magnesium and silicon. The upper mantle is solid, while the lower mantle is softer because minerals begin to melt as temperature increases.

SciByte

The upper part of the mantle and the crust together form the lithosphere.



c. Core

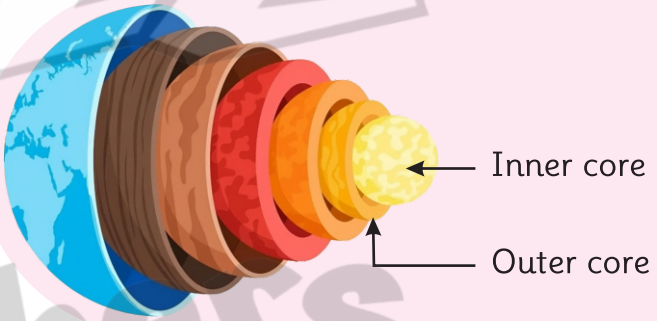
Beneath the mantle lies the core, which consists of two parts:

i. The Outer Core

The outer core surrounds the inner core. It is made mostly of molten iron and nickel. This layer is liquid because temperature is very high at this core.

ii. The Inner Core

The innermost part of the Earth is extremely hot and solid, also made up of iron and nickel. It is as hot as the surface of the sun.



The magnetic field will disappear, exposing Earth to harmful solar radiation if the Earth's core cools down. Earthquakes and volcanoes would also stop because the crust would no longer move.

Let's Think Aloud

The Earth's crust is made up of rocks. There are three main types of rocks: igneous, metamorphic and sedimentary. Find out about each of these rocks and note how they are different from one another.

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Valcano

In the deeper parts of the Earth there is molten matter which is known as magma. This magma always tries to come out from the internal parts the Earth. When magma finds passage in the form of crack or fault, it rushes upwards. It blasts the weaker parts of the Earth's surface and comes out on the surface. When magma reaches the Earth's surface, it is called lava. Lava can be as hot as 2,200°F (I,204°C).

Activity Time!

Objective: a. Make a model showing the layers of the Earth using plasticine or coloured clay to represent each layer.
b. Let's learn more about volcanoes with the help of following activity:

Resources:

- Soda bottle

Instructions:

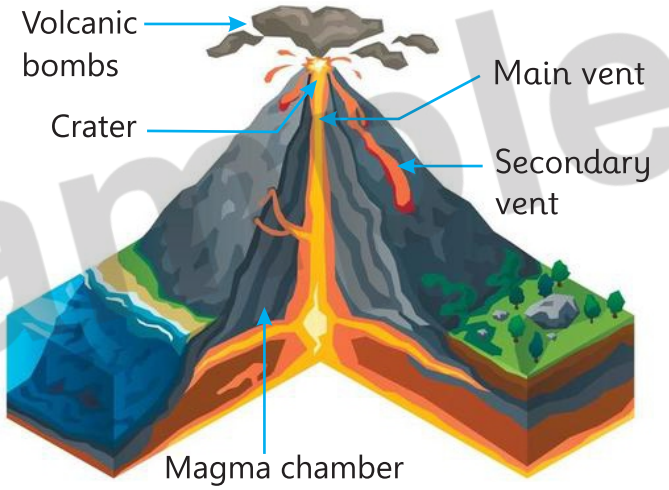
- Shake the bottle of soda hard.
- Observe that gas bubbles forming inside, creates the pressure.
- Open the cap, as soon as you remove the cap, the liquid shoots out with pressure quickly due to build up pressure.

Just like the soda bottle, a volcanic eruption occurs when pressure builds inside the Earth. Gas bubbles create in magma until they escape through cracks in the Earth's crust, causing the volcano to erupt.

Features of Volcano

The main features of a volcano are shown in the given diagram below:

- The magma chamber (it is a large underground pool of magma).
- Main vents (the central passage through which magma rises).
- Craters (volcanoes typically have a bowl-shaped opening at the top).

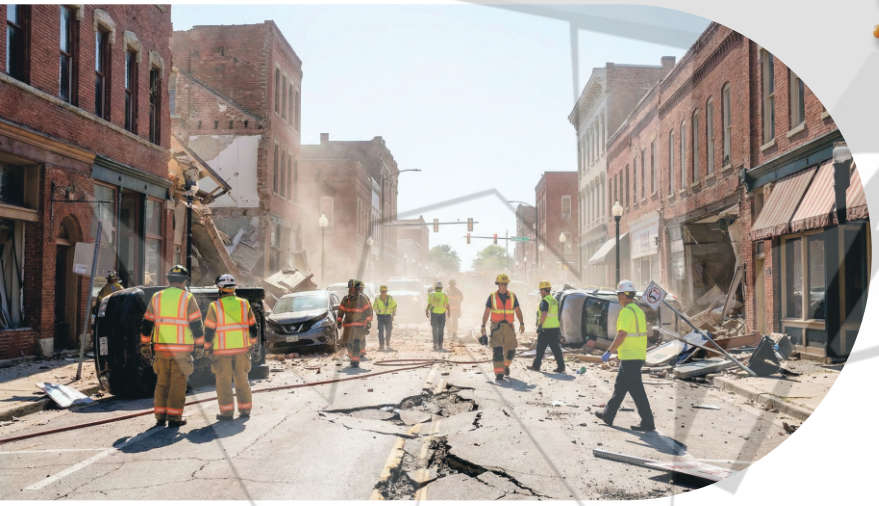


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Earthquakes

The Earth's crust and upper mantle together make up the lithosphere, which is broken into large slabs called tectonic plates. Tectonic plates are constantly shifting as they drift around on the viscous, or slowly flowing, mantle layer below.

This non-stop movement causes a stress on Earth's crust. When the stress gets too large, it leads to cracks called faults. When tectonic plates move, it also causes movements at the faults. An earthquake is the sudden movement of Earth's crust at a fault line.



SciByte

The energy from an earthquake travels through the Earth in vibrations called seismic waves, which scientists record using an instrument called a seismometer. A seismometer detects seismic waves and records them as a series of zig-zags.

What have you learnt?

- The interior of the Earth is divided into three main layers: crust, mantle and core.
- The core is the innermost part of the Earth.
- The mantle is a thick, hot layer beneath crust.
- The crust is the outermost layer where we live.
- Magma is hot, molten rock found beneath the surface of the Earth.
- When magma reaches the surface it is called lava.
- A volcano is an opening in the Earth's crust through which magma erupts.
- An earthquake is the sudden movement of Earth's crust at a fault line.

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Exercise

1 Choose the correct option.

i. Our Earth is the _____ planet from the Sun.

a third
b fifth
c fourth
d sixth

ii. The crust makes less than _____ of the total Earth's mass.

a 1
b 5
c 3
d 7

iii. A volcano is a place where _____ comes out from inside the Earth.

a water
b air
c magma
d sand

iv. On which layer of Earth do we live?

a Inner core
b Mantle
c Outer core
d Crust

v. What is the correct order of the Earth's layers?

a Mantle, Core, Crust
b Crust, Core, Mantle
c Mantle, Crust, Core
d Crust, Mantle, Core

vi. Which layer of the Earth is the hottest?

a Inner core
b Mantle
c Outer core
d Crust

vii. What is the opening at the top of a volcano called?

a Crater
b Valley
c Cave
d Peak

viii. When magma reaches the Earth's surface it is called _____.

a Lava
b Gas
c Oil
d Petrol

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ix. Mantle makes up _____ persent volume of Earth's volume.

(a) 74 (b) 84

(c) 94 (d) 4

x. Core is made up of.

(a) Iron and steel (b) Copper and iron

(c) Copper and nickel (d) Iron and nickel

2 Write 'T' for true and 'F' for false statement.

i. The crust is the hottest layer of the Earth. _____

ii. The inner core is composed of liquid iron. _____

iii. Magma becomes lava when it reaches the surface of the Earth. _____

iv. An earthquake is the sudden movement of Earth's crust at a fault line. _____

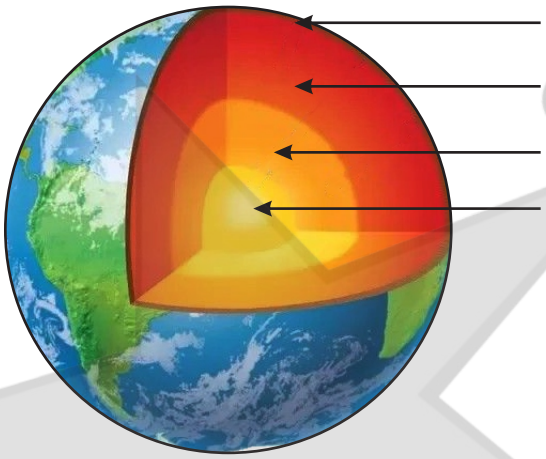
v. The Earth crust and core makes up the lithosphere: _____

3 a. Label the diagram of a volcano.



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b. Label the diagram of the layers of the Earth.



4 Write answers of the following questions.

i. What are the reasons that living organisms survive on Earth.

ii. Differentiate between continental and oceanic crust.

Continental crust	Oceanic crust

iii. Arrange the layers of Earth, from the inner side to the outer side.

iv. What are the characteristics of the Earth's inner core?

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v. Differentiate between lava and magma.

Lava	Magma

vi. Define earthquake.

vii. What are tectonic plates?

viii. Which layer of Earth is mostly made up of iron?

5 Write detailed answers to the following questions. (On note book)

i. Explain the physical characteristics of the layers of Earth.
ii. Define volcano and explain the physical features of volcano.

Constructed Response Questions

i. Why is the Earth called the blue planet?
ii. What would happen if the temperature of the crust were as high as that of the core?

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UNIT 8

The Soil

Students' Learning Outcomes

All students will be able to:

- Identify similarities and differences among different types of soils and classify them based on their clay, sand and organic content.
- Investigate the composition and characteristics of different soils.
- Explain how soil composition can change and how it hinders plant growth.
- Identify various causes of soil pollution.
- Recognize professions related to Earth Science such as paleontologists, seismologists and geologists.

Let's Start!

- Why is soil important for life on Earth?
- Why is there a difference in the absorption of water in the soil of different areas?
- What are some sustainable practices for soil conservation?



Soil

Soil is a thin layer of material on the Earth's surface where plants grow. It is a precious natural resource formed through weathering (the gradual breakdown of rocks) by the Sun's heat, wind, water and rain.

Soil provides nutrients, water and shelter for plants and small organisms.

Activity Time!

Objective: To observe and compare how different soil types affect plant growth under similar conditions.

Resources:

- 2 pots
- Soil samples from different areas (school ground and crop filed)
- Rose plants

Instructions:

- Take two pots.
- Fill one pot with soil from the school ground and the other pot with soil from the crop field.
- Plant a rose in each pot and place both under similar conditions for one week. After a week, observe which plant grows better.
- The plant in the crop field soil usually grows faster because of the higher nutrient content.
- The school ground soil is drier and contains fewer nutrients.

Types of Soil

There are three main types of soil:

a. Sandy Soil

Sandy soil is a soil formed from the breakdown of rocks and it is found in deserts. Sand has large, rough particles visible to the naked eye. It drains water quickly and has low nutrients, making it less suitable for plant growth.

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One table spoon of soil contains more microorganisms then the total number of people on Earth.

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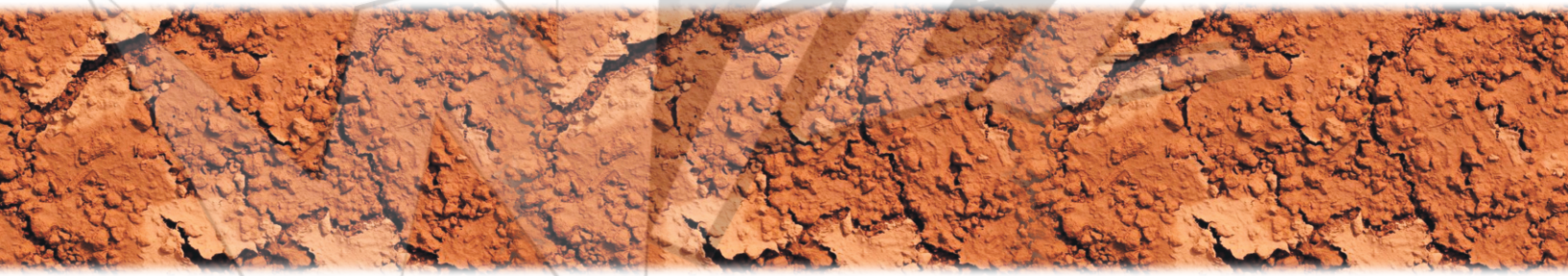
b. Silty Soil

Silty soil has medium sized particles with spaces that hold some water. This soil is smooth in texture and retains more moisture than sand. It is suitable for gardening and growing plants.



c. Clayey Soil

Clayey soil has the smallest particles packed tightly together with little air space. It retains water well but drains poorly. It is very sticky when wet and smooth when dry. Clayey soil is commonly used by potters to make pots.



Composition of Soil

A healthy soil consists of:

- Mineral particles
- Organic matter (humus)
- Water
- Air

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Loam is considered the fourth type of soil. It is a mixture of sand, silt and clay that combines the benefits of all three types.



Each type of soil has different characteristics.

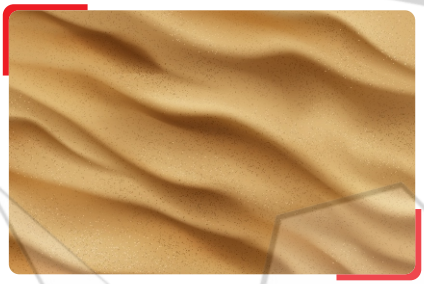
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Characteristics of soil

Soil can be described by its texture, colour, ability to hold water, moisture and amount of air.

a. Texture

Texture depends on the size of soil particles. Texture is a measure of whether the soil is more like sand, silt or clay. The more like sand a soil is, the less water it can hold. But the more like clay a soil is, the more water it can hold. Sandy soil feels rough and holds less water. Silty soil feels smooth and holds moderate water. Whereas, clayey soil feels sticky and holds maximum water.



Sandy soil



Silty soil



Clayey soil

b. Colour of soil

Soil colour indicates the minerals present in it:

- Red colour shows more iron.
- Grey colour shows more quartz.
- Green colour shows more potassium.
- Black colour shows more manganese.
- Dark brown colour shows more humus, which is best for plants.



Red soil



Grey soil



Green soil



Black soil



Dark brown soil

c. Water Absorption

Another property of the soil is the absorption of water. Soil absorbs water because it percolates through the soil, the process in which water passing down slowly through soil called percolation. Different soils have different percolation rates.



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Let's Think Aloud

Why do you think sandy soil absorbs water faster than clayey soil?

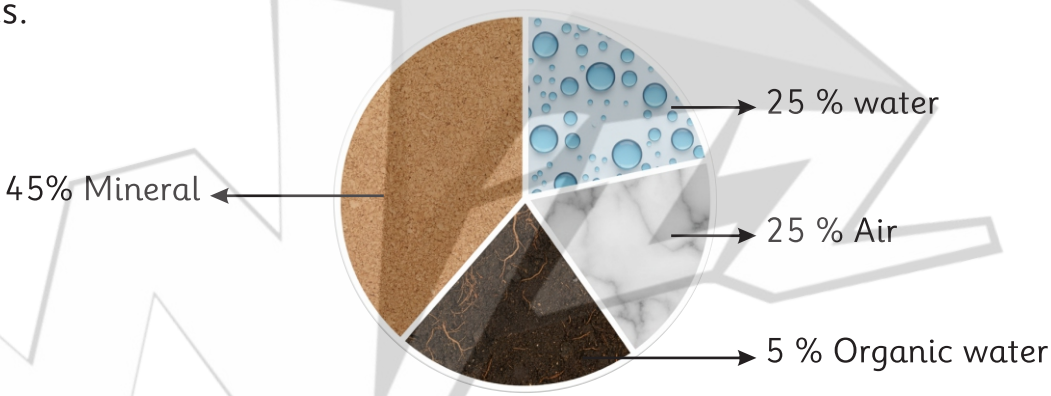


d. Moisture content

Moisture is the amount of water stored around soil particles. Clayey soil stores more moisture than sandy soil.

e. Amount of Air

Air fills spaces between soil particles, providing oxygen for roots and living organisms. Sandy soils have larger air spaces, while clayey soils have smaller ones.

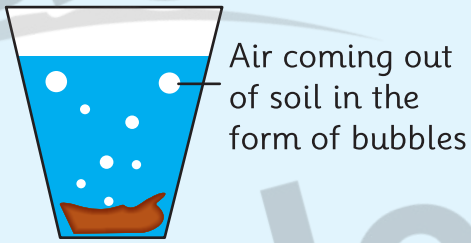


Activity Time!

Objective: To observe that soil contains air.

Resources:

- Glass
- Dry fertile soil
- Water



Instructions:

- Fill one third of the glass with dry fertile soil and press it gently.
- Pour water into the glass until its full.

Observe bubbles forming on the surface. What do you conclude?

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Bubbles are formed in the water because when water takes spaces between the soil particles, it pushes out the air from spaces. The air comes up on the water surface as bubbles. Therefore, we can say that soil contains air.

Soil Pollution

Soil pollution is the degradation of soil due to human activities, misuse of land or climate change. It reduces soil fertility and affect plants and animals life.



Causes of Soil Pollution

a. Deforestation

Large scale cutting of trees exposes land to erosion. It is defined as when wind or water slowly takes away soil from one place and moves it to another.

b. Solid waste

Land also becomes polluted by household garbage and industrial waste.

c. Sewage treatment

Commercial or industrial waste is a major contributer to soil pollution.

d. Industrial sources

Paints, chemicals, metals and plastics that are produced in the process of manufacturing goods also cause soil pollution.

Effects of Soil Pollution

a. Ecosystem damage

The healthy ecosystem is threatened and disrupts by soil pollution.

b. Health

There are many pollutants in the soil that can be very harmful when exposed to humans over a long period of time.

c. Vegetation

Soil pollution affects vegetation badly and reduces plant growth and soil fertility.

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Ways to Reduce Soil Pollution

- People should be educated about proper waste disposal.
- Instead of buying new ones, reuse materials like clothing, bottles, wrapping paper and bags.
- Dispose of litter responsibly.
- Promote recycling and tree plantation.

Professions Related to Earth Science

- Paleontologist is a scientist who studies the history of life on Earth through the fossil record.
- Seismologist studies earthquakes and their waves to figure out the Earth's structure and composition.
- Geologist is a scientist who studies the Earth, its history, nature, materials and processes.



What have you learnt?

- Soil is the thin layer of material on the Earth's surface where plants can grow.
- Weathering is the process through which soil forms slowly, from the gradual breakdown of rocks.
- Soil is of three main types: sandy soil, silty soil and clayey soil.
- Soil contains minerals, humus, air and water.
- Soil pollution is defined as degradation of soil as a result of human activities, misuse of land or climate change.

Exercise

1 Choose the correct option.

i. Which of the following is not a type of soil?

a Clay
b Silt
c Sand
d Cement

ii. Which soil has the largest particles?

a Sand
b Humus
c Silt
d Clay

iii. Which soil holds the most water?

a Sand
b Clay
c Silt
d Loam

iv. Soil forms through the gradual breakdown of rocks in a process called:

a Decomposition
b Erosion
c Cutting
d Weathering

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v. Which soil is best for plant growth?

a Sandy
b Silt
c Clayey
d Loam

vi. Red coloured soil contain more:

a Potassium
b Iron
c Manganese
d Quartz

vii. In which type of soil, water flows quickly?

a Loam
b Clay
c Sand
d Silt

2 Fill in the blanks.

i. _____ soil can be moulded into different shapes when it is wet.

ii. _____ is the mixture of sand, silt and clay.

iii. Alteration in natural soil is called _____.

iv. _____type of soil feels rough when it is touched.

v. _____ is the thin layer of materials on the Earth's surface where plants can grow.

3 Match the given professions with this appropriate description.

Column A	Column B
Paleontologist	A person who studies the earthquake to figure out the Earth's structure.
Seismologist	A person who studies the history and nature of Earth.
Geologist	A person who studies the history of life on Earth through fossil records.

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4 **Draw a pie chart of the composition of soil.**

5 **Write answers of the following questions.**

i. What is soil? Why is it important?

ii. How is clay soil important for humans?

iii. Define weathering.

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iv. Define soil pollution.

v. List atleast three ways to reduce soil pollution.

vi. How does the amount of air affect the soil quality?

6 Write detailed answers to the following questions. (On note book)

i. Describe the main types of soil and how they differ?

ii. State causes and effects of soil pollution.

Constructed Response Questions

i. Visit a nearby farm and interview a farmer. Ask what would happen if materials like plastics or glass were mixed with natural fertilizers. Record your observations.

ii. Can you think of a way to make poor quality of soil more fertile?

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UNIT 9

Space and Satellite

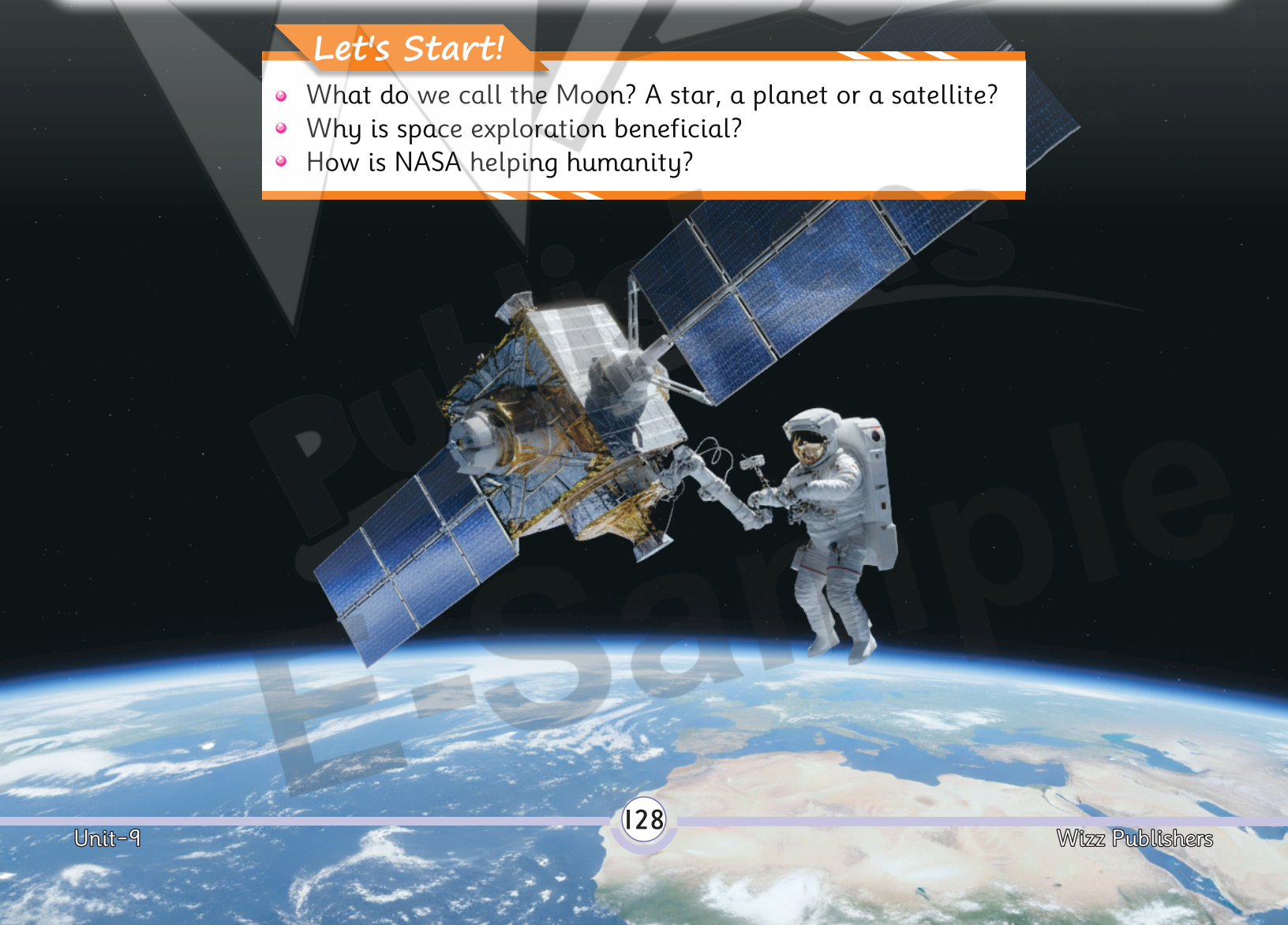
Students' Learning Outcomes

All students will be able to:

- Know that a satellite is an object in space that orbits a larger object and that a moon is a natural satellite that orbits a planet.
- Describe the natural satellites of the planets of the Solar System.
- Define artificial satellites and explain their importance in exploring the Earth and space.
- Recognize the role of NASA (National Aeronautics and Space Administration) and explore the contribution of SUPARCO in space exploration.
- Predict and comprehend how astronauts explore space, survive and conduct research in space.
- Identify using secondary sources the key milestones in space technology over the past 10 years.
- Identify professions related to Earth and space science, such as astronauts, physicists and space scientists.

Let's Start!

- What do we call the Moon? A star, a planet or a satellite?
- Why is space exploration beneficial?
- How is NASA helping humanity?



Public Sample

The Earth is surrounded by a layer of gases called the atmosphere. Space begins about 100km above the Earth's surface, where there is no air or atmosphere .



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The vast region between the stars and galaxies is called outer space. It is almost a complete vacuum with no air to breath and no sound.

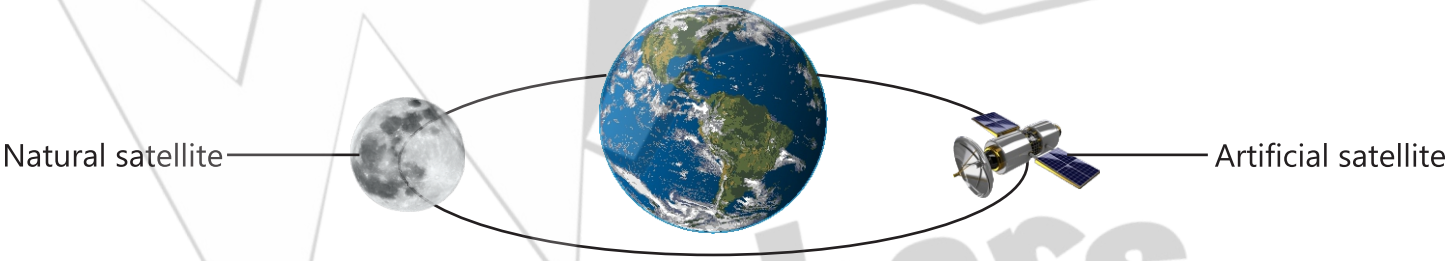
Let's Think Aloud

Why do we see Venus, Mars and Jupiter easily without a telescope?

Let's take a look at the Earth's nearest neighbours:

a. Natural Satellites

A satellite is an object that orbits around another object in space. Natural satellites are not man made. Moon is an example of natural satellite. Each planet revolves around the Sun, while moons revolves around planets.



The following list shows the number of moons of each planet of our solar system:

Sr. No.	Planet	Number of Moons
1	Mercury	0
2	Venus	0
3	Earth	1
4	Mars	2
5	Jupiter	95
6	Saturn	146
7	Uranus	28
8	Neptune	16

Let's Think Aloud

Why are artificial satellites sent to space?

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b. Artificial Satellites

An artificial satellite is a man-made object placed in orbit around the Earth or another planet to collect data or assist communication. Today, there are over thousand active satellites orbiting the Earth. The size, height and design of a satellites depend on their purpose.

Uses of Artificial Satellites

Let us look more closely at some examples of artificial satellites and what are they used for.

a. Weather Satellite



Weather satellites capture images of clouds, wind and storms They help predict weather and natural disasters.

A weather satellite orbits the Earth in North to South direction at a height of about 800 km, passing over the same point twice daily.

Communication Satellite

Communication satellites also known as low Earth orbiting satellites because they move very near in the Earth's orbit. These satellites allow us to communicate with people which are far away from us. They enable live broadcast of global events such as the Olympics.



There are more than 2,000 communications satellites in the Earth's orbit which are currently active.

Global Positioning System (GPS)



Global Positioning System (GPS), is a system of satellites designed to help navigate on the Earth, in the air and on water. It gives accurate information which comes from all over the world and is passed on to us through satellites. The GPS receives information from several satellites in space which is established by twenty-four satellites at a height of 400 km orbiting the Earth in six sets.

SciByte

The GPS system uses 24 working satellites and 3 backups, in case one stops functioning.

Space Exploration and Technology



Humans have always been curious about space. Exploring the space helps us to learn about our universe and develop new technology. Technology is the application of scientific knowledge to create tools like space shuttle, which makes space travel possible.

Space exploration is important because it:

- Helps us learn about the world we live in.
- Leads to inventions that improve daily life.
- Drives advancements in communication, navigation and medicine.

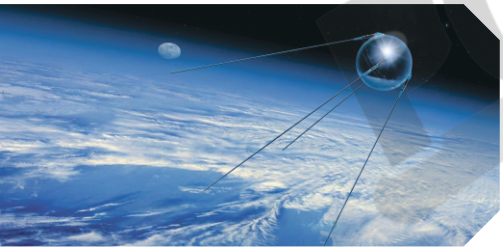
SciByte

An astronaut is a person who is trained to travel and work in space.

Role of NASA in Space Exploration

Have you ever heard about NASA?

NASA stands for National Aeronautics and Space Administration which is a U.S. government agency that is responsible for air and space research. The Space Exploration Journey started in 1957 with the launch of the Soviet satellite Sputnik-1. The agency was created to oversee U.S. space exploration and aeronautics research.



NASA has contributed to the advancement of space related industries that have a broad impact on our daily lives. NASA has made major contributions to world changing industries like satellite telecommunications, GPS, remote sensing, and space access.

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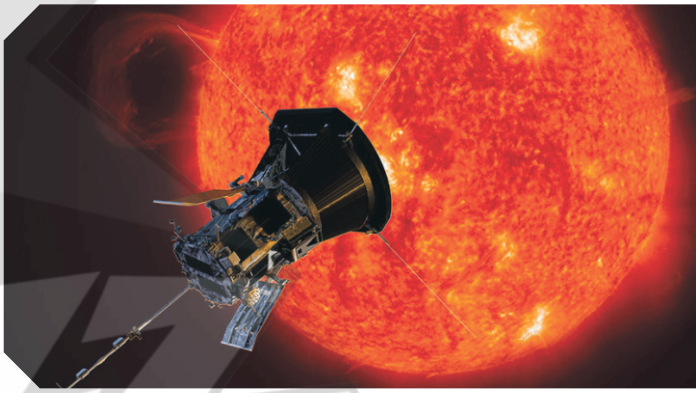
Scientists have believed that there are some experiments which we cannot perform on the Earth. To perform such experiments into space, NASA launched a space station called Skylab on May 14, 1973. This space station remained orbiting the Earth for about six months.

SciByte

The study of Earth from orbiting satellites is called remote sensing.

Interesting Information!

NASA has launched some robotic space probes which have visited every planet in the solar system. These robotic space probes also launched at several other celestial bodies. These probes have sent data of these celestial bodies, which is used to understand the formation of the space.



Milestones in Space Technology

Sr. No.	Date	Event
1	Oct 4, 1957	First artificial Sputnik-1 was launched.
2	April 12, 1961	Yuri Gagarin, first human, orbited the Earth.
3	July 20, 1969	Neil Armstrong, first human, walked on the Moon.
4	April 19, 1971	First space station launched.
5	July 20, 1976	First spacecraft landed successfully on Mars.
6	April 25, 1990	Hubble, space telescope placed in orbit.
7	July 1, 2004	First spacecraft orbited Saturn.
8	August 6, 2012	Mars, rovers landed on Mars.
9	July 14, 2015	First spacecraft flew by Pluto.
10	Feb 18, 2021	NASA's perseverance rover landed on Mars.

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Let's Think Aloud

Do you know the name of the first satellite launched by Pakistan?

What have you learnt?

- Space begins beyond Earth's atmosphere.
- NASA (National Aeronautics and Space Administration) is a U.S. government agency for air and space research.
- A satellite is an object that orbits a bigger mass. The Moon is Earth's natural satellite.
- Artificial satellites are man-made body and help in communication, GPS and weather forecasting.
- Space exploration teaches us about the universe and promotes scientific progress.

Exercise

1 Choose the correct option.

i. The invention of _____ made it possible to travel beyond into the space.

a rocket
b telescope
c aeroplane
d parachute

ii. NASA is a _____ government agency.

a USA
b UAE
c UK
d UN

iii. Sputnik-I was launched on:

a Oct. 4, 1957
b Oct. 6, 1957
c Oct. 5, 1957
d Oct. 7, 1957

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iv. Skylab was launched on:

a May 14, 1973
b May 16, 1973
c May 15, 1973
d May 17, 1973

v. GPS stands for:

a Global Positioning System
b Google Positioning System
c Global Production System
d Global Product System

vi. The planet which has the height number of moons is:

a Neptune
b Saturn
c Uranus
d Earth

vii. These planets do not have any natural satellites:

a Mars and Jupiter
b Saturn and Neptune
c Mercury and Venus
d Earth and Uranus

viii. We can get information from internet. This is possible due to:

a GPS satellites
b Geo-stationary satellites
c Communication satellites
d Weather satellites

ix. Astronauts landed on the Moon for the first time in:

a 1955
b 1969
c 1965
d 1959

x. The first artificial satellite was:

a Apollo
b Spitzer
c Hubble
d Sputnik-I

xi. The satellite which is used to find the exact location of a person is:

a GPS satellite
b Geo-stationary satellite
c Communication satellite
d Weather satellite

xii. GPS constallation requires minimum_____operational satellites.

a 21
b 22
c 23
d 24

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2 Write 'T' for true and 'F' for false statement.

i. The Soviet Union launched Sputnik-1 on October 4, 1957. _____

ii. Skylab orbited Earth for about six months. _____

iii. The Moon is an artificial satellite of Earth. _____

iv. Artificial satellites help in disaster management. _____

v. Weather satellites pass over the same position once every 12 hours. _____

vi. GPS helps people find routes and destinations. _____

vii. Neil Armstrong was the first man to walk on the Moon. _____

3 Draw a weather satellite orbiting the Earth.

4 Write answers of the following questions.

i. Define space.

_____

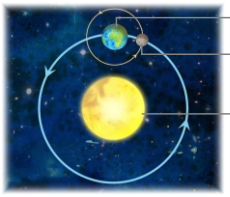
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ii. Why and who created NASA?

iii. Moon is a satellite because it revolves around the Earth. Is Earth a satellite too? Give reason.



iv. Why are artificial satellites important?

v. How many planets are there in a Solar system? Write their names.

vi. Highlight the role of NASA in space exploration.

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vii. Differentiate between natural and artificial satellites.

Natural satellites	Artificial satellites

5 Write detailed answers to the following questions. (On note book)

i. How does GPS help us?
ii. Explain the importance of communication satellites.

Constructed Response Questions

i. Can you imagine a world without GPS? How would it impact our daily lives?
ii. If humans wants to build a colony on the Moon or Mars, how would satellites help make this possible?



a. Research what project SUPARCO Pakistan's space agency is currently working on.

b. Satellites come in different shapes and sizes. Research why this is so, then build a simple cardboard satellite model.

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