Wizz World of SCIENCE

GRADE 4



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.

WHY WIZZ PUBLISHERS?

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- Backed by practical experience and critical analysis for over 30 years.
- Developed, designed and printed with the latest and modern techniques.
- 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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Wizz World of SCIENCE

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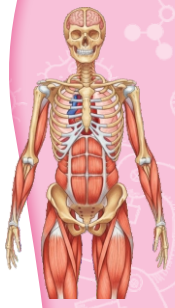
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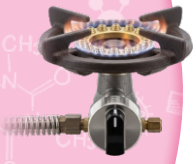
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UNIT 1A

Life Processes of Plants and Animals

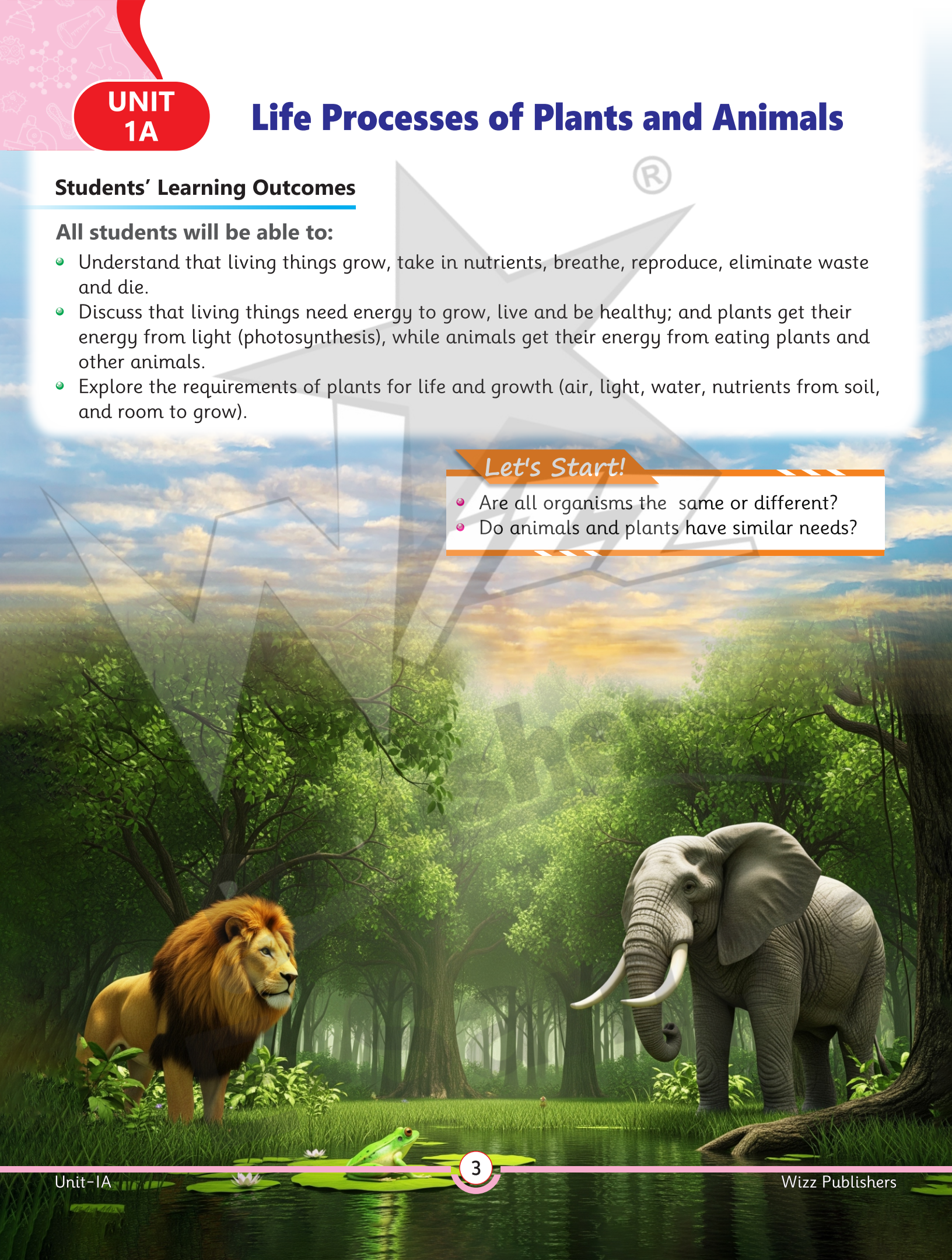
Students' Learning Outcomes

All students will be able to:

- Understand that living things grow, take in nutrients, breathe, reproduce, eliminate waste and die.
- Discuss that living things need energy to grow, live and be healthy; and plants get their energy from light (photosynthesis), while animals get their energy from eating plants and other animals.
- Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow).

Let's Start!

- Are all organisms the same or different?
- Do animals and plants have similar needs?



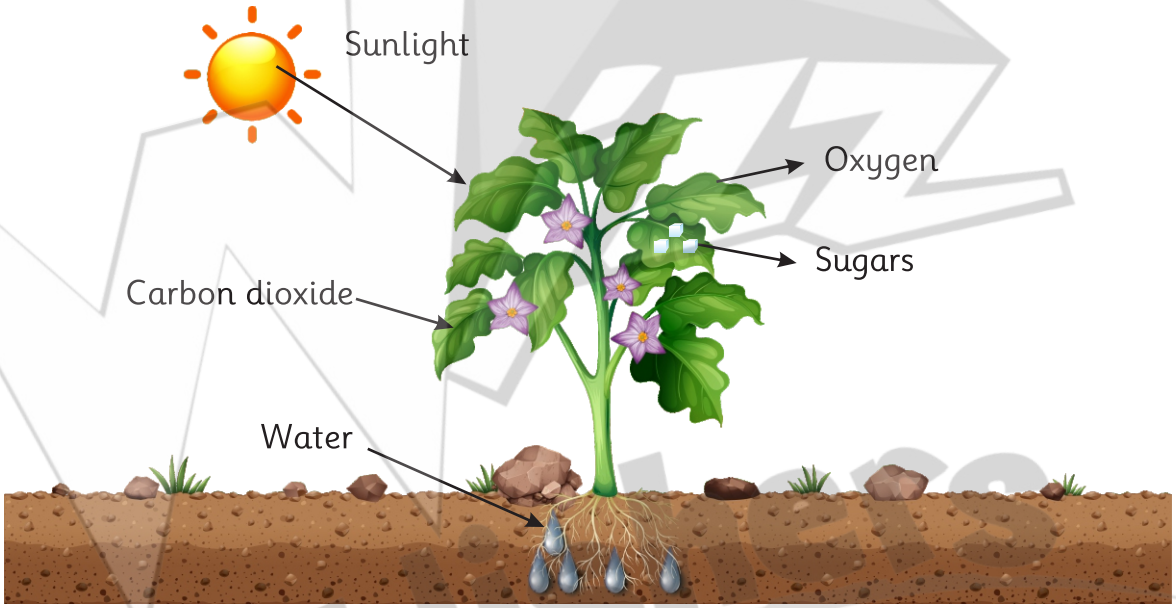
Characteristics of Living Things

All living things need energy to grow, live and stay healthy. They get this energy from the food. Energy is defined as the ability to do work.

Humans and animals get their energy by eating plants or other animals. But what about plants? Where do they get their energy from?

Plants are amazing organisms because they can produce their own food through a process called photosynthesis.

Photosynthesis is the process in which plants use water, carbon dioxide and sunlight to make food (in the form of sugar) and release oxygen.



Sunlight

Water (from soil) + Carbon dioxide (from air) ⟶ Food (in the form of sugar) + Oxygen

SciByte

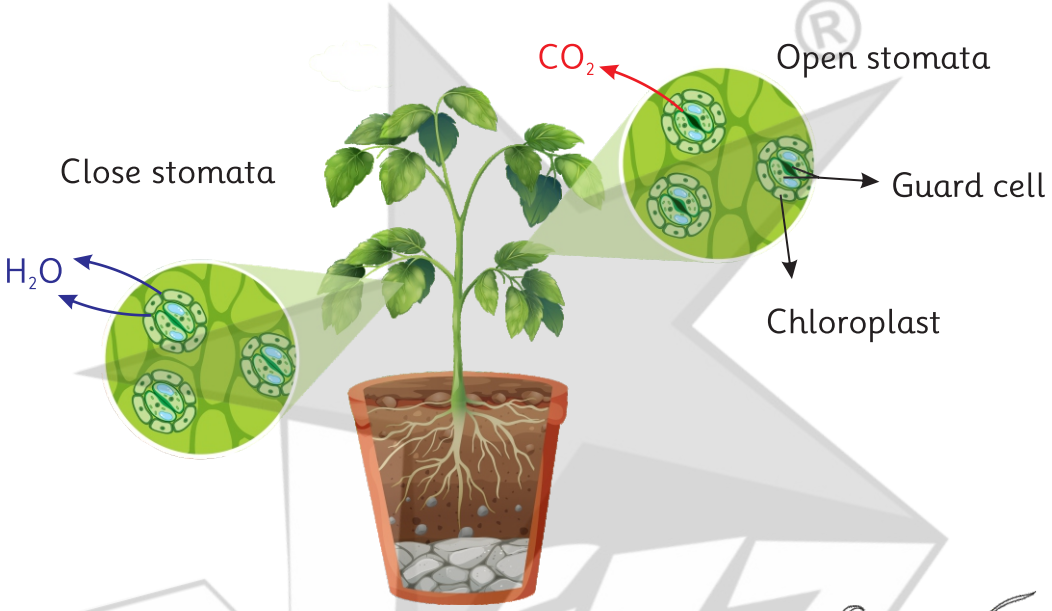
All living organisms on the Earth are made up of small units called cells.

All living things grow, take in nutrients, breathe, move, reproduce, eliminate waste and die. Both plants and animals are living, but they show these characteristics in different ways. Following are the characteristics of living things:

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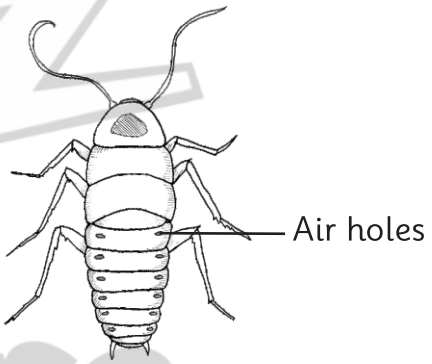
a. Breathing

Animals and plants can breathe differently. Plants exchange gases through tiny pores in their leaves called stomata.



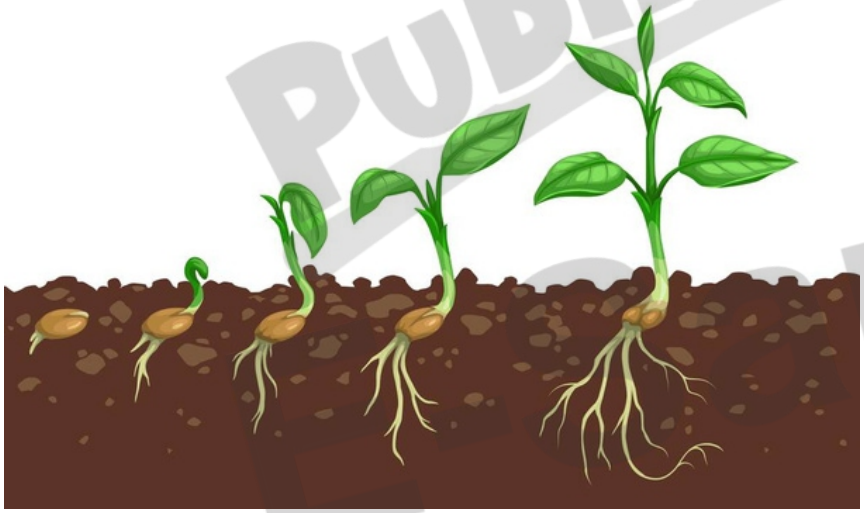
On the other hand, humans and animals take in oxygen and release carbon dioxide through their nose.

Insects like grasshopper and cockroach breathe through air holes in their bodies.



b. Growth

All living things grow. Plants grow throughout their lives. While animals grow only upto a certain stage.



SciByte

The Lungfish breathes through gills in water, but in dry conditions, it uses lungs to breathe air.



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The blue whale is the largest animal on Earth. It can grow upto 30 metres in length. An adult blue whale eats about 3600kg of krill a day.



c. Reproduction

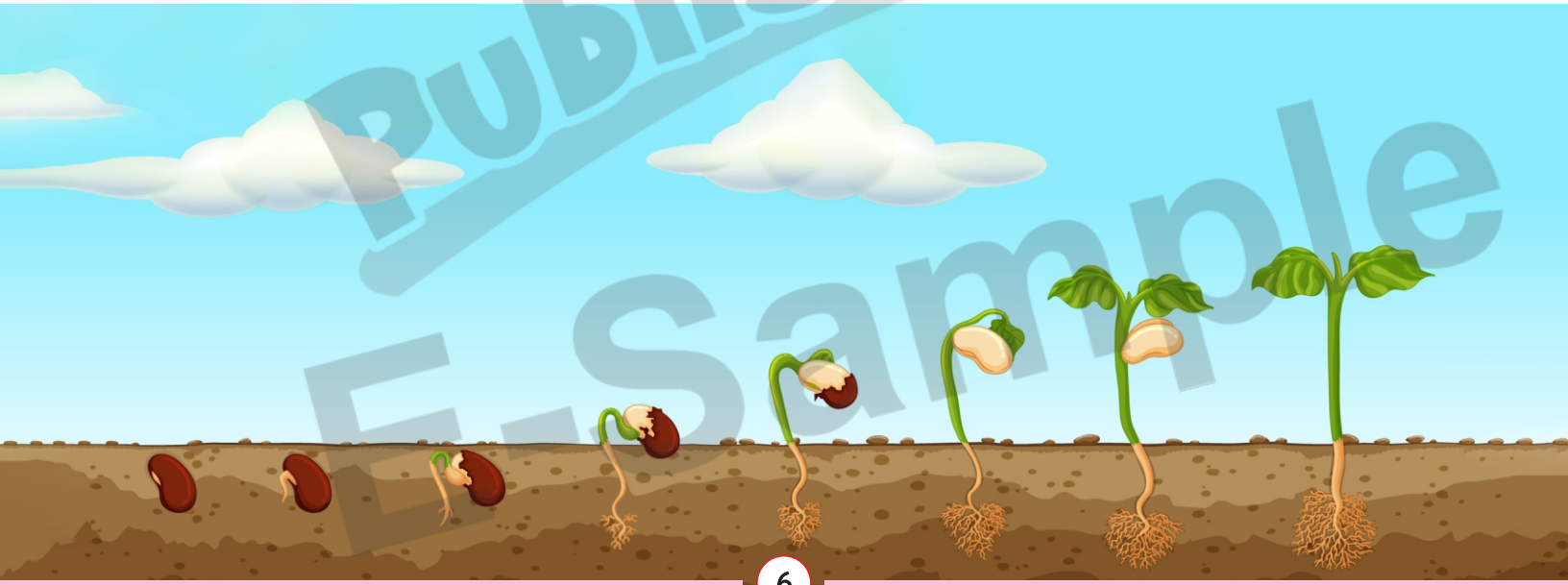
Reproduction is the process by which living things produce more of their own kind. Some animals lay eggs e.g., hen, fish, lizard, tortoise, crocodile, snakes etc. Other animals give birth to live young ones, e.g., cats, dogs, humans, etc.







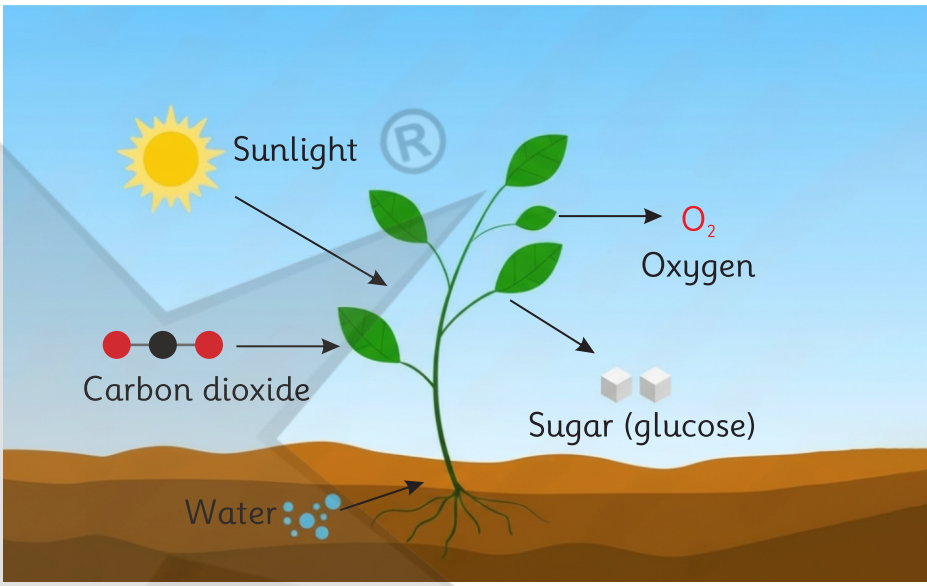

Most plants reproduce with the help of their seeds.



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d. Nutrition

Living things need food and water to survive. Animals cannot make their own food; they depend on plants directly or indirectly.



Plants have a green pigment called chlorophyll. Using sunlight, carbon dioxide, and water, they make food through a process called photosynthesis.

e. Death

All living things have a life cycle that starts with birth, grows through different stages, and eventually ends in death. Death means they no longer grow, move or breath.

f. Movement

Animals move from one place to another to find food, shelter and safety. Animals like cows, lions and dogs move with the help of their legs. Birds and some insects fly with their wings.





Plants cannot move from one place to another but parts of a plant exhibit movement. For example: the sunflower turns towards the sun.



E-Sample

g. Excretion

Excretion means removing waste from the body to get rid of waste products. Plants produce waste products in the form of two gases i.e. oxygen during photosynthesis and carbon dioxide during respiration. They excrete these gases through stomata. Animals have an excretory system to excrete through.

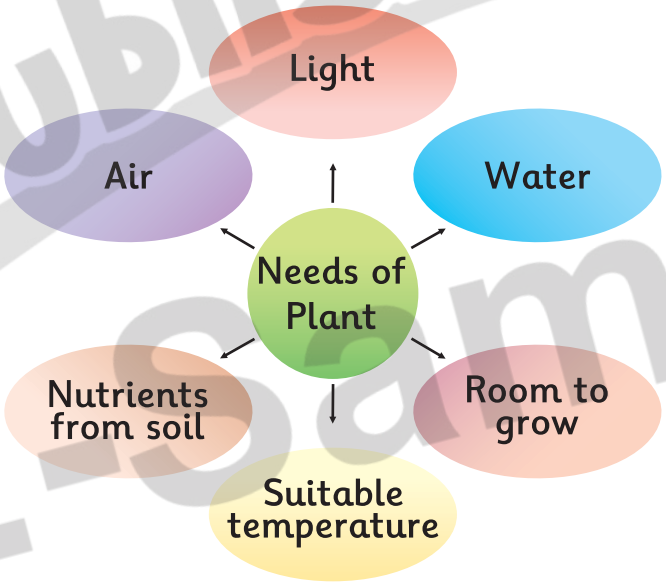


List at least five things at your home. Sort them into living and non-living things on the basis of their characteristics. One example has been done for you.

Things	Does it breathe?	Does it excrete?	Does it move on its own	Does it reproduce?	Does it breathe?	Does it need food?	Is it Living?	Is it Non-living?
Door	×	×	×	×	×	×	×	✓

Plants Requirement for Life

Like humans and animals, plants are also living organisms. Although they are different, but they also have some needs like air, light, water, nutrients, temperature and room to grow, for their survival.



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What have you learnt?

- Energy is what helps living things work, grow and move.
- Living things are classified into humans, plants, animals and microorganisms.
- Plants make their own food by photosynthesis.
- Plants have special pores called stomata for exchange of gases.
- Animals get energy by eating plants or other animals.
- Reproduction helps living things produce more of their kind.
- Taking in and giving out air out of the body is called breathing.
- Excretion remove waste from the body.

Exercise

1 Choose the correct option.

i. Plants make their food by a process called:

a Photosynthesis
b Excretion
c Respiration
d Movement

ii. Special pores in leaves for exchange of gases are called:

a Chloroplasts
b Xylem
c Stomata
d Phloem

iii. The process by which living things produce more of their own kind is called:

a Respiration
b Reproduction
c Photosynthesis
d Digestion

Publishers E-Sample

iv. Removal of waste from living organisms is called:

a Excretion
b Photosynthesis
c Digestion
d Transpiration

v. Which pigment makes plants green?

a Chemical
b Sulphate
c Chlorophyll
d Xanthophyll

vi. The leaves of which plant fold up when touched:

a Mango
b Apple
c Mustard
d Touch me not

vii. Which part of the plant does photosynthesis?

a Leaf
b Roots
c Stem
d Flower

viii. What are the products of photosynthesis?

a Sugar only
b Oxygen only
c Sugar+Oxygen
d Sugar+Carbon dioxide

2 Write "T" for true and "F" for false statement.

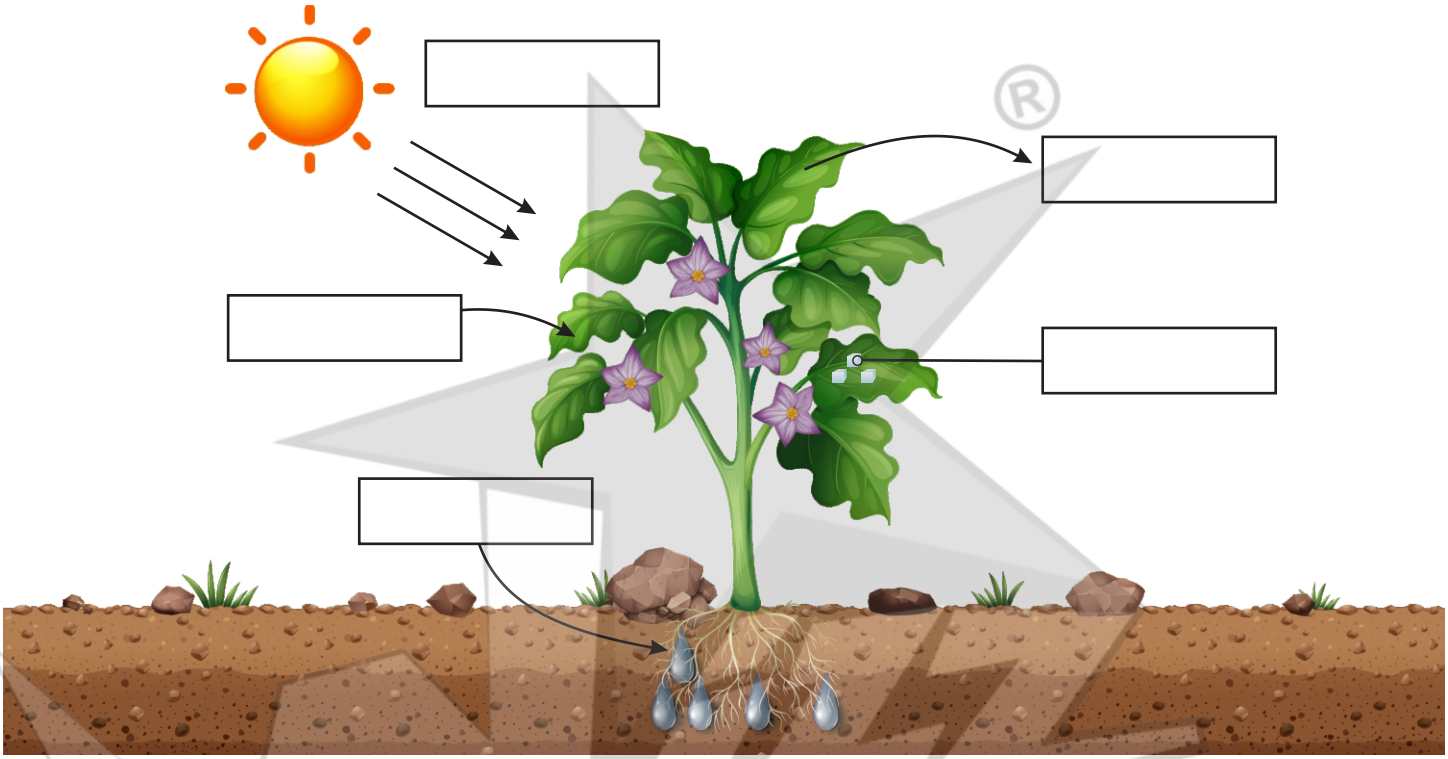
i. Animals can make their own food. _____
ii. Plants breathe through roots only. _____
iii. Human breathe using lungs. _____
iv. Plants absorb water through their stem. _____
v. Excretion gives us energy to do work. _____

3 Write one-word answer.

i. Tiny pores on the surface of leaves. _____
ii. Gas used by plants for breathing. _____
iii. The process by which living things produce more of their own kind. _____
iv. Removal of waste substances from living organisms. _____

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4 Complete the process of photosynthesis in the diagram given below.



5 Answer the following questions.

i. Where do animals get their energy from?

ii. How do plants get their energy?

iii. What do plants need to live?

iv. Define photosynthesis.

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v. How do plants respire?

_____

_____

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

i. List all the characteristics of living things.
ii. Write a short note on excretion.

Constructed Response Questions

i. If all the plants in world disappeared, how would it affect animals and humans?



Objective: Explore the requirements of plants for life and growth.

Resources:

- Small potted plants (e.g., bean plants)
- Water
- Soil (and sand for one test)
- Light source (sunlight)
- Containers, labels and markers

Instructions:

- Divide students into groups. Each group will test one condition:
  - ✓ Group 1: Normal plant (air, water, light, soil). Group 2: No light (dark area).
  - ✓ Group 3: No water.
  - ✓ Group 4: No soil nutrients (sand instead of soil).
  - ✓ Group 5: Limited air.
- Each group sets up their experiment and labels the containers.
- Students record daily observations (colour, size, growth)

Discussion question:

- After one week, bring the class together to share and discuss their findings.
- Discuss which needs were most important for plant survival?

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UNIT 2

Animals – Structure and Functions

Students' Learning Outcomes

All students will be able to:

- Classify major groups of animals with backbones (vertebrates: fish, amphibians, reptiles, birds and mammals) and without backbones (invertebrates: e.g. insects, snails, worm, jellyfish and corals) on the basis of their characteristics.
- Identify that some animals (spider, crab, beetles) have an exoskeleton.
- Describe some of the important functions of the skeleton.
- Describe the human digestive system including the simple functions of the organs involved (mouth, oesophagus, stomach, small and large intestine).
- Recognize that humans have different types of teeth (molar, premolar, incisors, canine) and know their functions in digestion of food.
- Investigate the causes and prevention of tooth decay and gum diseases.
- Identify that many vertebrates have a digestive system similar to humans.
- Recognize the items of first aid box.

Let's Start!

- Do all animals look the same or different?
- Into how many classes are animals classified?
- Do all animals have a skeleton?



Classification of Animals

Animals live in habitats; some live on land, some in water, and others fly and reside in trees or mountains. However, a significant difference between them is the presence or absence of a backbone (vertebral column). On this basis, animals are divided into two groups:

a. Vertebrates

b. Invertebrates



Let's Think Aloud

Imagine you are a scientist exploring a new ecosystem. You come across two animals. Observed them and answer:

- What similarities do you see between them?
- What differences do you see between them?

Write down your observations in your notebooks.



a. Vertebrates

Vertebrates are animals that have a backbone inside their bodies. They also have a well-developed and strong internal skeleton made up of bones, which helps them move and protects their organs. Vertebrates are further divided into five classes: amphibians, fish, mammals, reptiles, and birds.

i. Amphibians

- They live partly in water and partly on land.
- They have moist skin that helps in breathing along with lungs.
- They live on land but lay eggs in water.
- They are cold blooded animals.
- Examples include: frog, toad, salamander, newt, etc.



Frog



Toad



Salamander



Newt

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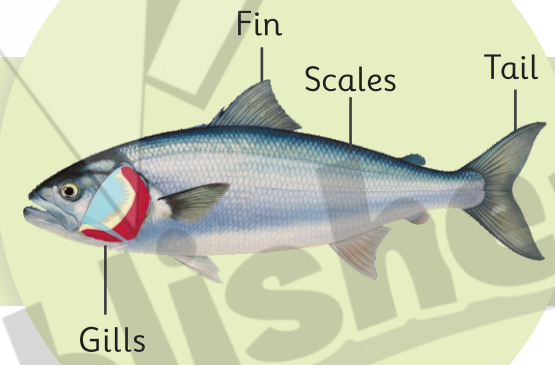
Cold-Blooded Animals	Warm-Blooded Animals
Cold-blooded animals have a body temperature that changes with the temperature of their surroundings. They depend on external sources of heat to regulate their body temperature.	Warm-blooded animals maintain a constant body temperature regardless of the temperature of their surroundings. They generate their own heat and cool down if they get too hot.

ii. Fish

- They live and lay eggs in water.
- They have streamlined bodies, fins and tails to swim easily.
- Most fish have skin covered with scales that protect their bodies and display colour.
- They breathe through gills.
- They are cold blooded animals.

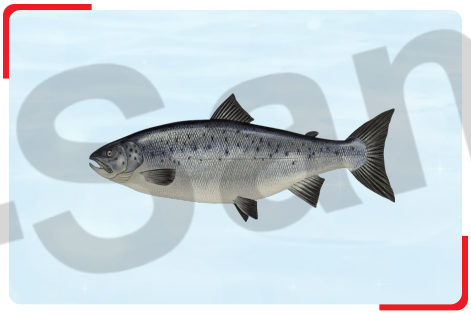
Let's Think Aloud

Why is Dolphin not considered as fish?



- Examples include: Goldfish, salmon, clownfish, etc.


Goldfish


Salmon


Clownfish

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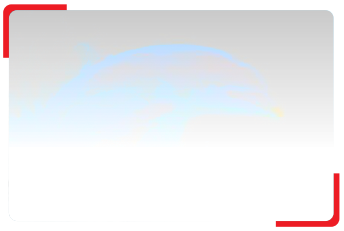
iii. Mammals

- They have hair or fur on their bodies.
- Most give birth to live young ones and feed them with milk.
- They breathe through lungs.
- They are warm blooded animals.
- Examples include: Human, lion, elephant, dolphin, dog, etc.


Human


Lion


Elephant


Dolphin

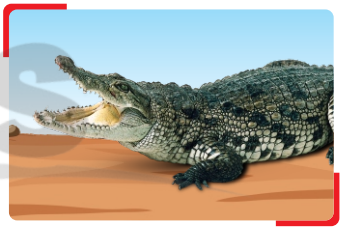
iii. Reptiles

- They lay eggs or give live birth.
- They have thick, dry, scaly skin for protection.
- They have lungs to breathe.
- They are cold blooded animals.
- Examples include: Snakes, lizards, turtles, crocodiles, etc.


Snake


Lizard


Turtle


Crocodile

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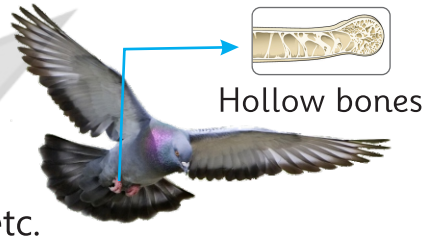
Dinosaurs were the largest reptiles. The biggest land dinosaur was Argentinosaurus, now extinct.



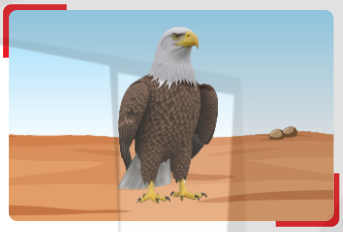
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vi. Birds

- They have feathers, beaks and wings.
- They have hollow bones, which make their body light weight so they can easily fly. All birds have wings but not all of them can fly. Some birds can swim in water.
- They lay eggs, from which off-spring hatches out.
- They breathe through lungs.
- They are warm blooded animals.
- Examples include: Sparrows, eagles, penguins, ostriches, etc.




Sparrow


Eagle


Penguin


Ostrich

Activity Time!

Complete a table to show which features belong to fish, amphibians, reptiles, birds or mammals.

Feature	Fish	Amphibian	Reptile	Bird	Mammal
Fins					
Scales					
Lay eggs					
Have live babies					
Feathers					
Gills					
Lungs					
Cold blooded					
Warm blooded					

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b. Invertebrates

Invertebrates are animals without a backbone. They make up about 97% of all animals. Some have a hard covering outside called an exoskeleton. It is on the outside of the body and protects the delicate body. Some invertebrates like earthworm have no skeleton at all.

Invertebrates are further classified into the following major classes: Insects, corals, jellyfish, snails and warms.

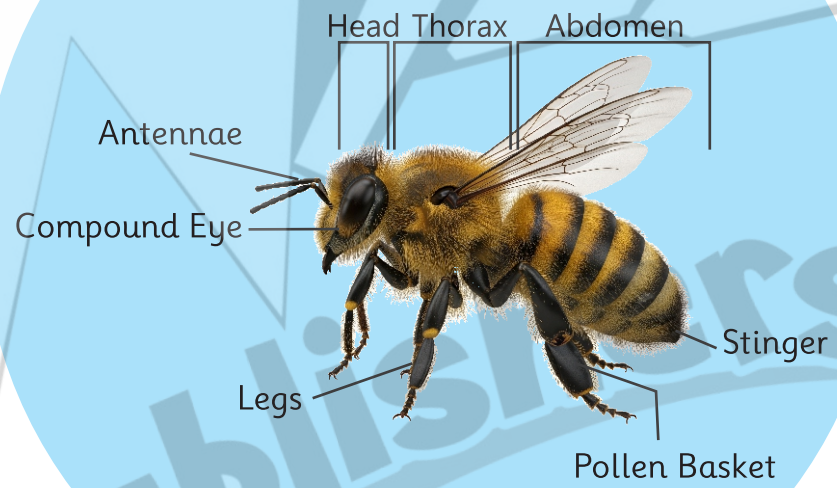
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Kiwi birds are blind and hunt using smell.



i. Insects

Insects are the class of invertebrates with six jointed legs. Their bodies are divided into three parts: Head, thorax, and abdomen. They have a pair of antennae which is used for smelling and feeling.



SciByte

This praying mantis looks like it is covered in dead leaves; some of those "leaves" are parts of its own body. The amazing camouflage helps it hide from predators.

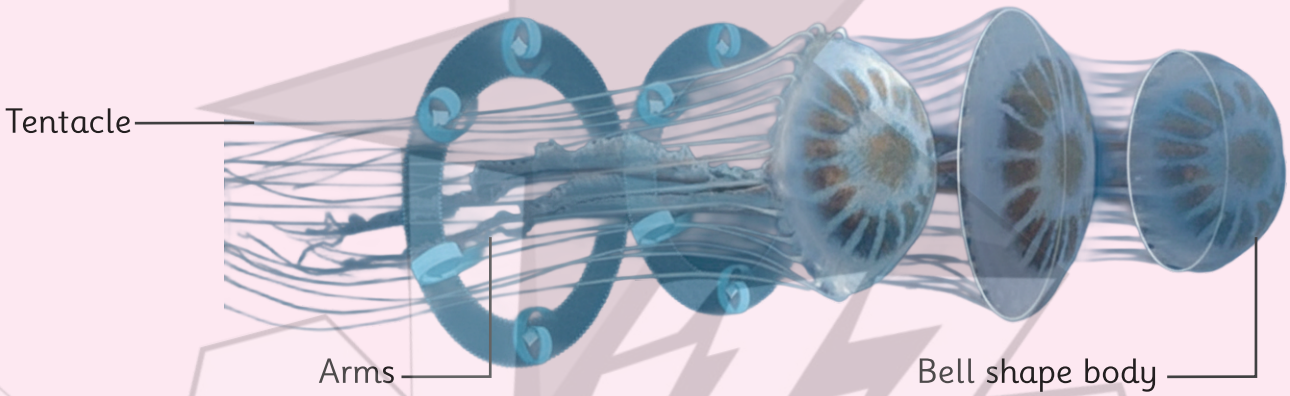


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ii. Jellyfish

They are not really a fish but live in water. They have soft jelly like bodies with stinging tentacles, which serve as a defense and as a powerful weapon for capturing prey.

To swim, the jellyfish opens its bell and then squeezes to push itself forward like a jet. When it does this, it makes two rings of water that help it move.



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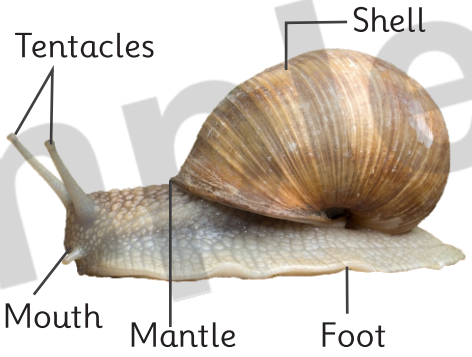
Australian sea wasp jellyfish is the world's most venomous, its sting can kill within seconds.



iii. Snails

They can be found in a wide range of environment, including ditches, deserts and in the depths of the sea. They have soft bodies with hard shells.

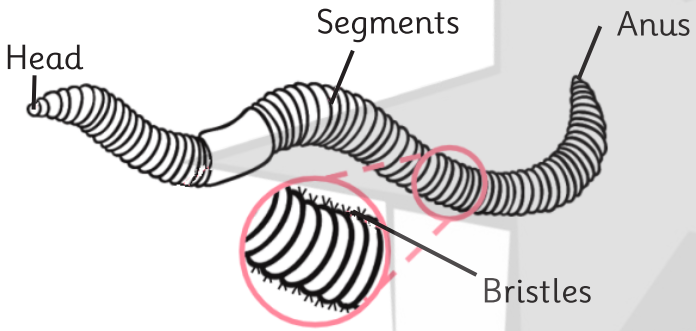
Snails move slowly using a muscular foot that secrete slippery mucus to enable them to crawl over rough surfaces. They have pairs of tentacles which have eyes at the tips. The role of tentacles is to smell and sense light. Snails eat by scraping food with tiny teeth.



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iv. Worms

Worms are all around, some live in water, some live on land and others live inside animals, plants or humans. Worms have soft segmented bodies, with no limbs. Each segment has bristles, which helps in movement of earthworm. The body of worms has two openings: a mouth at one end and anus at the other end. Worms respire through moist skin.





Let's Think Aloud

Earthworms don't have bones; then how do they move?

v. Corals

They are found in water and live in the form of colonies. Their bodies are full of holes or pores, which allows water to circulate through them, bringing the food and removing wastes. They have one opening which is surrounded by stinging tentacles. They have a hard-outer skeleton.



Skeleton

We can see bones of different shapes and sizes in an X-ray. Bones are white, strong and hard pieces, which join together at points called joints. All the bones in the body form a frame called the skeleton.

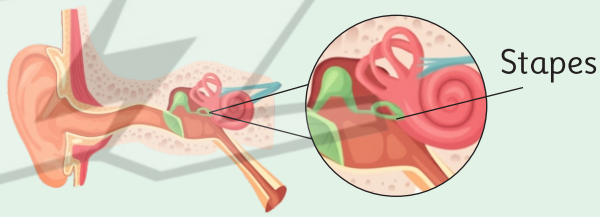
Let's Think Aloud

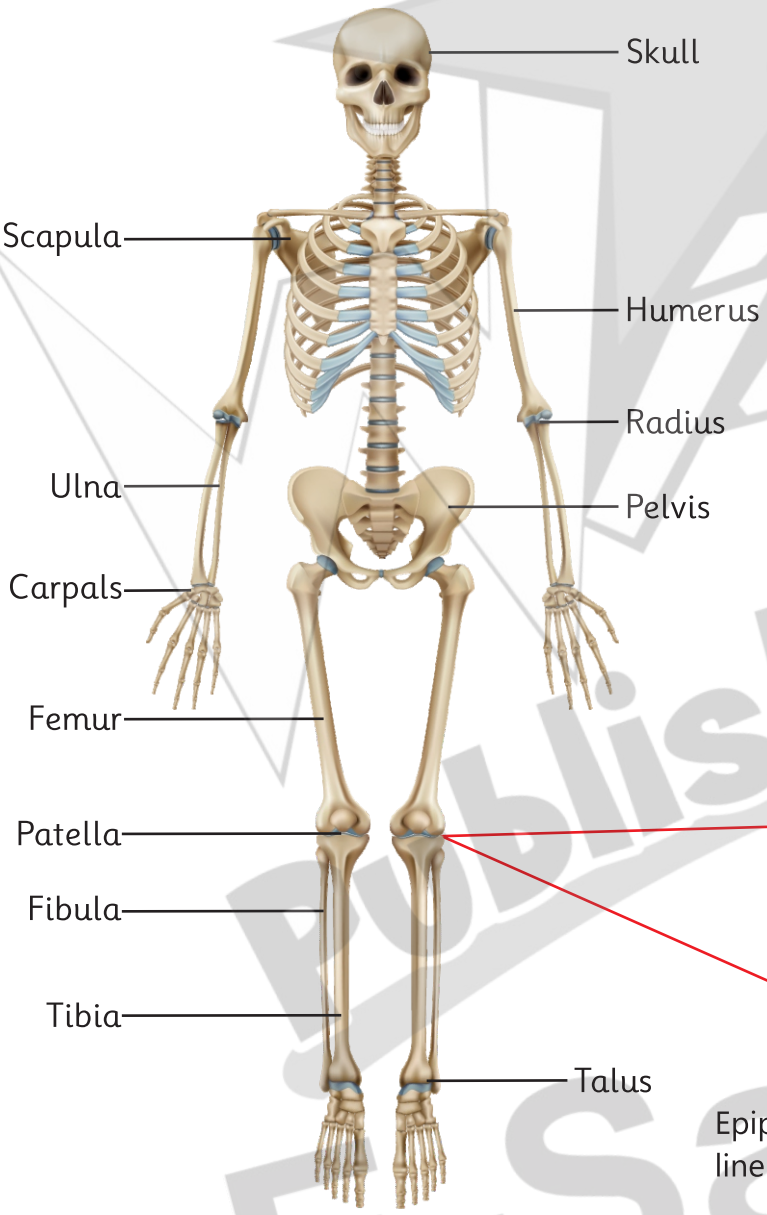
Observe the X-ray and describe what you see. Can you name the different parts?



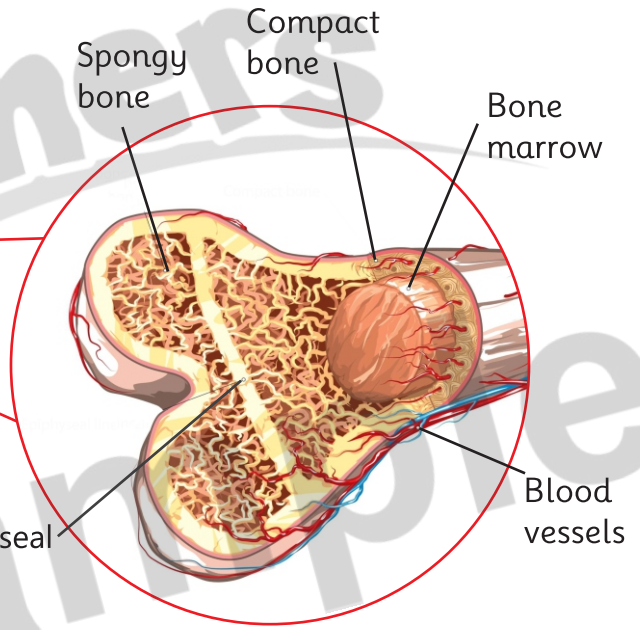
SciByte

The smallest bone in the body is found in the ear.





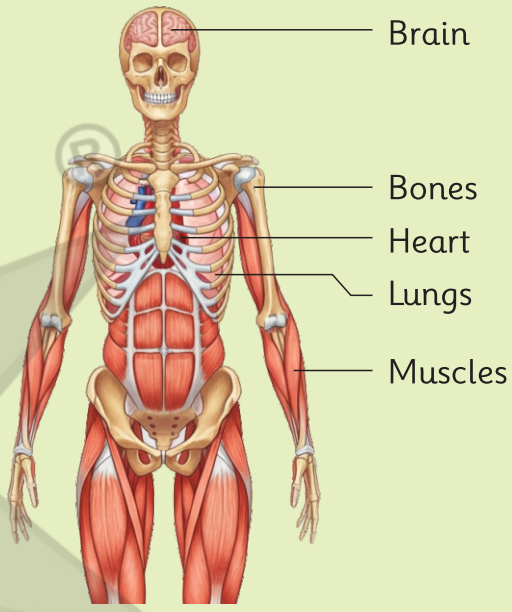
A Human Skeleton



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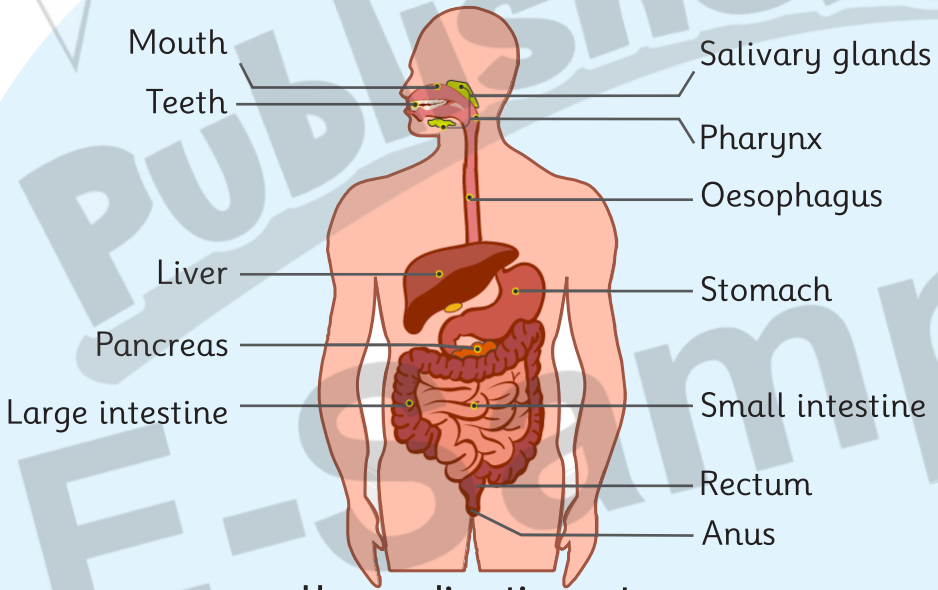
The skeleton has several important functions:

- It provides a framework that supports the body and keeps its shape.
- It protects vital organs. For example, the skull protects the brain and the rib cage protects the heart and lungs.
- Bones work with muscles to make movement possible. Muscles contract and relax to produce movement. The human body has about 600 muscles.
- Blood cells are produced in bone marrow.



Human Digestive System

We need food for energy and growth. To use the energy in food, it must be changed into a form that the body can use. The process in which food is broken down into smaller parts that can be absorbed into the bloodstream is called digestion. The energy from digested food is used for movement, repairing cells and growth.



Human digestive system

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Organs of the Digestive System

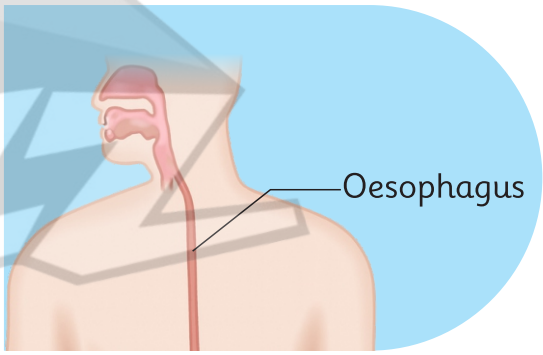
The organs involved in digestion makes up the digestive system. The digestive tract begins at the mouth and ends at the anus.

a. Mouth

When we eat food, the teeth chew the food and the process of digestion begins. Chewed food mixes with saliva, a digestive juice produce by salivary glands. Saliva moistens and softens food so it can be swallowed easily. The role of tongue moves food around the mouth to help in chewing and swallowing. When food is swallowed, it passes through the throat and into the oesophagus.

b. Oesophagus

The oesophagus is a tube that carries food from the throat to the stomach. Its muscles contract and relax to push food down.



c. Stomach

The stomach is a hollow organ on the upper left side of the abdomen. It receives food from the oesophagus. The stomach produces digestive juices called gastric juices, which partly break down food. A lining of mucus protects the stomach from these acidic juices.



The stomach muscles grind food and turn it into a semi-liquid called chyme. The food then mixes with gastric juices. Food may remain in the stomach for over an hour to more than five hours. After the stomach empties, the stomach muscles continue to move. This causes hunger pangs. Starch and sugar are easily digested, so they remain in the stomach for only a couple of hours. Proteins remain for three to five hours. Fats may remain in the stomach even longer. This is why eating a meal containing protein and some fat satisfies our hunger longer. The stomach then pushes chyme into the small intestine.

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d. Small Intestine

The small intestine is about 22 to 25 feet long and is the longest part of the digestive system. Digestion is completed here. The digested food are absorbed by the blood stream through tiny finger like projections (villi) on the inner wall of the small intestine. The undigested food passes into the large intestine.

e. Large Intestine

In the large intestine, water and minerals are absorbed into the blood. The remaining waste moves into the rectum, where it is stored as feces. Finally, the waste passes out of the body through the anus.

Many vertebrate have a digestive system similar to humans.



Digestive system in herbivores



Digestive system in carnivours





Let's Think Aloud

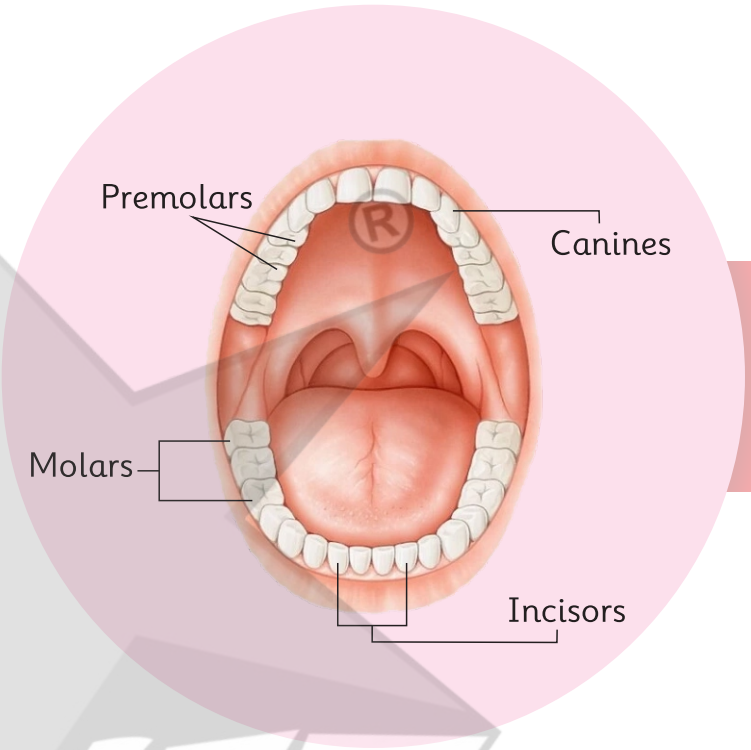
What would happen if you do not have teeth?

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Human Teeth and Types

Teeth are part of digestive system. They grind and cut food into small pieces before swallowing. Humans have four main types of teeth.

Teeth present in our mouth are of different shapes and sizes. We have four different types of teeth:



- **Incisors:** Teeth in the front are called incisors. There are eight incisors and are four in each jaw. They are chisel-shaped. They are used for cutting and biting the food.

 Incisors act like a knife. 

- **Canines:** The pointed teeth on either side of incisors are called canines. There are four canines which are sharp. They are used for tearing and piercing the food.

 Canines act like a fork. 

- **Premolars:** Next to canines are the premolars. There are eight premolars. They are used to crush and chew the food.

 Premolars act like a nutcracker. 

- **Molars:** Bigger and flatter teeth beside the premolars are molars. There are twelve molars. They are used to chew and grind the food well.

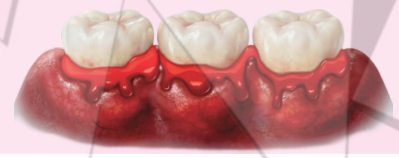
 Molars act like a crusher. 

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SciByte

Milk Teeth once fallen are replaced by permanent teeth which are 32 in number. If permanent teeth fall, they are not replaced naturally.

Tooth diseases and their Causes

Disease	Causes
Tooth Decay (Cavities) 	• Bacteria in mouth. • Consuming too much sugar. • Not cleaning teeth properly.
Gum Diseases 	• Poor oral hygiene. • Plaque (a sticky layer of bacteria on teeth.)
Tootache 	• Cavities. • Gum disease. • Injury to the teeth.

Prevention

There are some preventive measures against tooth diseases.

- Brush with fluoride toothpaste after eating or drinking.
- Rinse your mouth
- Visit your dentist regularly
- Avoid frequent snacking
- Eat tooth-healthy foods
- Go for antibacterial treatments (if required)
- Dental flossing

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First Aid Kit

Do you have a first aid kit at home? Do you know what items are inside it and why it is important?

A first aid kit is a box that contains important supplies to treat minor injuries such as:



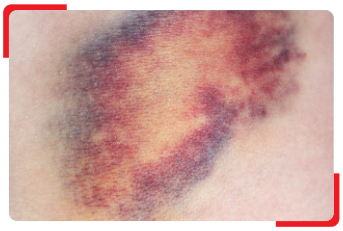
Cuts



Scratches



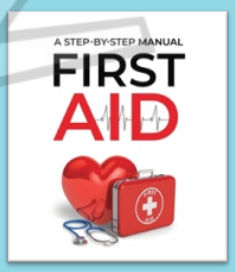
Burns



Bruises

Following are some basic items that should be there in every first aid kit:

Handbook of First Aid Manual: This book contains simple instructions, such as how to check temperature, dress wounds or use ointments.





Tweezers and Scissors: It is used to hold, grip and cut objects during dressing.

Cotton and Alcohol: It is used to clean wounds before bandaging.



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Bandages: It is used for small wounds.

Gauze: It is used to cover larger wounds and absorb blood.





Medical tape: It is used to fix gauze or bandages in place.

Thermometer: It is used to check body temperature.





Medicine: It is used to give relief from pain.

Ointment: It is used to reduce swelling, inflammation and treat minor injuries.



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What have you learnt?

- Vertebrates are animals that have a backbone.
- Vertebrates are classified into five classes: fish, amphibians, reptiles, birds and mammals.
- Invertebrates are the animals that do not have a backbone.
- Invertebrates are classified into five main classes: jellyfish, corals, worms, insects and snails.
- Cold-blooded animals change their body temperature with the change in temperature of their surroundings.
- Warm-blooded animals keep their body temperature constant.
- All the bones in the body form a frame called the skeleton.
- The point where two bones join together is called a joint.
- The process in which food is broken down into smaller parts that can be absorbed by the blood is called digestion.
- Humans have four types of teeth: incisors, canines, premolars and molars.
- A cavity is a damaged area in the tooth surface that develops into holes.
- Plaque is a sticky film of bacteria that forms on the surface of teeth.
- A first aid kit is a box that contains supplies to treat minor injuries.

Exercise

1 Choose the correct option.

i. Which of the following animals is a vertebrate?

a Earthworm
b Jellyfish
c Frog
d Starfish

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ii. Which characteristic is common to all vertebrates?

a. They have no backbone
b. They lay eggs
c. They have a backbone
d. They can fly

iii. Which of the following animals is an invertebrate?

a. Snake
b. Lion
c. Butterfly
d. Whale

iv. Which of these is a characteristic of invertebrates?

a. They have a spinal cord
b. They have an exoskeleton
c. They have a backbone
d. They have internal bones

v. The body of the fish is covered with:

a. Scales
b. Feathers
c. Wings
d. Hair

vi. How many molars are there in the jaw?

a. Twelve
b. Sixteen
c. Six
d. Eight

vii. Stomach receives food from the food pipe and releases it into:

a. small intestine
b. liver
c. large intestine
d. anus

viii. Which organ does a fish use to respire?

a. Gills
b. Air sac
c. Lings
d. Skin

ix. Which of the following animal has dry and scaly skin?

a. Fish
b. Amphibian
c. Reptile
d. Bird

x. Which of these animals is an amphibian?

a. Snake
b. Kangaroo
c. Salamander
d. Eagle

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2 Fill in the blanks.

i. _____ is the part of digestive system that absorbs the most nutrients.

ii. Adult human has _____ permanent teeth.

iii. Heart is protected by _____.

iv. The point where two bones connect together is called _____.

v. A human body has about _____ muscles.

3 Match parts given in column A with their functions in column B.

Column A		Column B
Teeth	○	○ To digest the food
Joints	○	○ To bite food
Stomach	○	○ Where bones meet
Muscles	○	○ Contract and relax
Bones	○	○ To protect the inner parts

4 i. Chose the correct word.

i. Digestion begins from **mouth / stomach.**

ii. The tube which contracts and relaxes to push the food from the throat is **small intestine / oesophagus.**

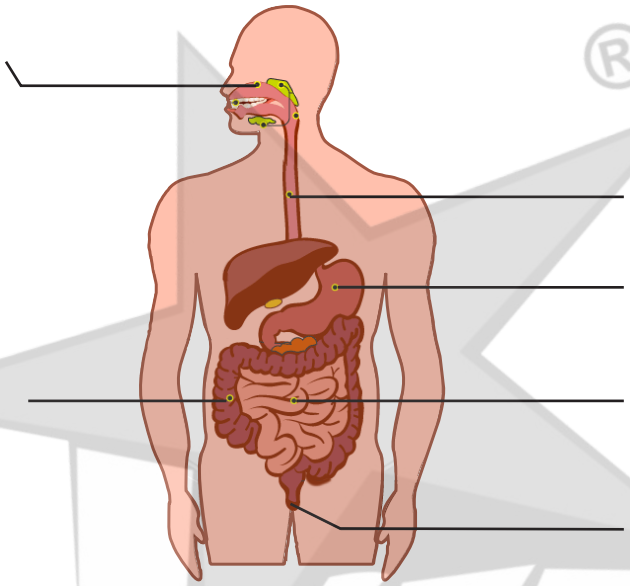
iii. It is 22-25 feet long tube **small intestine / large intestine**.

iv. The part of digestive system where water and minerals are absorbed is **stomach / large intestine.**

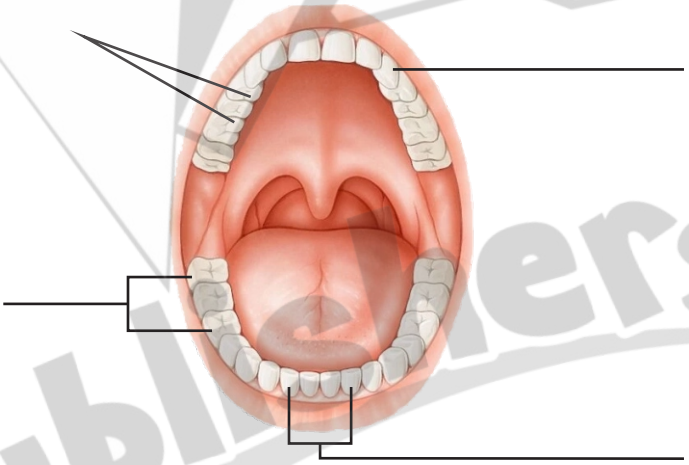
Publishers E-sample

ii. Label the body part in the following diagram using the list provided:

(Mouth, Oesophagus, Stomach, Small intestine, Large intestine, Anus)



5 i. Label the incisors, canines, molars and premolars in the diagram given.



ii. Write down the types of teeth with their numbers and functions.

Type of teeth	No. of teeth	Function

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6 Sort the following animals into their respective columns.

Dove	Giraffe	Housefly	Frog	Salamander	Shark	Crow
Butterfly	Horse	Crocodile	Snake	Tapeworm	Goldfish	Earthworm
Bat	Lizard	Cockroach	Newt	Ostrich	Rooster	Rahu

Amphibians	
Mammals	
Fish	
Insects	
Worms	
Birds	
Reptiles	

7 Answer the following questions.

i. Differentiate between vertebrates and invertebrates.

Vertebrates	Invertebrates

ii. Differentiate between cold blooded and warm blooded animals.

Cold blooded animals	Warm blooded animals

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iii. Write down the classes of vertebrates.

iv. Write any three characteristics of birds.

v. Insects have three pairs of legs. Can we say that spiders are insects?

vi. Differentiate between endoskeleton and exoskeleton.

Endoskeleton	Exoskeleton

vii. Write any two preventive measures against tooth diseases.

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viii. Write at least two functions of skeleton.

ix. Define plaque.

x. What is first aid kit?

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

i. How are amphibians different from reptiles?
ii. Define digestion and explain the role of stomach in digestion.
iii. Give the characteristics of mammals.
iv. Write a note on warms.

Constructed Response Questions

i. What would happen if you over hunt a particular specie in an area? How it would affect the biodiversity?
ii. Do bones move without muscles?

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UNIT 4

Matter and its Characteristics

Students' Learning Outcomes

All students will be able to:

- Identify and describe three states of matter and their characteristics.
- Compare and sort the materials on physical properties (e.g., mass, volume, density, states of matter, conduction of heat or electricity)
- Identify properties of metal (appearance, texture, colour, density, conduction of heat and electricity using daily life examples).
- Investigate the conditions that cause matter to change states (heating or cooling), and explain the processes associated with it. (i.e., melting, freezing, and boiling).
- Design models of sphere, cube, prism, cylinder and cone with clay or play dough using environmental friendly material.

Let's Start!

- What are the states of matter you know? Can you give examples of each?
- How do you think matter changes from one state to another?
- Have you ever wondered why ice floats on water or why balloons rise when filled with helium? How might these phenomena be related to matter?



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Matter

We are surrounded by uncountable objects such as paper, pens, chairs, windows, glass, plants, animals and many others. Each of these objects has mass and occupies space (volume). Anything which has mass and occupies volume is referred to as matter.

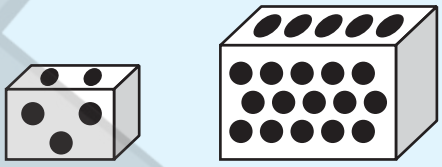


Let's Think Aloud

Is the air around us a matter?

Mass

The amount of matter in an object is called its mass. It is measured in grams (g) and kilograms (kg).



Less mass More mass



Volume

Matter along with mass, also occupies volume. The amount of space occupied by an object is known as volume. It is measured in cubic centimetres (cm^3), metres (m^3) and litres (l^3).

Matter is made of tiny particles called atoms which combines to form molecules.

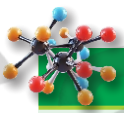


H Atom H_2 Molecule

States of Matter

Matter exists in three main states:

a. Solids
b. Liquids
c. Gases



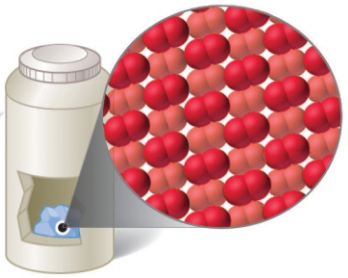
SciByte

Plasma which is called the fourth state of matter. It exists in stars, the Sun and the Earth.

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a. Solids

Knock the table. What do you feel, is it solid? What makes some materials solids? It is the arrangement of particles in materials, which specify the state of matter. In solids the particles are closely packed and arranged in a regular pattern, which restrict particles to move freely. The close packed arrangement of particles is due to strong force of attraction between the particles. Some examples of solids are:





Bat



Book



Football



Dice

Solids have following properties:

- They have definite shape.
- They have definite volume.
- They cannot be compressed.

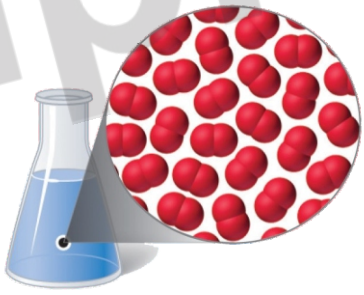
By applying force, solids can be bent, broken, cut or reshaped.





b. Liquids

Liquids are not like solids, they can flow, this is because the particles of liquids are loosely packed, due to which they have spaces to slide past each other. The force of attraction between the particles of liquids are weaker than solids but stronger than gases.



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SciByte

Liquids and gases can flow from one place to another. Therefore, they are called fluids.

Some examples of liquids are:


Oil


Water



Blood


Mercury



Milk

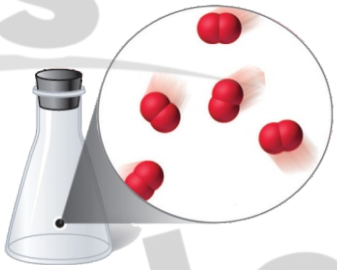
Liquids have following properties:

- They have indefinite shape.
- They have definite volume.
- They cannot be compressed.

Liquids can flow, so they can take the shape of the container, but their volume remains the same.

c. Gases

The particles in the gases are loosely packed and are far apart from each other, due to which they can flow easily. The reason why gases flow is due to greater distance between the particles resulting in weaker force of attraction. Some examples of gases are:




Air



Helium



Ozone



Carbon dioxide

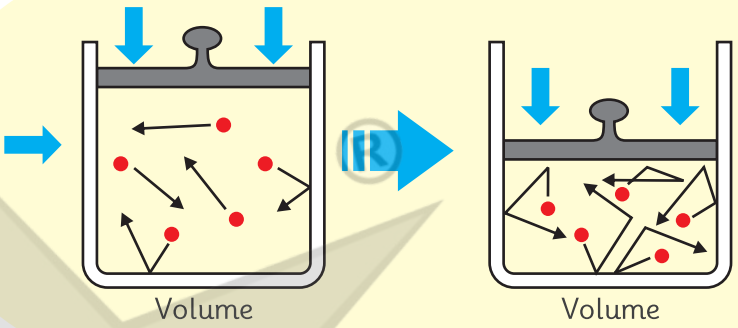

Water vapour

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Gases have following properties:

- They have indefinite shape.
- They have indefinite volume.
- They can be compressed.

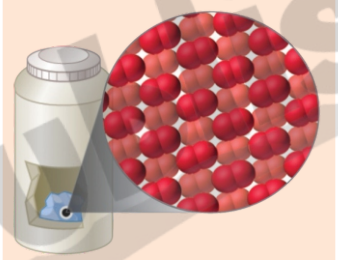
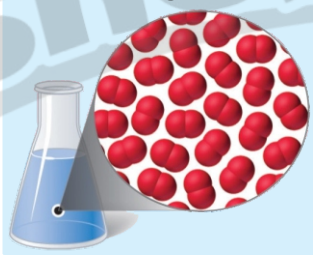
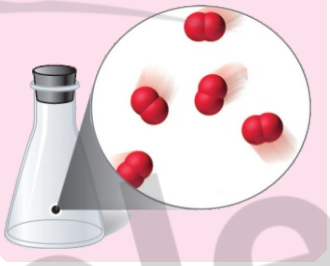
Gases fill a container and spread evenly when they are put into it. Following diagram shows that gases have indefinite volume and they can be compressed.



SciByte

The human body is an interesting example in which all the states of matter are present. Our body has solids (skin, muscles and bones), liquids (blood, saliva, etc.) and gases (oxygen, carbon dioxide in the lungs, etc.)

Summary of States of Matter

Properties	Solids	Liquids	Gases
Arrangement of Particles	Very closely packed 	Loosely packed (weaker than solids but stronger than gases) 	Very Loosely packed 
Shape	Fixed shape	No fixed shape	No fixed shape
Volume	Definite volume	Definite volume	Indefinite volume
Compressibility	Cannot be compressed	Cannot be compressed	Can be compressed

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Activity Time!

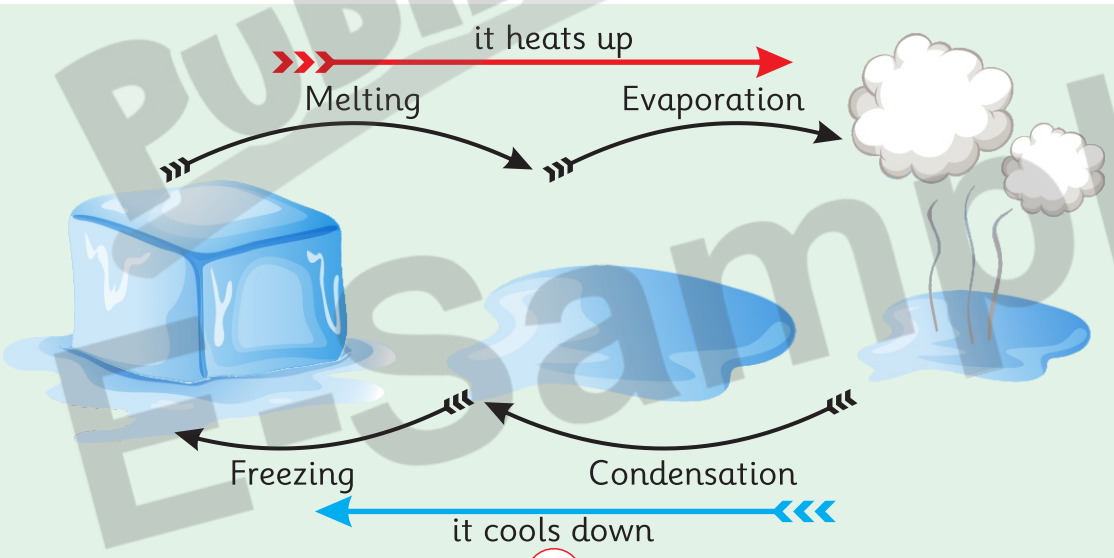
Sort out the materials as solid, liquid and gas.

Materials	Solid / Liquid / Gas	Reason for identification
Juice 		
Steam 		
Mercury 		
Wood 		
Syrup 		

Conditions that cause Change in State of Matter

We know that matter exists in different states. Each state of matter can change its form by heating or cooling.

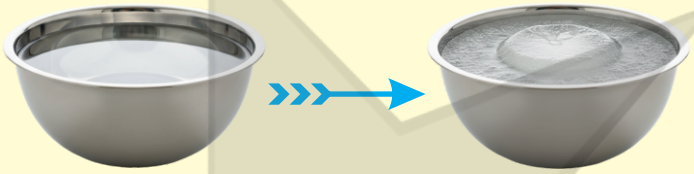
The changes in states of matter occur due to the addition or removal of energy, specifically heat energy. During the change in states, processes such as freezing, melting, evaporation and condensation takes place.



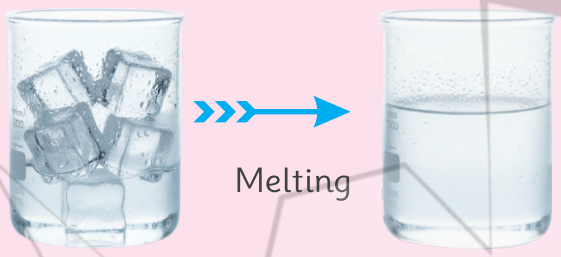
Publishers Sample

a. Freezing

Water can change from liquid to solid on cooling. When we keep water in a freezer, it turns into ice. The process by which a liquid changes into a solid state on cooling is called freezing.



Liquid Freeze



Ice cubes Melting Water

b. Melting

When we heat solid wax, it changes into liquid wax. Similarly, when we heat ice cubes or keep ice cubes out of the freezer, they turn into water. The process by which a solid changes into liquid state on heating is called melting.

c. Evaporation

When liquid water turns into gas (water vapour) at room temperature, the process is called eveporation .



Water droplet



d. Condensation

It is the opposite process of evaporation, where the gas cools and changes back into a liquid, forming water droplets such as when you see fog on a cold window.

Publisher Example

Physical Properties of Matter

Physical properties are features we can see or measure without changing the substance. Materials are sorted out on the basis of following physical properties like:

a. Mass
b. Volume
c. States of matter
d. Ability to conduct heat or electricity

a. Mass

Matter contained in a body is called its mass or it is the amount of substance that makes up an object.



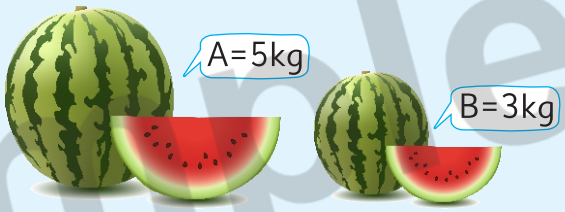


b. Volume

Volume is defined as the amount of space an object occupies.

Activity Time!

- Watermelon A is about 5 kg, while watermelon B is about 3 kg. Tell which melon has more mass and why: A or B?



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- Look at the images below and identify which object occupies more volume: A or B.



c. States of Matter

States of matter are different on the basis of arrangement of particles as shown in the given diagram.



d. Ability to Conduct Heat or Electricity

Think if the material of wire is made up of jute, will it be able to conduct electricity?



For a wire to conduct electricity, it must be made of a good conductor like copper or aluminium. Materials which conduct heat or electricity are called conductors; whereas materials which do not conduct heat or electricity are called insulators.

Jute, being an insulator, is not suitable for making electrical wires and would prevent the flow of electricity.



Conductors of electricity and heat



Insulator of electricity and heat

Publishers Sample

Properties of Metals

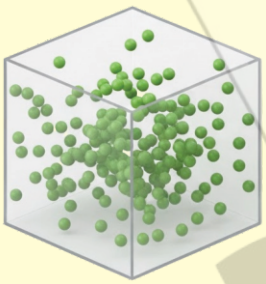
We use many objects in our daily life which are made of metals. For example: knives, spoons and other cooking utensils. Metal is a specific type of matter with the following properties:



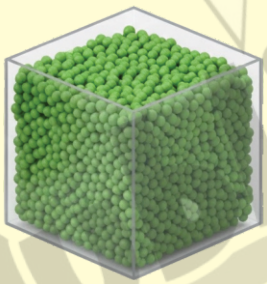
- They are lustrous, means they have shiny surfaces.
- They are usually solids. Some metals are hard and strong, like iron, while some metals are soft such as gold, silver and copper. Therefore, metals are malleable and ductile, means they can be stretched into sheets and wires.
- They have different colours. Gold is yellow, while silver is white in colour.



Gold Silver



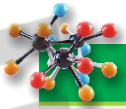
Cube A



Cube B

- They are good conductor of heat and electricity.
- They have higher densities. Density is defined as mass per unit volume.

Can you tell which of the two cubes has higher density? Cube B has a higher density because it contains more mass in a unit volume.



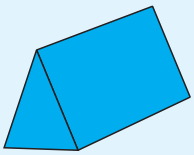
SciByte

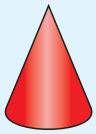
Mercury is the only metal which exists in liquid form. It is found in thermometer.

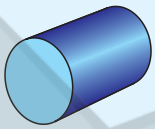
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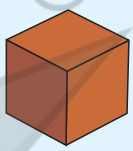
Activity Time!

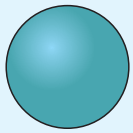
Model of Sphere, Cube, Prism, Cylinder and Cone.


Prism


Cone


Cylinder


Cube


Sphere

Resources: Clay and water

Instructions:



- Take clay to make a model.
- Add some water in a clay to make a dough.
- Now stretch and compress to make it smooth. It is also called kneaded clay.
- Use the kneaded clay and make a sphere, cube, prism cylinder and cone with it.

What have you learnt?

- Anything with mass and volume is referred as matter.
- The quantity of matter in an object is called its mass.
- Matter is composed of tiny particles called atoms which combine to form molecules.
- Solids have a definite shape, volume and cannot be compressed.
- Liquids have an indefinite shape, definite volume and cannot be compressed.
- Gases have an indefinite shape and volume and can be compressed.
- The process by which a liquid changes into a solid state on cooling is called freezing.
- The process by which a solid changes into a liquid state on heating is called melting.
- The process by which a liquid changes into a gas at room temperature is called evaporation.
- Condensation is the reverse process of evaporation.
- Density is defined as mass per unit volume.

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Exercise

1 Choose the correct option.

i. All matter is made up of tiny particles called:

a Cells
b Atoms
c Compounds
d Elements

ii. Which of the following has definite mass and volume?

a Water
b Juice
c Cement brick
d Milk

iii. Mercury exists in which of the following state:

a Solid
b Gas
c Liquid
d None of them

iv. Which of the following is a good conductor of heat?

a Wooden log
b Plastic bottle
c Metal spoon
d Glass

v. The amount of mass per unit volume is called:

a Matter
b Speed
c Density
d Velocity

vi. The amount of space an object occupies is called:

a Matter
b Volume
c Density
d Velocity

vii. The standard unit of mass is:

a m/sec
b kg
c m^3
d Km

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viii. Ice, water and steam exists at different temperatures. What is the correct order from hottest to coldest?

a Steam, water, ice
b Water, ice, steam
c Steam, ice, water
d Ice, steam, water

2 Fill in the blanks.

i. _____is called the fourth state of matter.
ii. Liquids and gases can flow so they are called_____.
iii. State of matter can change its forms by heating or_____.
iv. Matter states are different on the basis of arrangement of_____.
v. Metals are good conductors of heat and_____.

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

i. Gas cannot be compressed. _____
ii. Space that an object occupies is called its volume. _____
iii. Liquids have a definite volume. _____
iv. Particles in solids make a lot of movement. _____
v. Copper is good insulator. _____

4 Draw arrangement of particles in each state of matter.



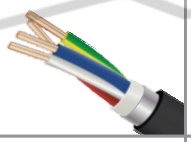
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5 Write at least five examples of each one.

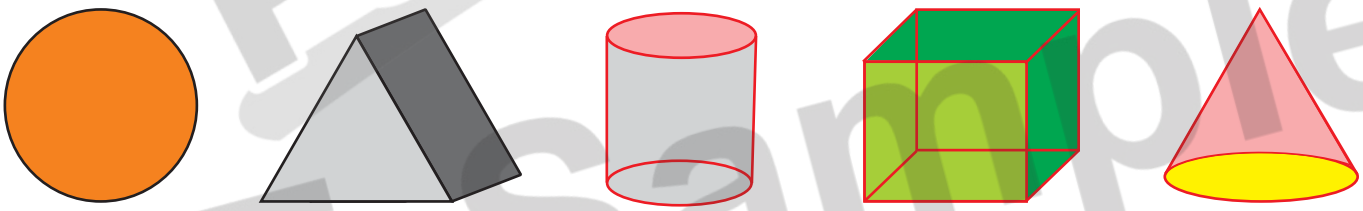
Conductors	Insulators

6 Look at the pictures below. Classify them as heat or electric conductor or insulator.

Objects	Insulator	Conductor
		
		
		
		

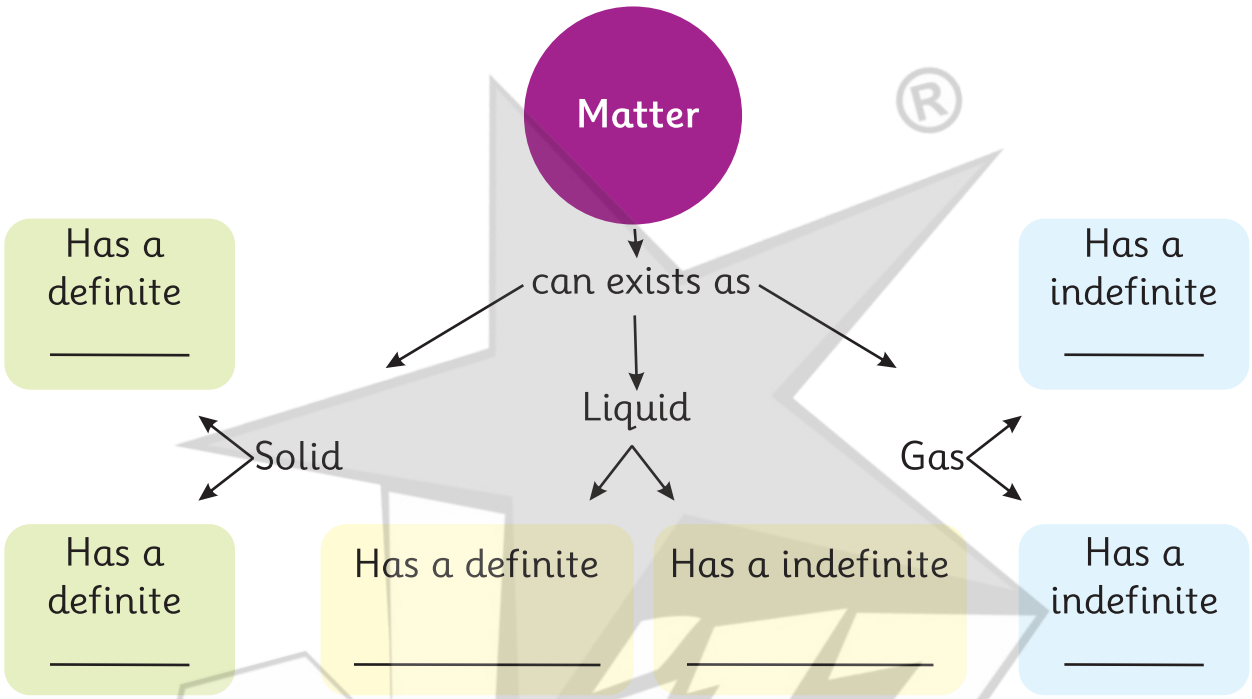
Objects	Insulator	Conductor
		
		
		
		

7 Identify the following shapes.



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8 Complete the concept map of matter.



9 Answer the following questions.

i. Do the particles in a liquid stay in one place?

_____

_____

_____

ii. Why gases can be compressed while solids are incompressible?

_____

_____

_____

iii. Differentiate between mass and volume.

Mass	Volume

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iv. What are conductors? Give examples.

v. What is meant by density?

vi. Why do you think the electrician wear rubber gloves while repairing the electric switch?

vii. What are the main characteristics of solids?

viii. Define matter and its states.

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

i. Discuss the physical properties of metals.

ii. Describe the arrangement of particles in solids, liquid and gas.

Constructed Response Questions

i. Why does smell of a sprayed perfume spread quickly in a room?

ii. How can you show that air occupies space?

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Testing Conductors and Insulators

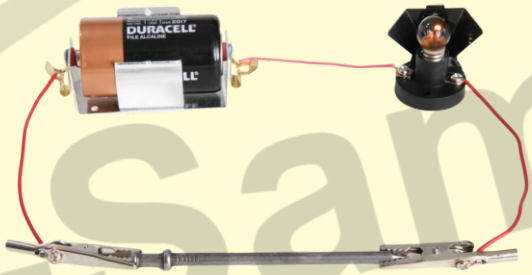
Objective: To show that conductors allow electricity to pass through them, while insulators do not.

Resources:

- Battery (9V)
- Battery holder with wires
- Small light bulb (with holder)
- Various materials to test (copper wire, aluminium foil, plastic straw, rubber band, wooden stick, jute string, etc.)
- Alligator clip leads (or additional wires)
- Scissors

Instructions:

- Connect the battery to the battery holder.
- Attach one wire from the battery holder to the light bulb holder.
- Attach one alligator clip to the free end of the light bulb holder wire.
- Attach the other alligator clip to one end of the material being tested (e.g., copper wire).
- Complete the circuit by attaching the other end of the material to the remaining wire from the battery holder.
- Observe whether the light bulb lights up. If it does, the material is a conductor. If it doesn't, the material is an insulator.
- Test each material (copper wire, aluminium foil, plastic straw, rubber band, wooden stick, jute string) and record whether the light bulb lights up or not.



Discussion:

- Why the light bulb lights up with some materials and not others.

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UNIT 6

Force and Simple Machines

Students' Learning Outcomes

All students will be able to:

- Describe different types of forces (friction, resistance, muscular, gravitational, magnetic, and electric).
- Investigate that friction can neither be detrimental or useful under different circumstances (ways to reduce friction).

  List uses of different types of forces in our daily lives.
- Explore how force can move or stop objects, change direction, shape and speed.
- Describe that an object may have multiple forces acting on it, even when at rest.
- Compare the effects of forces of different strengths in the same or opposite directions acting on an object.
- Recognize that simple machines, (e.g., levers, pulleys, gears, ramps) help make motion easier (e.g., make lifting things easier, reduce the amount of force required, change the distance, change the direction of the force).
- Design hammer, wheels, rollers and gears using clay or playdough/ cardboard/ environment friendly material.

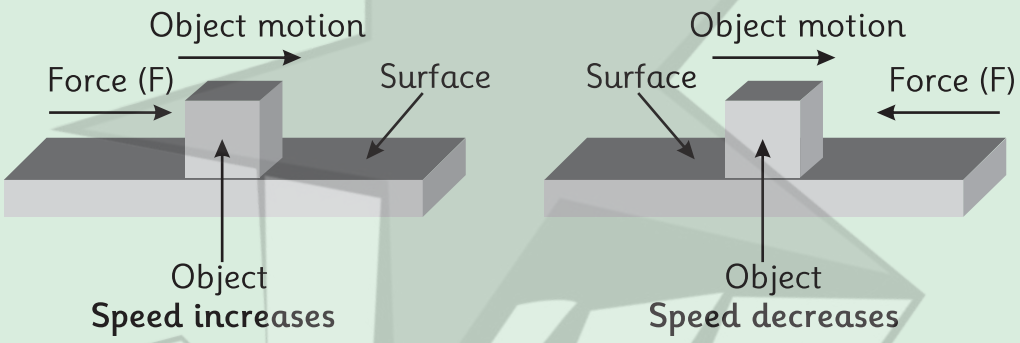


Let's Start!

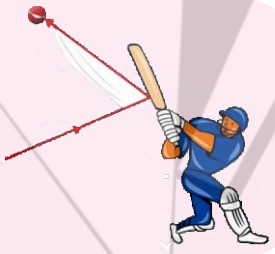
- How does friction affect the movement of objects?
- Can you think of situations where friction is helpful or harmful?
- How do simple machines use forces to work?

Look in your surroundings. You will find some objects are moving while some remains at rest. What if you want to move the objects at rest? You need force to move them. Force is defined as a push or a pull.

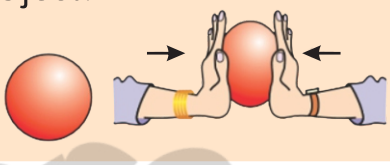
- While pushing or pulling, we apply some force on an object. When applied, a force increases or decreases the speed of an object.



- Force can change the direction and motion of an object.



- Force can change the shape of an object.



Activity Time!

Identify a push and a pull in each case. One has been done for you.

Description	Push	Pull	Both
Opening a door.		✓	
Shutting a door.			
Drawing a bucket of water from a well.			
A football player taking a penalty kick.			
A cricket ball hit by a batsman.			
Opening a drawer.			
Moving a loaded cart.			

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Types of Forces

Following are few types of forces:

a. Frictional Force

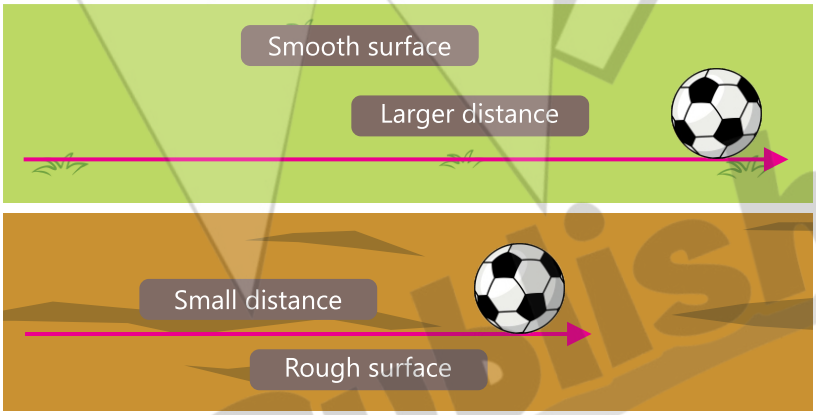
Kick a football, you will notice that it stops after covering some distance. Have you ever thought why it does so? It means there must be some type of force that slows down and stops the football. This type of force is called friction and it is defined as: the resistance that a surface or object encounters when moving over another surface.

Frictional force is a contact force, because it only works when two objects are in contact. It always acts in the opposite direction of motion.



For example, when you slide a book across a table, friction between the book and the table slows it down and eventually stop.

Smooth surfaces have less friction than rough surfaces.





i. Advantages and Disadvantages of Friction

Advantages	Disadvantages
Friction enables us to walk freely.	It always resists the motion, so extra energy is required to overcome it.
It helps ladders stay against walls.	It causes wear and tear of machines.
Brakes of vehicles work due to friction.	It reduces the life expectancy of moving parts of vehicles.

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ii. Ways to Reduce Friction

Reducing friction can make easier to move things and helps prevent wear and tear on surfaces. Here are some simple ways to reduce friction:

Let's Think Aloud

Why do you think putting oil on a bike chain makes it easier to pedal?

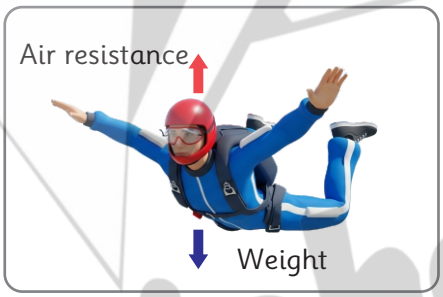
- Apply lubricants (oil, grease, or soap) on surfaces to make them slippery.
- Use wheels or rollers under heavy objects.
- Make surfaces smoother by polishing them. A smooth slide is much faster and easier to go down than a rough one.
- Use of ball bearings made of metal that reduces friction in machines, like the wheels of a skateboard.

b. Resistance

It is the type of frictional force that makes motion difficult. When an object moves, the resistance of air tries to slow it down. The faster the object's move, the greater the air resistance is exerted against it. Similarly, if someone moves against the water, the water resists the motion.



Water resistance



Air resistance

Let's Think Aloud

Why is the shape of an airplane streamlined?

c. Muscular Force

It is the force applied by our muscles when we push, pull, lift, or move things. The food we eat provides energy for our muscles. Lifting weights, getting up from a seat, climbing and so on, all require muscular force. Muscular force is essential for all kinds of movements and activities in our daily lives.





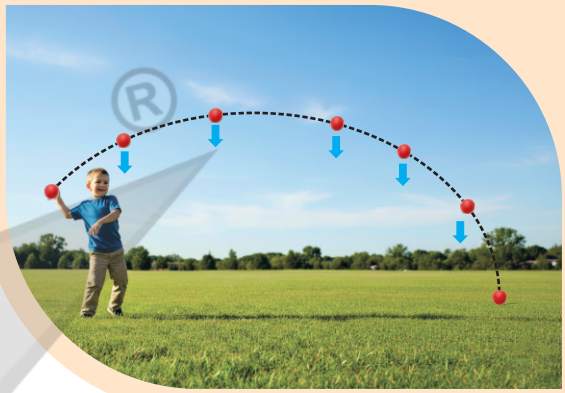




d. Gravitational Force

When you drop or throw up a ball, why does it fall on the ground?

There is the force by which the Earth attracts another object towards it and this force is called gravitational force or gravity. All objects on the Earth experience the gravitational force, which is directed downwards towards the center of the earth.



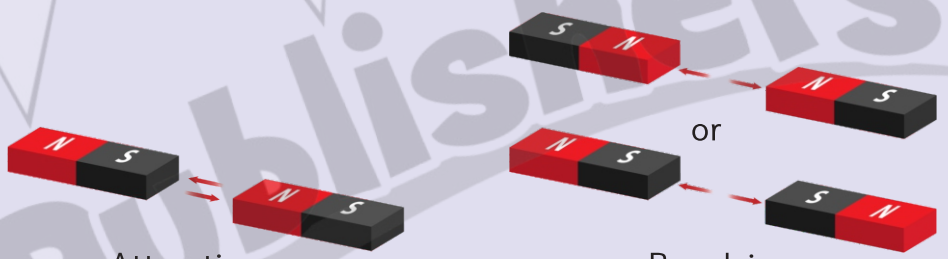
d. Magnetic Force

Have you ever seen a magnet? What do you observe when it is placed near another magnet? Magnet can attract or repel other magnetic objects placed near by. The force of attraction which is exerted between an object and a magnet is called magnetism. Magnetism is only observed in magnetic materials. For example, if a piece of wood is placed near a magnet, it will neither attract nor repel, because wood is a non-magnetic material.

SciByte

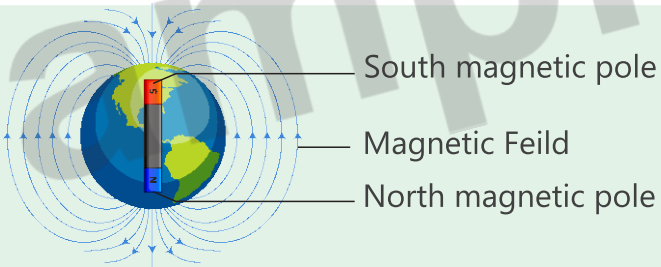
The Moon's gravity pulls Earth's water, causing tides.





SciByte

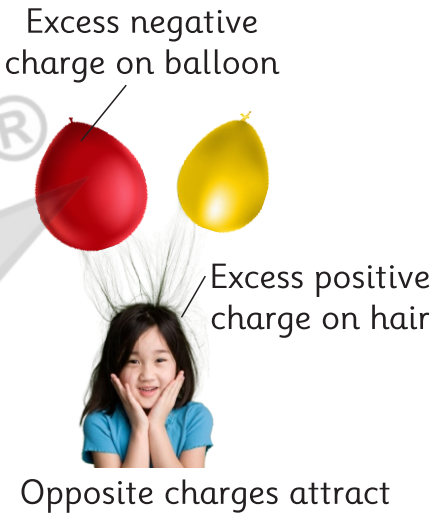
Magnetic compass use Earth's magnetic field to show directions.



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e. Electrical Force

Electrical force occurs between charged particles. Objects with opposite charges (positive and negative) attract each other, while objects with same charges repel each other.

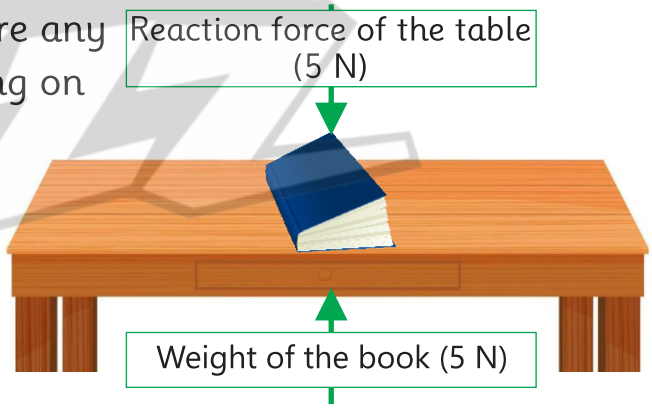


Opposite charges attract

When you rub a balloon on your hair, electric charges build up and your hair stands up because like charges repel each other. The repelling force between the charged hair strands makes them move away from each other, causing hair to stand up and look puffy.

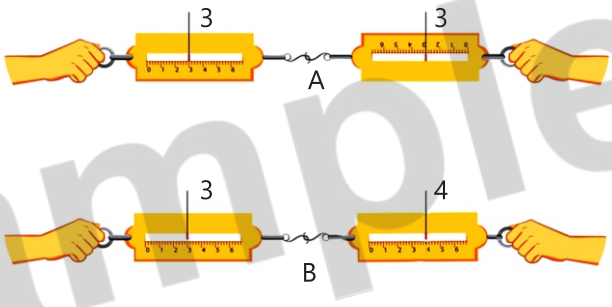
Multiple Forces Acting on an Object

a. Consider a book resting on a table, is there any force acting on it? Not true. Two forces acting on an object all the time even if it is at rest. The gravitational force and the normal force.



Gravitational force exerted by the Earth pulls the book in downward position. Meanwhile, an equal and opposite force is exerted from the table pushes upward. Since these forces are equal and opposite in direction, the sum of these forces is equal and zero and thus, the book is at rest. If the weight of the book becomes more than the upward normal force, the table will break down and the book will fall down.

b. Look at the given pictures. What difference do you notice between them. You have noticed that in picture A, equal, but opposite force is applying, therefore the object is in static equilibrium, means it is not moving.



But in picture B, you will notice that the object starts moving in one direction because on that side the strength of force is greater.

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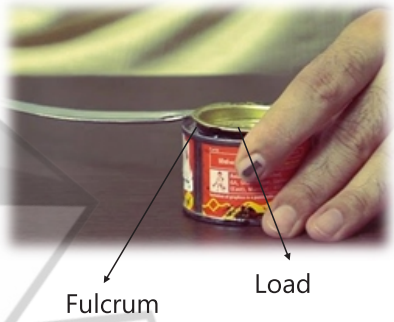
Simple Machines

We use machines at home, work, on the road, in sea or in air. Simple machines make work easier but need force to operate.

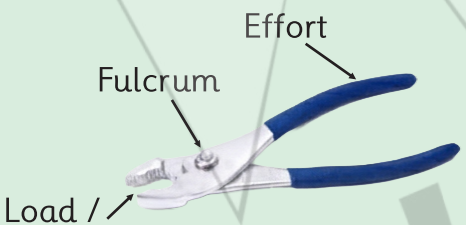
Following are few kinds of simple machines: the lever, the pulley, the inclined plane and the gear. Each of these machines has a specific function and applications.

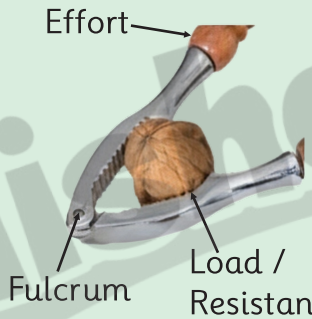
a. The Lever

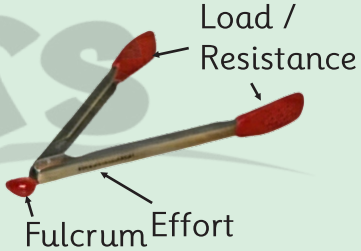
A lever is a type of simple machine that helps us lift, move, or apply force on objects with less effort. To understand how lever works, look at the given diagram.



A lever has an arm that turns around on a fixed point called the fulcrum. When you fit one edge of a spoon under a can's lid, the edge of the can act as the fulcrum. The downward force of your hand on the spoon's handle is the effort. The lid being lifted is the load. Thus, the lever makes the task of lifting the lid easier by reducing the effort required.









Let's Think Aloud

- Can you identify examples of levers in your home or school?
- Why do you think some tools are designed as levers?
- How does changing the position of the fulcrum affect the effort needed to lift a load?

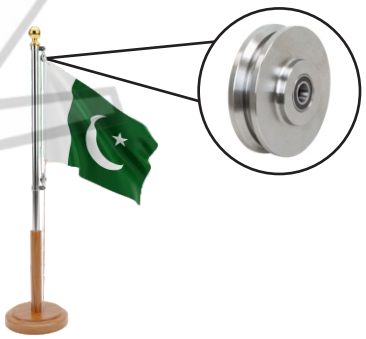
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b. The Pulley

A pulley is another type of simple machine that helps lift or move heavy objects with less effort. It consists of a wheel with a groove around its edge, through which a rope or cable passes.



Pulleys change the direction of force instead of lifting up, it can reduce the amount of effort needed.



Pulling downward becomes easier. For example, a bucket of water can be easily drawn from a well by using a pulley, raising or lowering a flag on a pole and lifting heavy loads at construction sites.

c. The Inclined Plane

Suppose you have a patient in a wheel chair and you have to take them inside a hospital. Which way is easier: lifting directly (A) or using a ramp (B)?



A



B

It is obvious that moving the patient is easier with the ramp. A ramp is a slanted surface placed with one end higher than the other. It is a common example of an inclined plane, which moves object to a higher level with less effort.

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Activity Time!

Objective: To create and test an inclined plane.

Resources:

- A sturdy board/ exam board, books (to create different heights)
- A small toy car
- A ruler or a measuring tape.

Instructions:

- Place the board on a stack of books to make a ramp.
- Measure the length of the ramp and its height from the ground.
- Roll the toy car up the ramp and observe the effort needed.
- Change the height of the books and repeat the test.
- Notice how the height affects the effort needed to move the car.
- Record your findings in the data sheet.



Data Record Sheet:

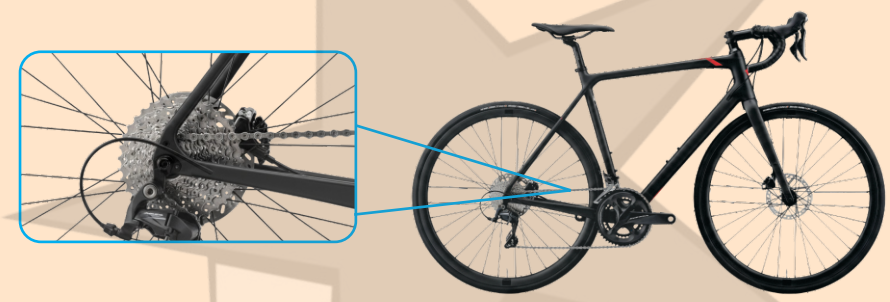
Number of books	Height (cm)	Distance covered (m)

Conclusion

E-Sample

d. The Gear

A gear is a type of simple machine that consists of wheels with teeth. These teeth interlock with the teeth of another gear to transmit motion and force. Gears can increase the speed of a machine or its force. They are commonly used to change speed, direction, or the amount of force applied to moving parts in machines.



Gears are used in bicycles which help riders adjust speed and effort, clock use gears to keep accurate time, whereas cars use gears in engines to control motion.



Objective: To make a model of hammer, wheels, rollers and gears using clay or play dough.

Resources:

- Clay and water

Instructions:

- Take some clay used to make a model.
- Add some water in a clay to turn it into a dough.
- Now strecth and compress to make it smooth. It is also called kneaded clay.
- Use the kneaded clay and make a hammer, wheel, roller and gear using with it.



- Force is defined as a push or a pull.
- Friction is the resistance that a surface or object encounters when moving over another surface.

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- A smooth surface has less friction compared to a rough surface.
- Muscular force is the force applied by muscles when we push, pull, lift, or move things.
- Gravity is the force by which the Earth attracts objects towards its center.
- Magnetism is the force of attraction which is exerted between an object and a magnet.
- Electrical force occurs between charged particles.
- Simple machines make our work easier.
- A lever help us lift, move, or exert force with less effort.
- A pulley helps lift or move heavy objects with less effort.
- A ramp is a slanted surface placed that allows objects to be moved to a higher level with less effort.
- A gear is a wheel with teeth that changes speed, direction or force.

Exercise

1 Choose the correct option.

i. It is defined as a push or a pull:

a Force
b Friction
c Pressure
d Area

ii. Which of the following are the effects of force?

a Force can increase or decrease the speed of an object.
b Force can change the direction or motion of an object.
c Force can change the shape of an object.
d All of them

iii. The resistance that a surface or object encounters when moving over another surface is called:

a Gravitational force
b Frictional force
c Muscular force
d Electric force

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iv. The force by which the Earth attracts objects towards it self is called:

a Gravitational force
b Frictional force
c Muscular force
d Electric force

v. Which of the following is a magnetic material?

a Plastic
b Wood
c Iron
d Jute

vi. Slides in the park are example of:

a Pulley
b Lever
c Wheel and axle
d Inclined plane

vii. If upward force equals to downward force on an object that is placed on a table, what will be the object's motion?

a Upward
b Downward
c Both upward and downward
d Neither upward nor downward

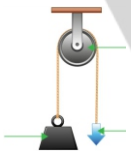
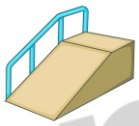
viii. Which machines consist of grooved wheels?

a Inclined plane
b Gear
c Pulley
d Lever

ix. What is the primary purpose of using gears in a machine?

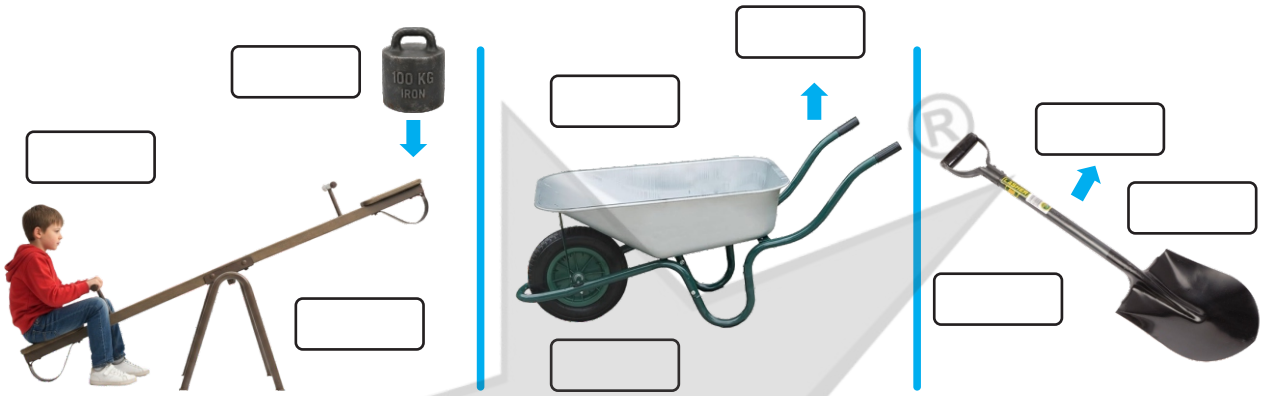
a To increase friction
b To change the direction or speed
c To reduce the weight of machine
d To Increase the temperature

x. Encircle the image of a gear:

a 
b 
c 
d 

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2 **Label fulcrum, load and effort.**



3 **Look at the image. The man wants to load boxes in the truck but boxes are too heavy. Which machine will be helpful to take him on stage and why?**



4 **What type of force is present in the following pictures? Write "R" for resistance and "F" for friction.**



The force between the two hands.



The force between the plane and the air.



The force between the boy and the water.



The force between the parachute and the air.



The force between the table and the ground.



The force between the boy and the slide.

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5 Match the definitions in column (A) with the correct images in column (B).

Column A	Column B
It is a simple machine that can be used to push or lift heavy objects.	
It is a simple machine which consists of toothed wheels of different sizes.	
It is a simple machine which consists of grooved wheel and rope.	
It is a simple machine with one end relatively higher than the other. It allows to move heavy objects.	

6 Answer the following questions.

i. Define friction.

ii. How can we reduce friction?

iii. State some effects of force.

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iv. Define force.

v. Why do sailors use pulleys on their boats?

vi. Define electrical force.

vii. Define simple machine with examples.

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

i. Explain that force of gravity pulls everything towards the ground.
ii. Give some advantages and disadvantages of friction.
iii. Write a note on:
- Lever
- Inclined plane.

Constructed Response Questions

i. Why do streamlined bodies experience less friction?
ii. Why are tides formed?
iii. Which simple machines are used in a bicycle?
iv. What happens if there were no gravity?

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UNIT 8

Solar System and Our Earth

Students' Learning Outcomes

All students will be able to:

- Describe the Solar System with the Sun at the center and the planets revolving around it.
- Understand that planetary systems contain stars, planets, asteroids and comets.
- Recognize that Earth has a Moon that revolves around and explain why the Moon looks different at different times of the month (Phases of the Moon).
- Investigate and describe how day and night are caused by Earth's rotation on its axis and give evidence from changing shadows.
- Illustrate and explain how Solar and Lunar Eclipses occur.

Let's Start!

- What brings about day and night?
- What are the main components of our solar system?
- What is the role of the Sun in our Solar System?



The Sun

We see many celestial objects in the sky such as stars, the Moon and planets. Do you know that among the stars, the Sun is the largest star of our galaxy called "Milky Way".

The Sun is a huge, glowing ball of gases at the center of the solar system. It is made mostly of hydrogen and helium gases. It provides us light and heat, essential for life. The sunlight helps plants grow, warms our planet and makes day and night possible.

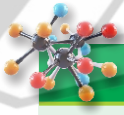




The Sun is very powerful. Never look directly at it without proper protection (like solar glasses).

The Solar System

The Sun is at the centre of the solar system. Our solar system consists of eight planets, which orbits the Sun in fixed paths called orbits. The time taken by a planet to complete one orbit is called its orbital period. Their sizes and order of planets, starting from the mercury, are given in the following table:



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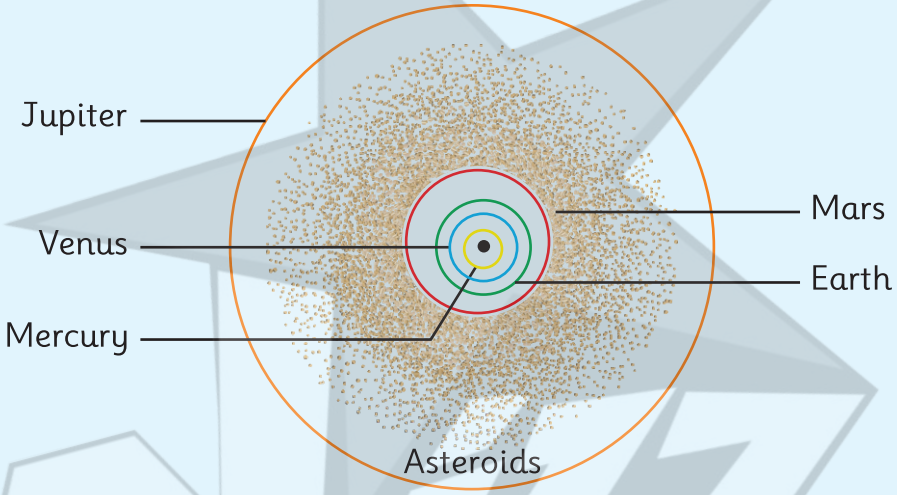
Venus is the hottest planet in the solar system.

Planets	Relative Size	Distance from the Sun (Million Kilometers)	Diameter (Kilometers)
Mercury		50	4,900
Venus		110	12,100
Earth		150	12,800
Mars		228	6,780
Jupiter		780	142,800
Saturn		1,430	120,800
Uranus		2,870	51,800
Neptune		4,497	49,400

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Planetary System

Our planetary system is called the Solar System. It includes the Sun and everything that orbits around it: the eight planets, their moons, stars and many smaller objects such as dwarf planets, asteroids and comets.



Inner Solar System

a. Stars

They are huge balls of hot gases that emit light and heat. Stars are usually at the centre of planetary system. For example, our Sun is a star.

b. Planets

They are large objects that orbit around stars. Some are rocky (like Earth and Mars) while others are gaseous (like Jupiter and Saturn).

c. Dwarf Planets

They are smaller than the main planets. The most famous example is pluto.

d. Asteroids

They are rocky objects, mostly found in the asteroid belt between Mars and Jupiter.

e. Comets

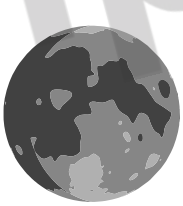
They are icy bodies that develops glowing tails when they get closer to the Sun.

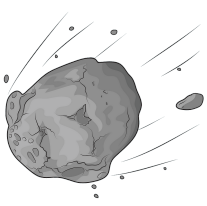

Stars


Planets

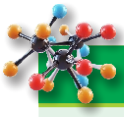

Asteroid


Comet


Satellite (Moon)


Meteoroid

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The largest known star in the universe is UY Scuti. Its radius is around 1,700 times larger than the radius of the Sun.



Activity Time!

Modeling Planetary Orbit

Objective: Create model of the solar system.

Resources:

- Balloons of different colours
- Chalk
- String

Instructions:

- Use a large yellow balloon for the Sun. Use eight smaller balloons of different colours for the planets.
- In an open area, mark circular orbits with chalk or string.
- Place the balloon as "Sun" in the center.
- Assign each child a planet and make them stand on their orbit lines.
- Let them walk around the "Sun" to demonstrate the planet's motion.

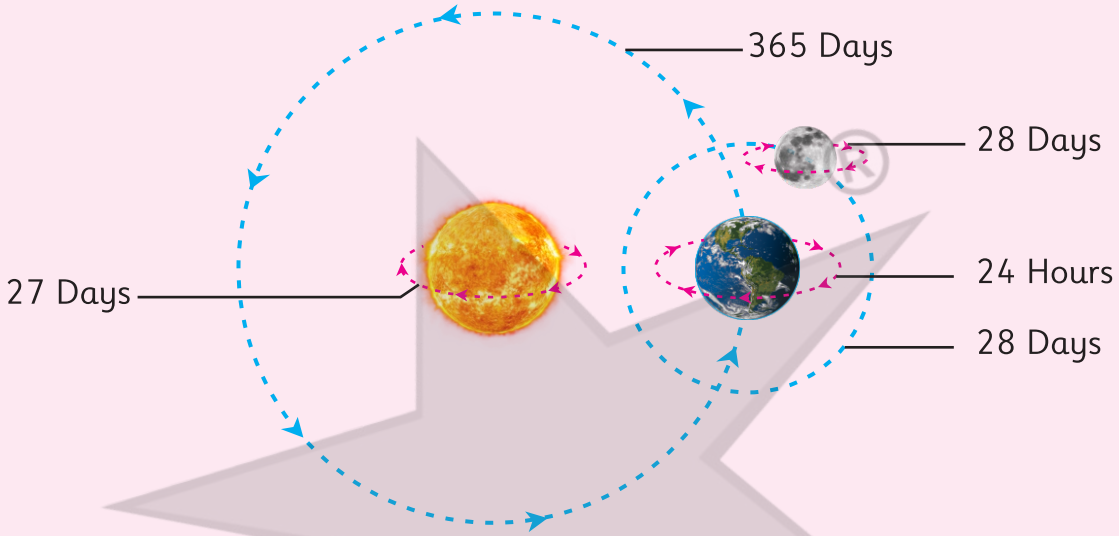
The Moon

Like Sun, moon is also a source of light but, moon does not have its own light. It only reflects the light of the sun which falls on its surface.

The Moon is the natural satellite of the Earth, which is defined as a small object that orbits, or revolves around, a larger object in space.

Like Earth which revolves the Sun, Moon revolves the Earth and it completes its one revolution around the Earth in about 29.5 days. This is the reason when a person views the moon from the Earth, he or she will be able to see the different phases of the moon at different times of the month.

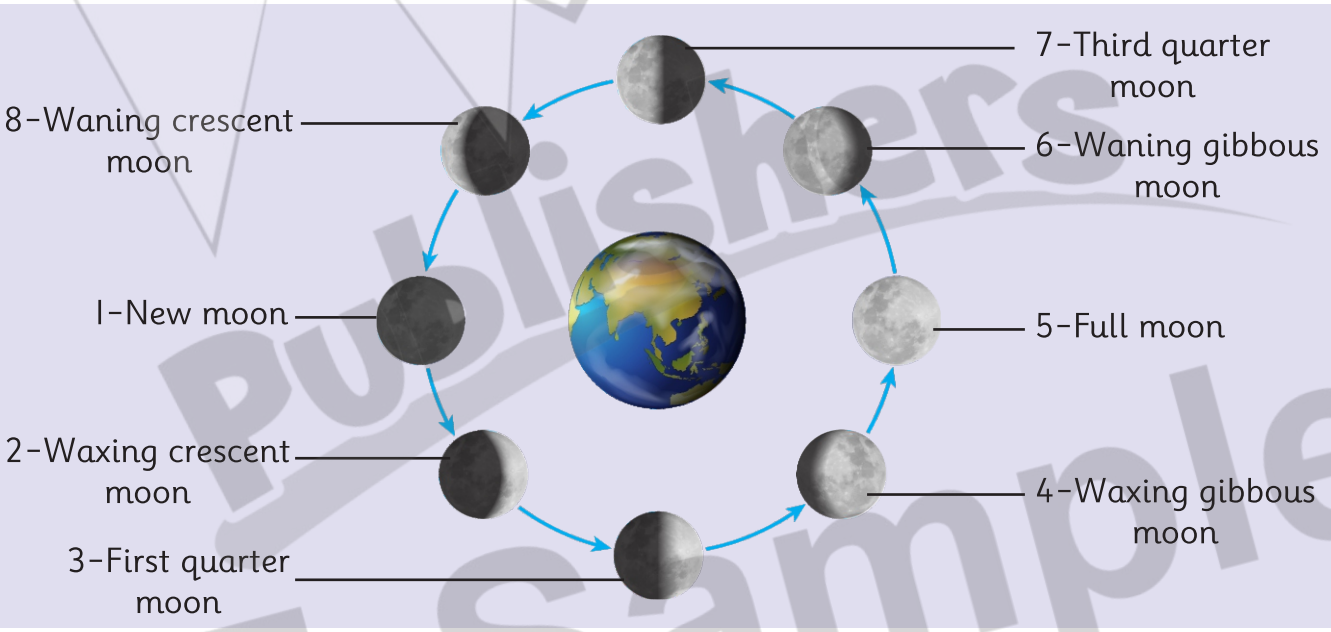
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Moon not only revolve around the Earth, it also rotates around its own axis and takes approximately 27 days for the moon to rotate once on its axis. Moon is at a distance of 384,000 kilometers from the Earth.

Phases of the Moon

As the moon revolves around Earth, its appearance changes in a repeating cycle. These changes are called the phases of the moon.



- **New:** The new moon cannot be seen from Earth.
- **Waxing Crescent:** During the rotation, we see the waxing crescent phase as a thin crescent of light appears on the right.

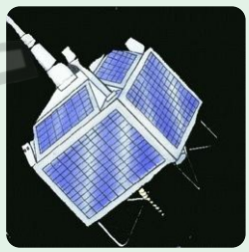
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- **First Quarter:** We see the first quarter phase as a half moon.
- **Waxing Gibbous:** The waxing gibbous phase is between a half moon and full moon. Waxing means it is getting bigger.
- **Full Moon:** We can see the Moon completely illuminated during full moon.
- **Waning Gibbous:** The waning gibbous phase is between a half moon and full moon. Waning means it is getting smaller.
- **Third Quarter:** We see the third quarter moon as a half moon, too. It is the opposite half as illuminated in the first quarter moon.
- **Waning Crescent:** During the rotation, we see the waning crescent phase as a thin crescent of light on the left.

The Moon completes this cycle in about 27 days, so we seen this eight phases one after another every month.

SciByte

(Badr-Al-بدر meaning Full Moon–A) was the first artificial and digital communication satellite launched by Pakistan's national space authority: the SUPARCO in 1990.



Activity Time!

Objective: To prepare a model of the phases of moon.

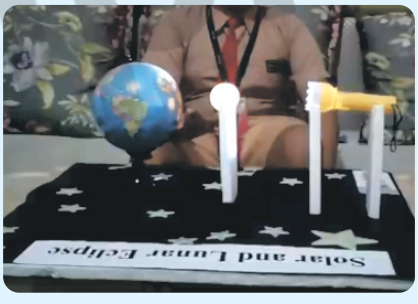
Resources:

- White clay / plasticine or any such material
- Black paint

Instructions:

- Using white clay or plasticine or any such material and prepare model of phases of moon.
- Paint with black colour to show the Earth's shadows on the moon for various phases.





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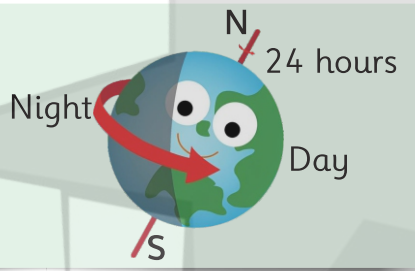
Rotation of the Earth

The Earth spins or rotates on its own axis. The axis is an imaginary line running through the North and South poles.

The Earth takes about 24 hours to complete one rotation. This rotation Earth causes day and night.

SciByte

The Earth rotates from the West to East.



Let's Think Aloud

Why do we have day and night?

When Earth rotates, the side of the Earth facing the Sun experiences day while the side of the Earth facing away from the Sun experiences night.

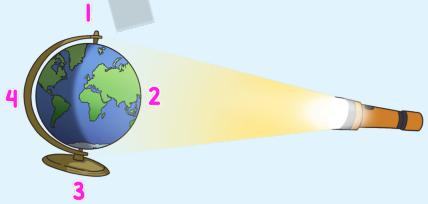


Activity Time!

Objective: To observe how Earth's rotation causes day and night.

Resources:

- Plastic globe
- Torch



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Instructions:

- Place the globe on a flat surface. Switch off all lights in the room.
- Next, take a torch and shine on one side of the globe. What do you notice?
- Now, slowly rotate the globe to observe.
- What do you notice?

Effect of Rotation on Shadows

The Earth's rotation affects the length and direction of shadows throughout the day. As the Earth rotates on its axis, the position of the Sun changes in the sky, causing shadows to change in length and direction.

In the morning, shadows are long and stretch westward. As the Sun moves higher in the sky towards noon, shadows shorten and point north (in the Northern Hemisphere). In the afternoon, shadows lengthen again, stretching eastward.

Shadows are longest during early morning and late afternoon when the Sun is low in the sky. They are shortest around noon when the Sun is at its highest point in the sky.

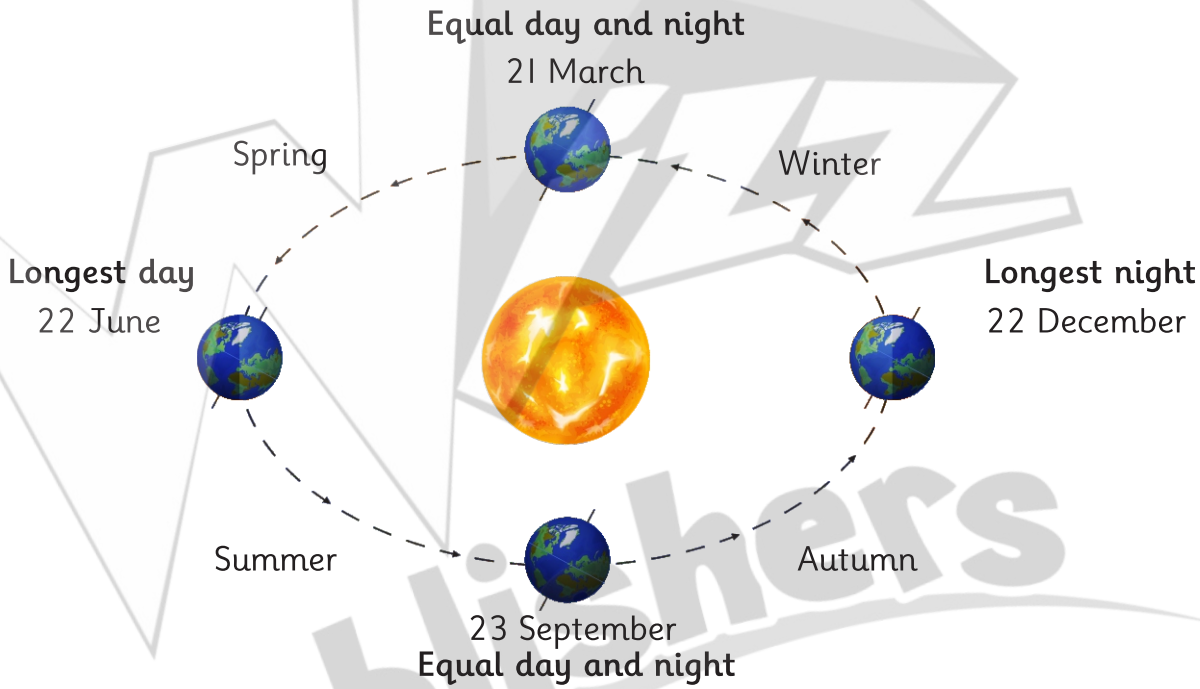


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Revolution of the Earth

The Earth also revolves around the Sun. This revolution takes about 365.25 days to complete. This period is known as a year. The Earth's axis is slightly tilted to one side. Because of this tilt, the sunrays fall vertically on the Northern Hemisphere during that part of the year. The result is longer days and shorter nights, making the summer season in the Northern Hemisphere. At the same time, the Southern Hemisphere receives slanting sun rays. This causes shorter days and longer nights making the winter season there.

The imaginary line which divides the Earth in equal halves; Northern and Southern hemisphere is called the equator.



Eclipses

An eclipse occurs when one celestial object blocks another object from view. There are two main types of eclipses:

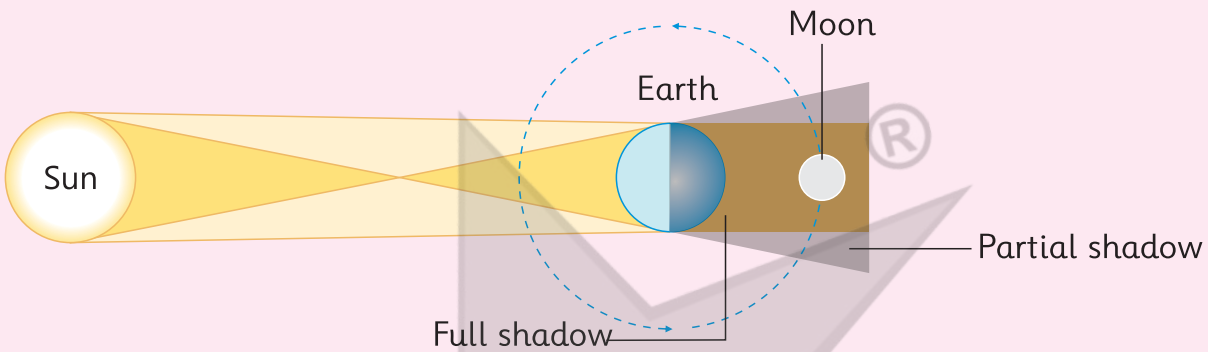
a. Lunar eclipse

b. Solar eclipse

a. Lunar Eclipse

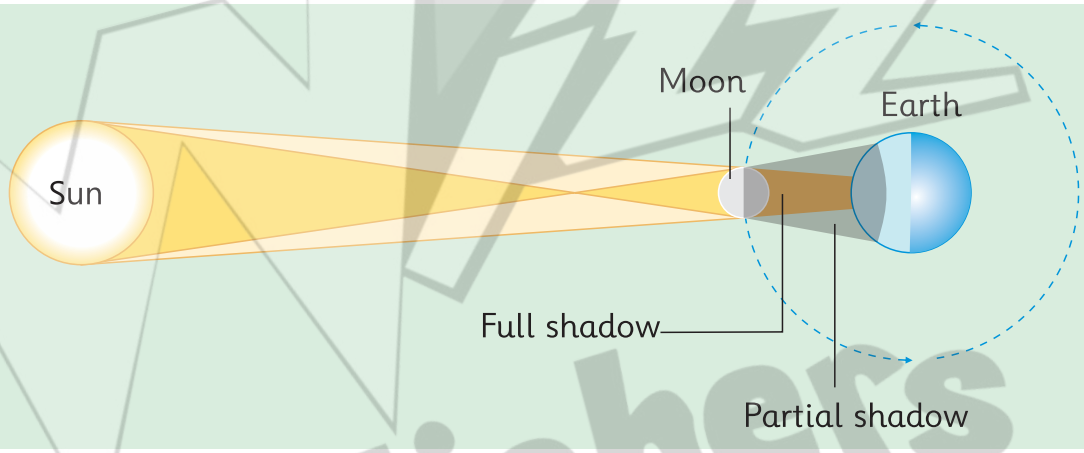
During the rotation of the Moon around the Earth, sometimes the Earth comes between the Sun and the Moon. Due to which, the sunlight does not reach to the Moon, and there is a shadow of the Earth formed on the surface of the Moon. This is called lunar eclipse.

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b. Solar Eclipse

During the rotation of the Earth, sometimes the Moon comes between the Sun and the Earth. Due to that the Sun either completely or partially hides behind the Moon and is not visible from the Earth. This is called solar eclipse.



What have you learnt?

- There are eight planets in the solar system.
- The moon is the natural satellite of the Earth.
- The spinning of the Earth around its axis is called the rotation of the Earth.
- The axis is an imaginary line which runs through the North and South poles of the Earth.
- The rotation of the Earth causes day and night.
- The movement of the Earth around the Sun is called the revolution of the Earth.

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- The Earth takes around 365.25 days to make one complete revolution around the Sun.
- The imaginary line which divides the Earth in equal halves: Northern and Southern hemisphere is called the equator.
- During the rotation of the Moon around the Earth, sometimes the Earth comes between the Sun and the Moon. Due to that, the sunlight does not reach to the Moon and there is a shadow of the Earth formed on the surface of the Moon. This is called lunar eclipse.
- During the rotation of the Earth, sometimes the Moon comes between the Sun and the Earth. Due to that, the Sun either completely or partially hides behind the Moon and is not visible from the Earth. This is called solar eclipse.

Exercise

1 Choose the correct option.

i. The Sun is the biggest star of our galaxy called:

a Milky Way galaxy
b Andromeda galaxy
c Virgo A galaxy
d Triangulum galaxy

ii. How many planets are there in the solar system?

a 7
b 8
c 9
d 10

iii. Which of the following is a dwarf planet?

a Jupiter
b Saturn
c Mars
d Pluto

iv. Jupiter is the _____ planet from the Sun.

a 3^{rd}
b 5^{th}
c 7^{th}
d 9^{th}

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v. An _____ is a small, rocky object that orbits the Sun.

a asteroid
b comet
c meteor
d meteoroid

vi. Which of the following is a natural satellite of Earth?

a Moon
b Sun
c Earth
d None of them

vii. The Earth rotates from:

a East to West
b West to East
c North to South
d South to North

viii. The Earth spins about its own axis. This movement is called the _____ of the Earth.

a rotation
b revolution
c movement
d reparation

2 Fill in the blanks.

i. All planets revolve around the _____ in fixed orbits.

ii. Our Earth _____ on its own axis.

iii. The Moon changes from a _____ to a full moon and back again to a crescent.

iv. The size of a shadow changes as the Earth _____.

v. _____ is the imaginary line that divides the Earth into two hemispheres.

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

i. The light of the Earth shines on the Moon. _____

ii. The Sun is a star. _____

iii. The planets revolve around the Earth. _____

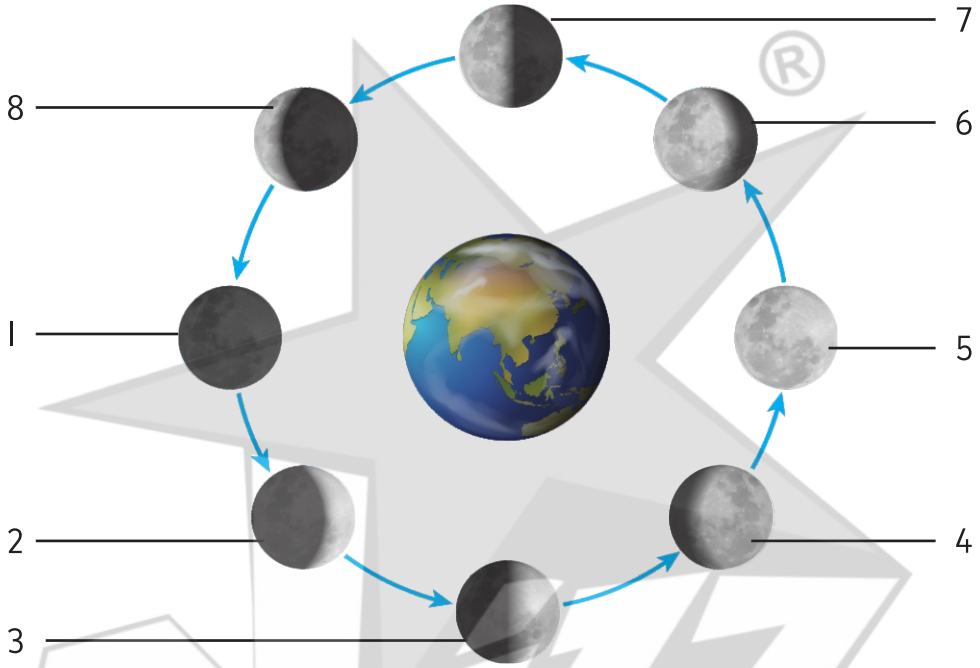
iv. The Earth takes one year to rotates on it axis. _____

v. There are eight planets in solar system. _____

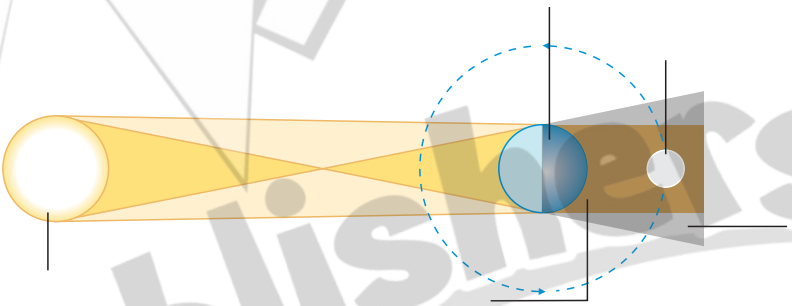
vi. The Earth rotates on its orbit. _____

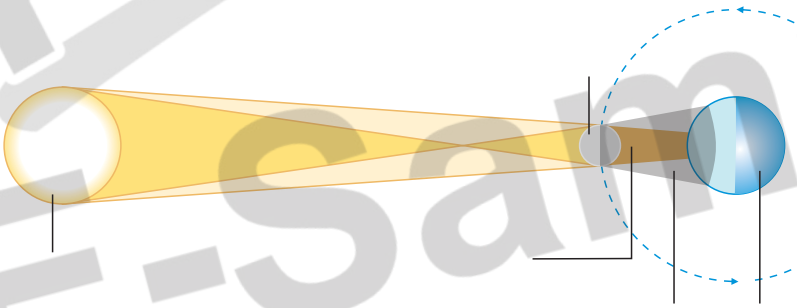
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4 i. Label the phases of moon.



ii. Write which is a solar eclipse and which is a lunar eclipse. Also write the names of each element.





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5 **Answer the following questions.**

i. What is planetary system?

ii. Write the names of the planets in order starting from the sun.

iii. Define orbit.

iv. Why is it difficult to spot the moon in the sky during day time?

v. Define equator.

vi. What causes day and night?

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vii. Differentiate between rotation and revolution.

Rotation	Revolution

viii. Differentiate between comet and asteroid.

Comet	Asteroid

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

i. What causes the change of seasons? Explain.
ii. Define Lunar eclipse with the help of diagram.

Constructed Response Questions

i. The Moon is a non-luminous object. Why and how does it appears to shine?
ii. Why can a person on Earth see different phases of the Moon?

PROJECT TIME

Make a model of Solar and Lunar eclipses using low-cost or no-cost materials.

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