

Wizz World of **SCIENCE**

GRADE

6



Aligned with Single National Curriculum

PREFACE

Wizz Social Studies for grades 1 to 5 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 Social Studies 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?

Wizz Publishers is the best choice for students because it is:

- 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.

PROJECT DIRECTOR	:	Muhammad Ahmad
PROJECT CO-ORDINATOR	:	Jawad Tahir
CREATIVE HEAD	:	Muhammad Asif Hanif
Designer	:	Amir Taj
GRAPHICS	:	Wizz Arts

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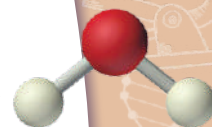
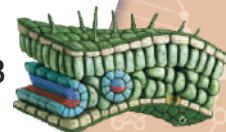
Wizz World of SCIENCE

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Students' Learning Outcomes

All students will be able to:

- Recognize cells as the basic unit of life that are organized into tissues, organs, systems and organisms.
- Arrange and rank different levels of cellular organizations- cells to tissues, organs and organisms.
- Relate the structures of some common cells (nerve, muscle, epithelium and blood cells) to their functions.
- Identify the structures present in an animal cell and plant cell as seen under a simple microscope and relate them to their functions (only cell membrane, cytoplasm, nucleus, cell wall, chloroplast, mitochondria and vacuole).
- Describe the similarities and differences between the structures of plant and animal cells.
- Sketch the animal and plant cells and label key organelles in each.
- Compare and contrast an animal cell and plant cell by preparing slides using onion peels and cheek cells.

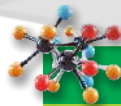
Let's Start!

- Why do you think cells are called the "building blocks of life"?
- How do small parts come together to form a complete organism?
- What might happen if any part of your body stopped working?
- What tools or methods do scientists use to study cells?

1.1 Cells - The Building Blocks of Life

Imagine building a wall with bricks. Each brick plays an important role in holding the wall together, giving it shape and strength. Similarly, the cells are like the brick that make up the body of living things.

All living things are made up of tiny units called cells. These cells are the basic building blocks of life, meaning they can perform all the functions necessary to stay alive. Cells are living units that can feed, grow, reproduce and respond to their surroundings.



SciByte

Robert Hook was the first to person to discover cells in 1665.



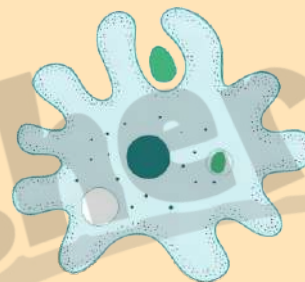
Some living things are made up of only one cell, called unicellular organisms, while others consists of many cells are known as multicellular organisms.



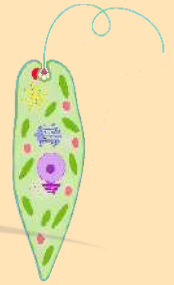
Chlamydomonas



Paramecium



Amoeba



Euglena

Unicellular Organisms



Animals



Plants

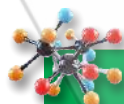
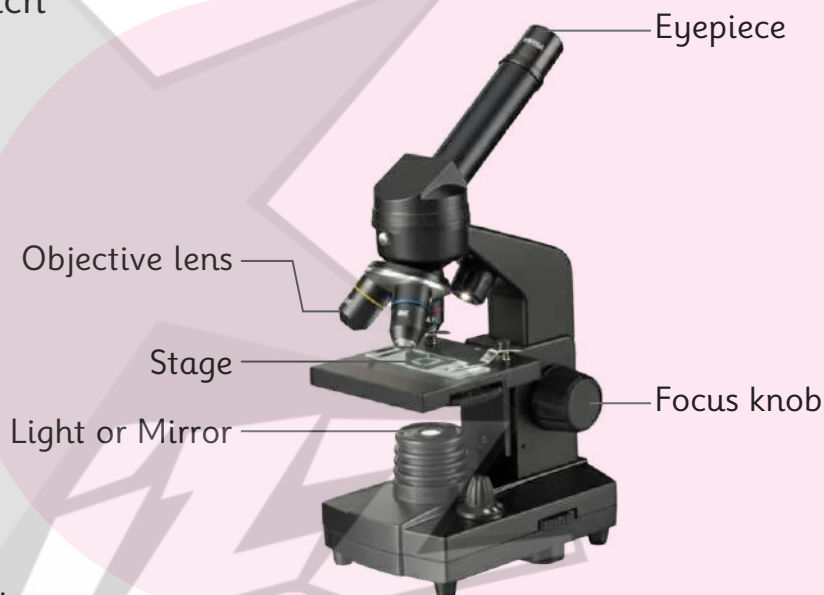
Multicellular Organisms

Look at the given picture of an instrument. Can you guess its name?

The instrument shown is called a microscope. It helps us see objects that are too small for the naked eye by magnifying them, allowing us to study them in detail.

Here are some important parts of a basic microscope:

- **Eyeiece:** The part through which you look.
- **Objective lenses:** These lenses magnify the object.
- **Stage:** The platform where the slide (a small glass plate with the specimen is placed).
- **Light or Mirror:** It reflects or provides light to illuminate the specimen.
- **Focus Knobs:** These help to make the image clear.



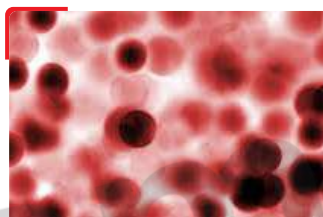
SciByte

The first microscope was invented over 400 years ago. It allowed scientists to discover microscopic life forms for the very first time.

Following are specimens of an animal and a plant cell as seen under a microscope.



Plant cell



Blood cell

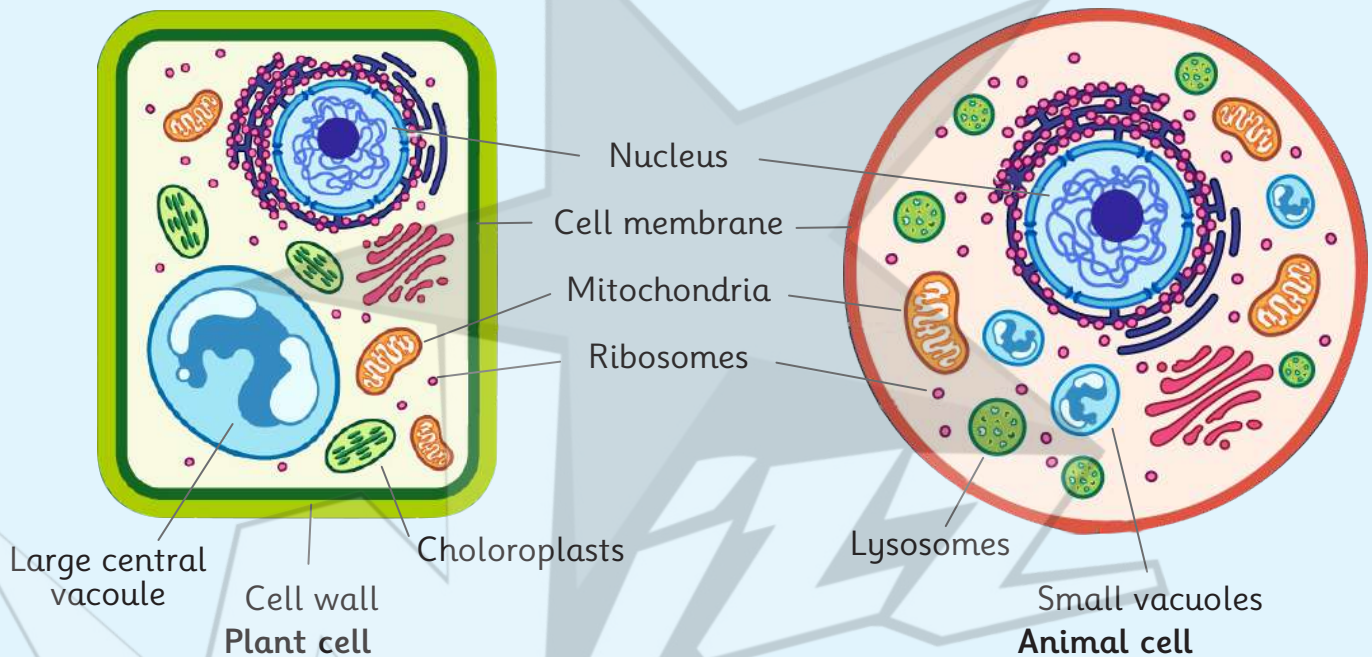


Teacher's Note:

Encourage students to engage in hands on lab work and demonstrate how to use microscope to observe specimen.

Cell Organelles

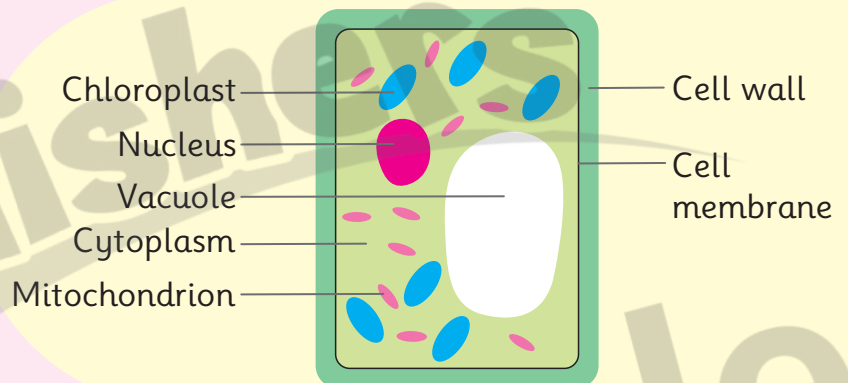
When observed under a microscope, we can see several important parts of plant and animal cell, called cell organelles.



Each cell organelle performs a special function to keep the cell alive and working properly.

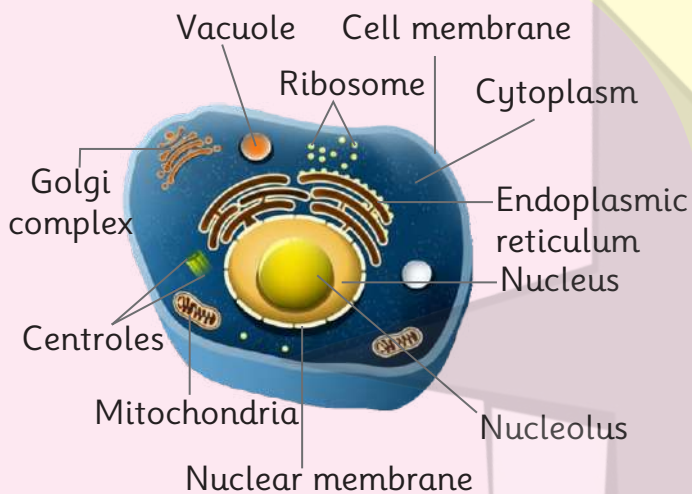
a. Cell Wall

A strong outer layer that protects the cell and gives it shape. Cell wall is present in plant cells, whereas absent in animal cells. It helps plants remain upright and firm.



b. Cell Membrane

The cell membrane is a thin layer surrounding the cell. It controls what enters and leaves the cell, much like the skin of the body. It is partially permeable, it is also called plasma membrane. Allowing certain substances cell wall to pass through. In plant cells, the cell membrane is located just inside the cell wall. It also helps cells communicate with one another and maintain balance.



c. Nucleus

The nucleus is the control center of the cell. It directs all activities and functions. In animal cells, the nucleus is located almost near the centre of animal cell, whereas, in plant cells, a large vacuole pushes it to one side.

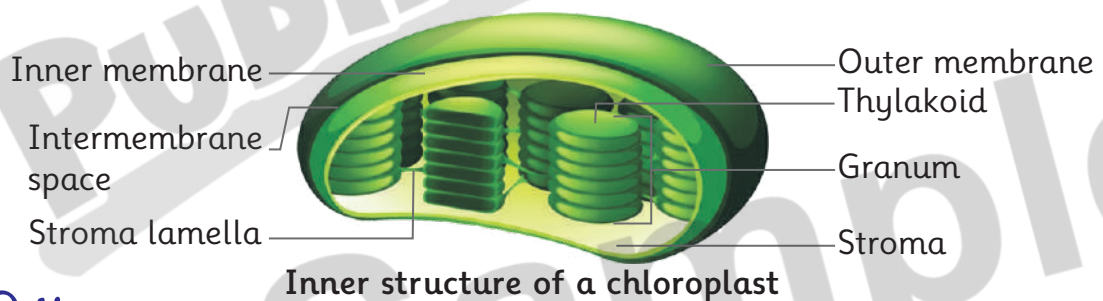
The nucleus is surrounded by a nuclear membrane, and the material inside is called nucleoplasm. Within it are rod-shaped structures known as chromosomes, made of DNA and protein, which carry genetic information.

d. Cytoplasm

The cytoplasm is a jelly-like substance found inside both plant and animal cells. It fills the space between the cell membrane and the nucleus and holds the cell organelles in place. Most cell functions occur within the cytoplasm.

e. Chloroplast

A chloroplast is a green, oval-shaped organelle found only in plant cells. It contains chlorophyll, a green pigment that captures sunlight to produce food through photosynthesis. Thus, chloroplasts are called the food producers of plant cells. Chloroplasts are not present in animal cells.



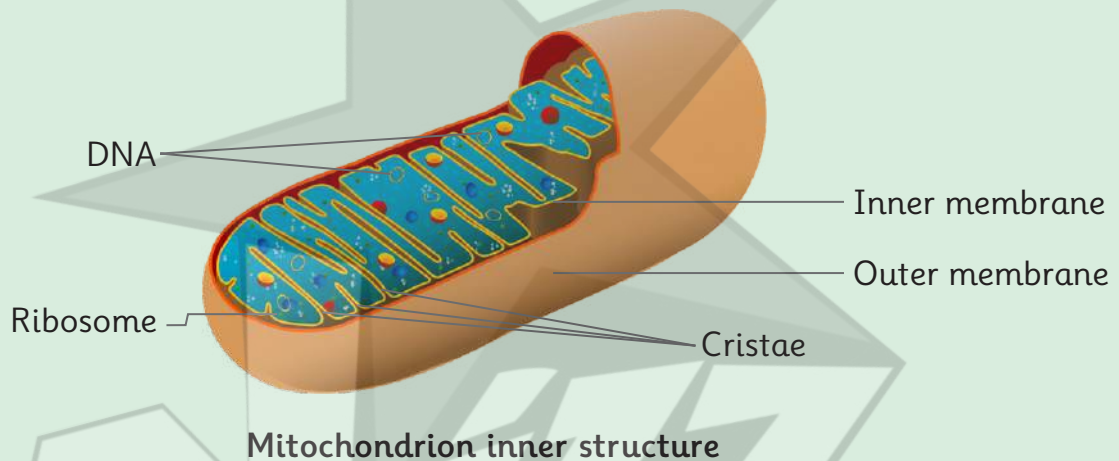
Let's Think Aloud

What would happen if a plant did not produce chlorophyll?
How would it absorb sunlight?

f. Mitochondria

The mitochondrion is a bean-shaped organelle found in the cytoplasm. It has an inner folded membrane called cristae.

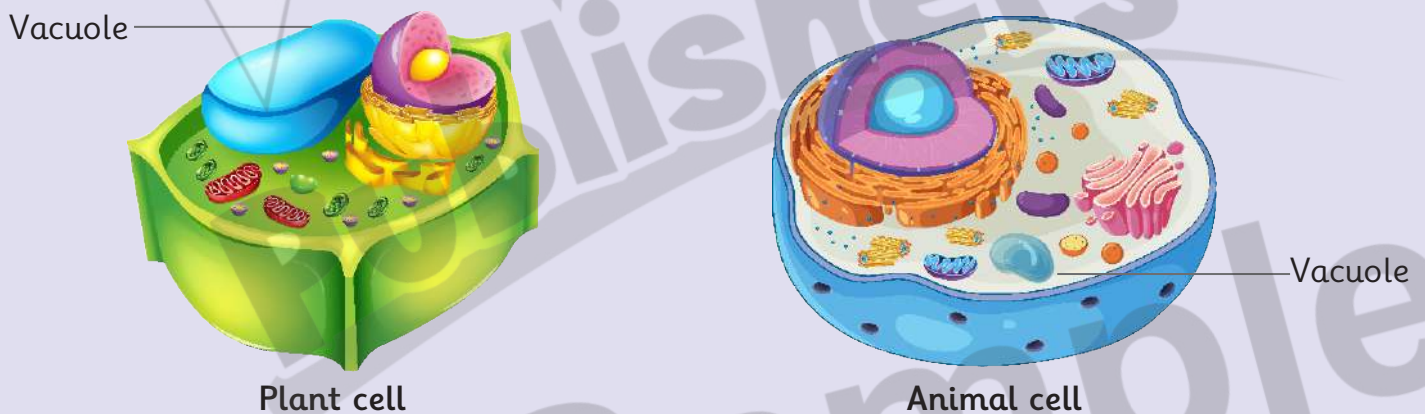
It is known as powerhouse of the cell, as it produces the energy needed for growth, repair and movement.



g. Vacuole

A vacuole is a sac like structure that stores water, food and waste. Plants cells have one large vacuole, while animal cells have smaller and multiple vacuoles.

Vacuoles help maintain cell shape and protect the cells from toxins by storing waste materials.



Let's

Think Aloud

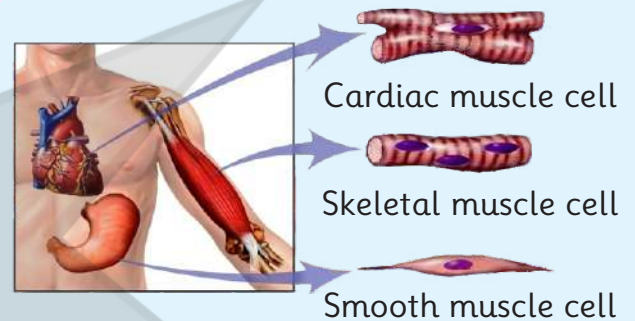
How many cells do humans have in their bodies?

1.1.1 Types of Cells in the Human Body

Different types of cells in the human body have specialised structures and functions.

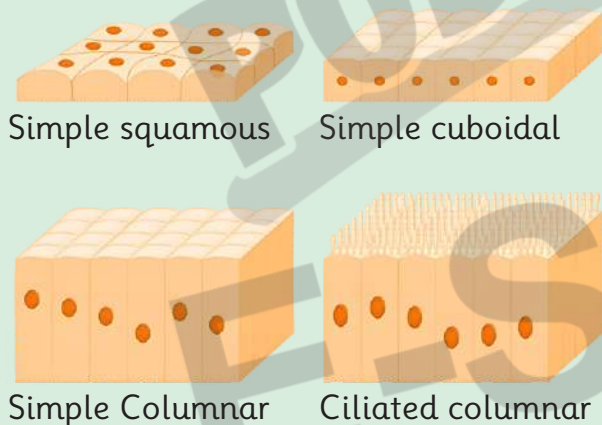
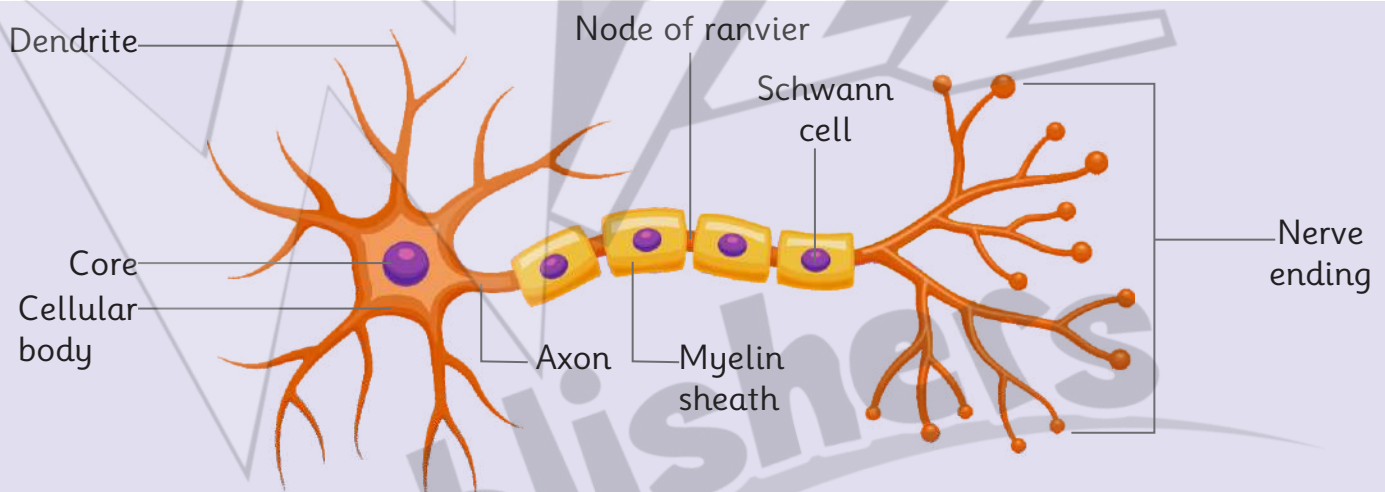
a. Muscle Cells

They are long, thin and cylindrical in shape. They can contract and relax to allow movement.



b. Nerve Cells (Neurons)

They are long, thin and branched. The branched ends to connect to other cells, transmitting electrical signals throughout the body.

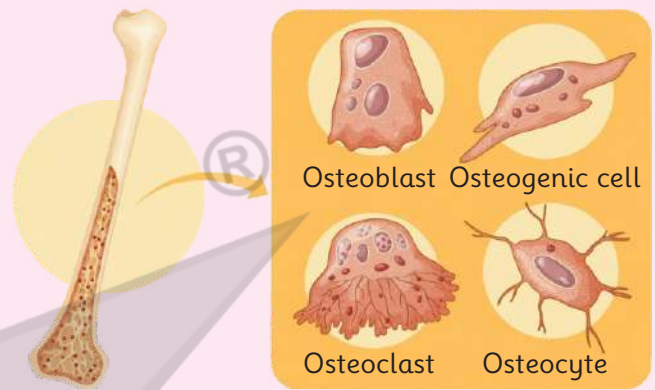


c. Epithelial Cells

They are flat, tile shaped or cube shaped cells packed closely together to form protective layers. They cover and protect body surfaces like skin and lining of organs.

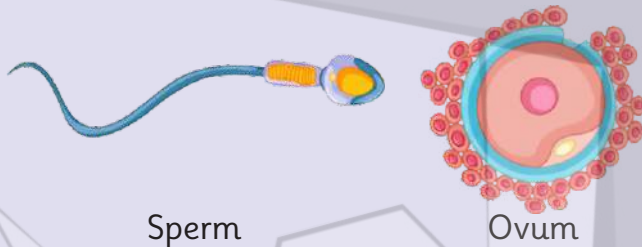
d. Bone Cells

They are flat, short and irregular in shape. They provide structure and support to the body.



e. Reproductive Cells

Reproductive cells, also called sex cells. They are special cells involved in sexual reproduction. There are two main types of cells: Egg and sperm cells.

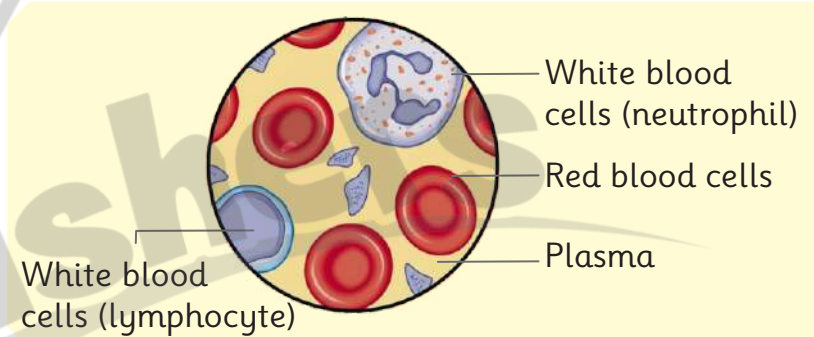


f. Blood Cells

Blood cells are of two main types:

i. Red Blood Cells (RBCs)

They are disc-shaped and flexible to move through small blood vessels. They contain hemoglobin, a red coloured pigment that carries oxygen and carbon dioxide.

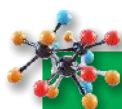


Hemoglobin binds with oxygen in the lungs and carries oxygen through the bloodstream to all the cells and tissues.

Hemoglobin also helps carry some carbon dioxide (a waste gas) from the cells back to the lungs to be exhaled.

ii. White Blood Cells (WBCs)

They are irregular in shape and flexible to move to infection sites, helping the body fight diseases.



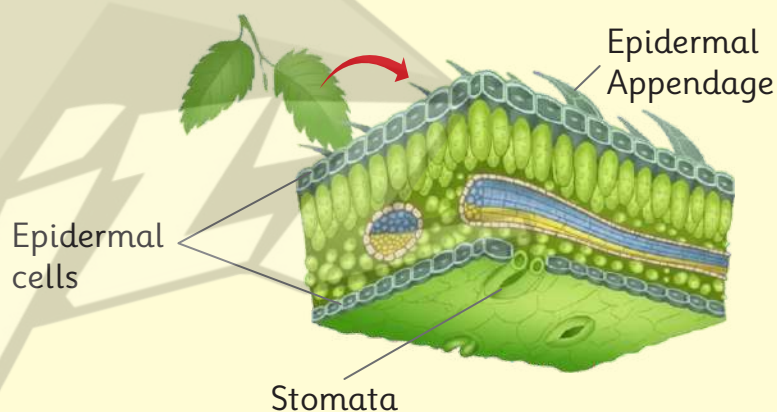
Different cells have different life spans, some live only few days, while brain cells can last a whole lifetime.

1.1.2 Types of Cells in Plants

Different parts of a plant are made up of different types of cells. These cells vary in shape and structure depending on the function they perform. In a leaf, for example, the cells that make up the surface, the middle layer and the transport tissues all have different forms and specialised roles.

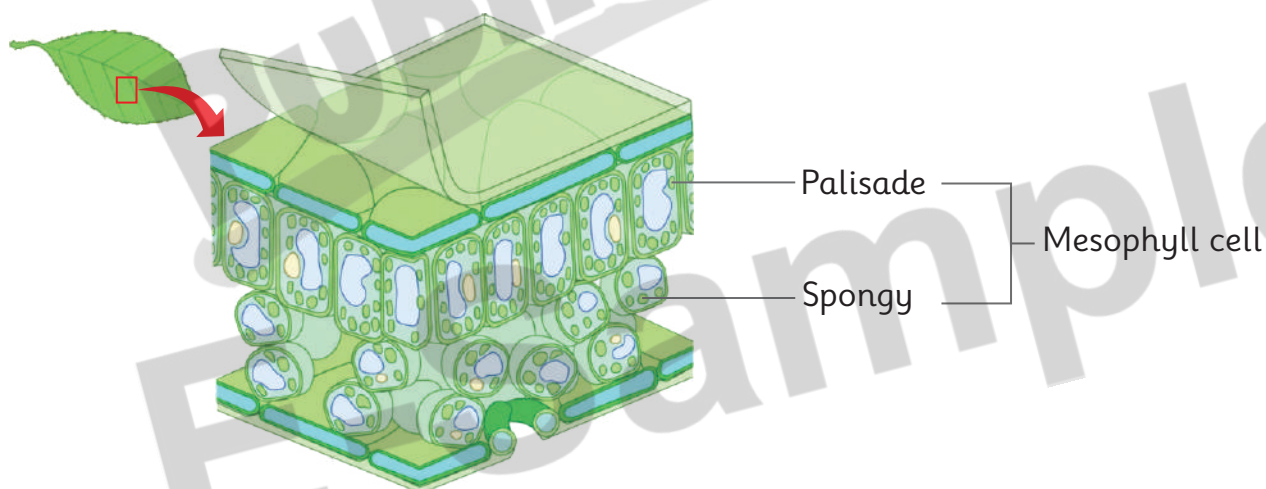
a. Epidermal Cells

They are thin, flat, and tile like cells. They form the outer protective layer of a plant's leaf upper epidermis and lower epidermis helping prevent water loss and infection.



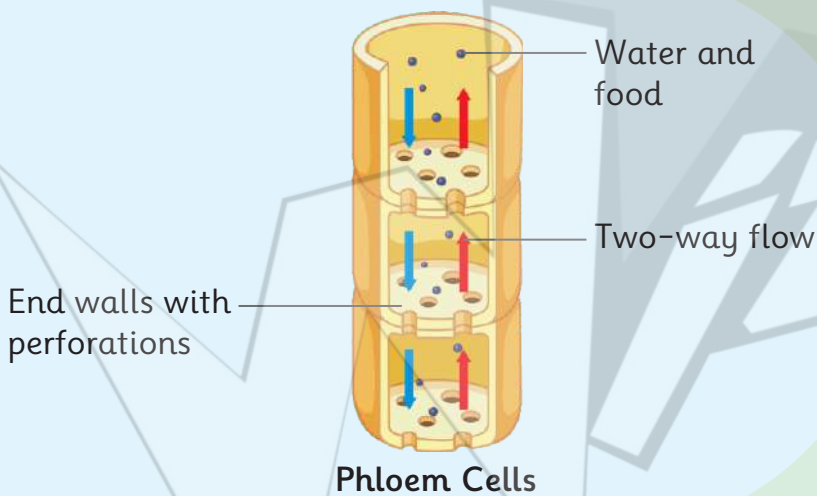
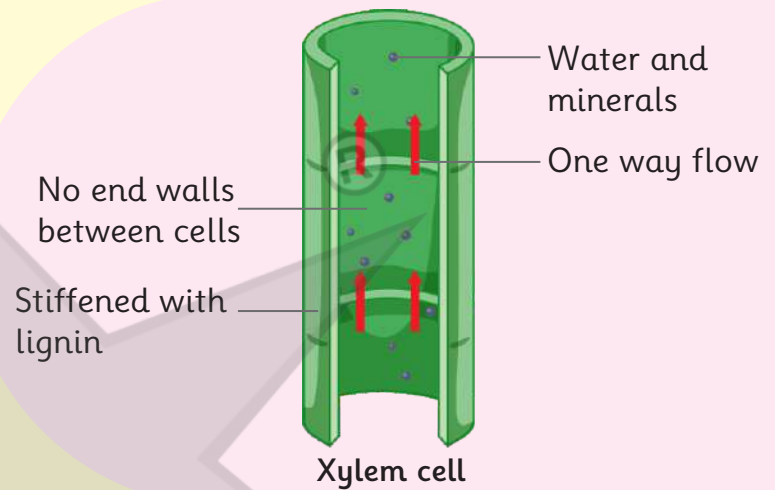
b. Mesophyll Cells

Mesophyll cells are elongated or irregular in shape and are located in the middle layer of the leaf. They contain chloroplasts and are the main site of photosynthesis, where sunlight is converted into food energy for the plant.



c. Xylem Cells

Xylem cells are long and tubular in shape. They transport water and minerals absorbed by the roots to other parts of the plant. They also provide mechanical support due to their thickened walls.

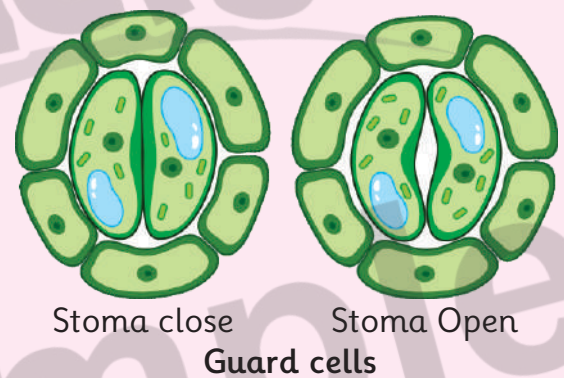


d. Phloem Cells

Phloem cells are also tubular in shape and are responsible for transporting food from the leaves, where it is made, to other parts of the plant that need it for growth and storage. The movement is known as translocation.

e. Guard Cells

They are kidney shaped and play a vital role in controlling gas exchange and water balance in the plant. They surround tiny pores called stomata and regulate their opening and closing, allowing gases like carbon dioxide and oxygen to move in and out of the leaf.



Teacher's Note:

Engage students in identifying and exploring the location, structure and importance of xylem and phloem cells through simple diagrams or microscope observations of plant tissues (such as onion and celery stem sections.)



Let's

Think Aloud

What would happen if guard cells lost their ability to open and close the stomata? How would that affect the plant's breathing, water loss and overall health?

Animal Cell	Plant Cell
There is no cell wall.	There is an additional outer layer called cell wall.
The cell membrane is the outermost layer.	The cell membrane is inside the cell wall.
The nucleus is usually in the centre.	The nucleus is often pushed to one side by a large vacuole.
Contains multiple, small vacuoles.	Contains a single, large vacuole.
No chloroplasts present.	Contains chloroplast for photosynthesis.



Activity Time!

Objective: To observe the parts of an animal cell under a microscope.

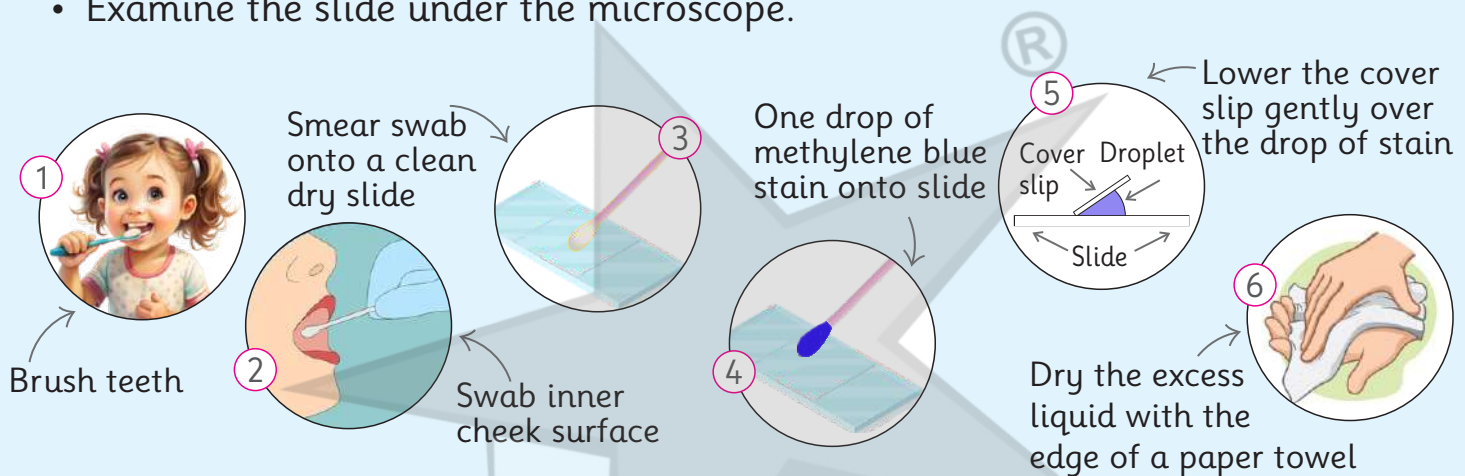
Resources:

- Methylene blue
- Glass slide
- Coverslip
- Microscope
- Cotton swab

Instructions:

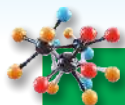
- Brush your teeth to clean the mouth area.
- Gently scrape the inside of your cheek with a cotton swab.
- Smear the swab onto a clean dry glass slide.

- Add one drop of methylene blue stain onto the slide.
- Lower the coverslip gently over the stained area.
- Examine the slide under the microscope.



a. What parts of the cells can you see?

b. Draw what do you observed under the microscope.



SciByte

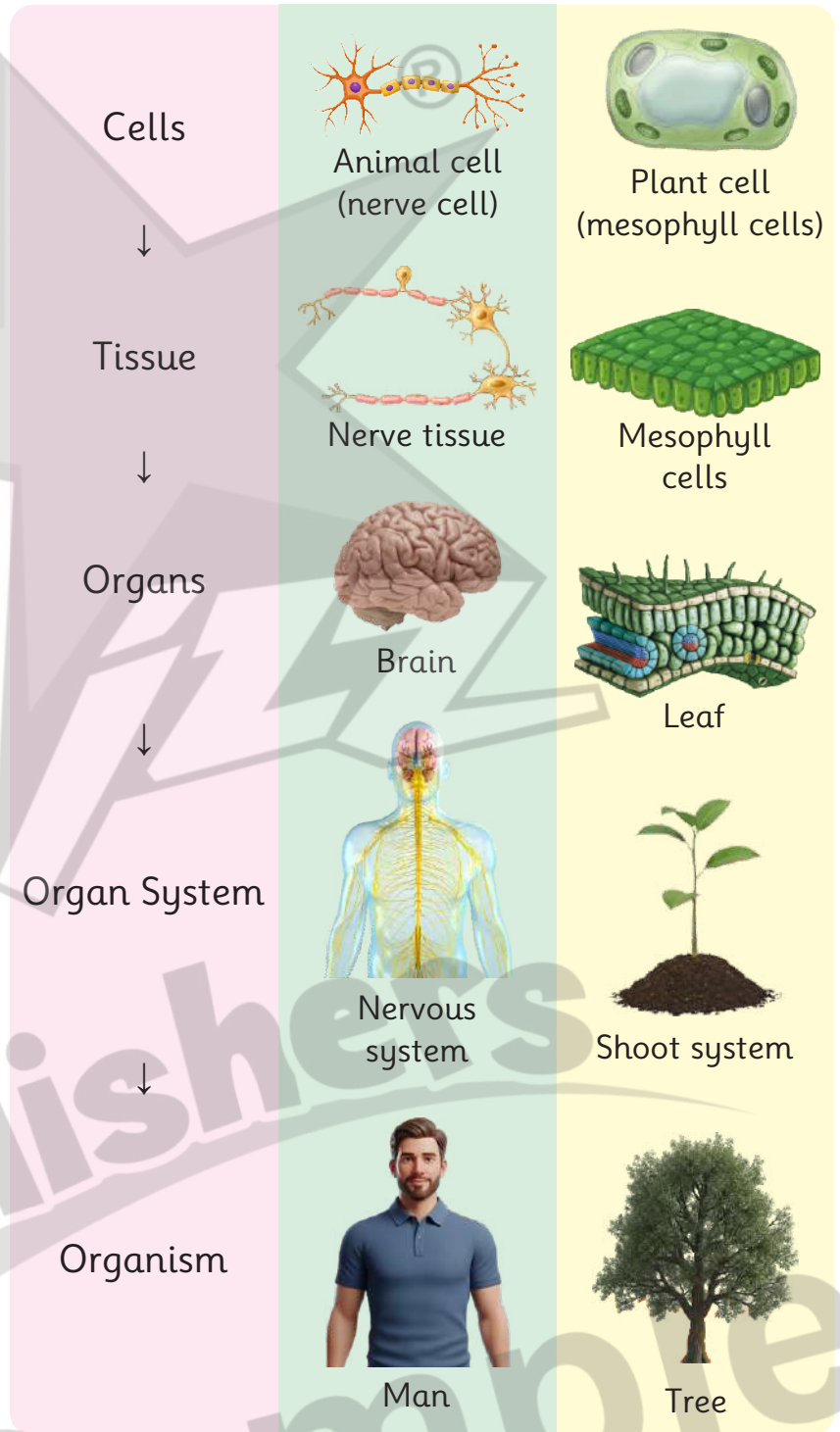
When a cell becomes damaged or infected, it can self-destruct through a process called apoptosis.

1.1.3 Levels of Cellular Organizations

Cellular organization describe how cells are arranged structured and grouped in living organisms so different functions are performed efficiently.

In multicellular organisms, organization follows a hierarchy:

- **Cells** are the smallest structural and functional units of life.
- A group of similar cells working together forms a **tissue**.
- Different tissues combined form an **organ**. Each organ with a specific job and structure.
- Organs that cooperate to perform body functions form an organ system.
- All organs together make a complete organism.



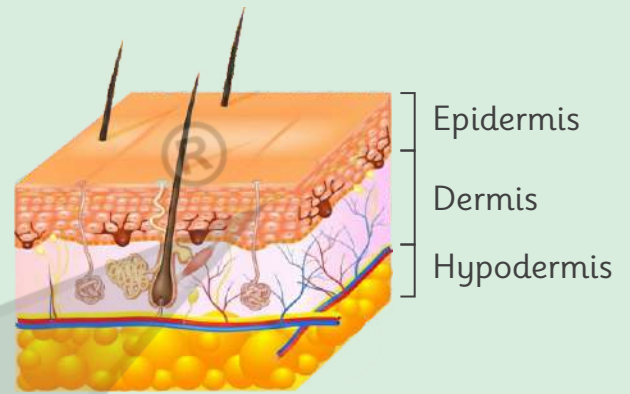
1.2 Tissues

1.2.1 Animal Tissues

Following are four major tissue types occur in animals:

a. Epithelial Tissue

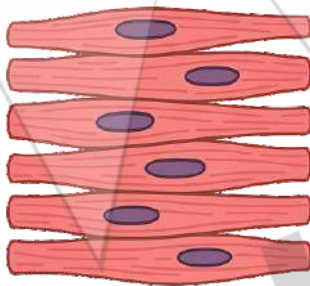
Epithelial tissue are closely packed cells form flat sheets or layers that covers the body line organs, cavities and protect underlying structures.



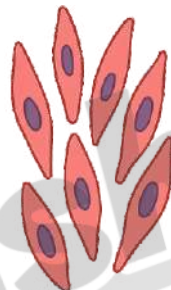
b. Muscle Tissue

These tissues are made of muscles cells that contract to produce movement. There are three types:

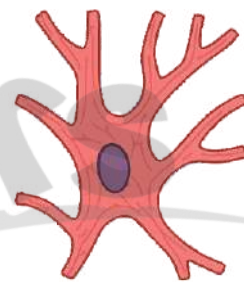
- Cardiac muscles in the heart make the heart beat to pump blood throughout the body.
- Skeletal muscles make the muscles to contract and relax and aid in movement.
- Smooth muscles are found in the walls of internal organs like the stomach and blood vessels and cause movement in different organs.



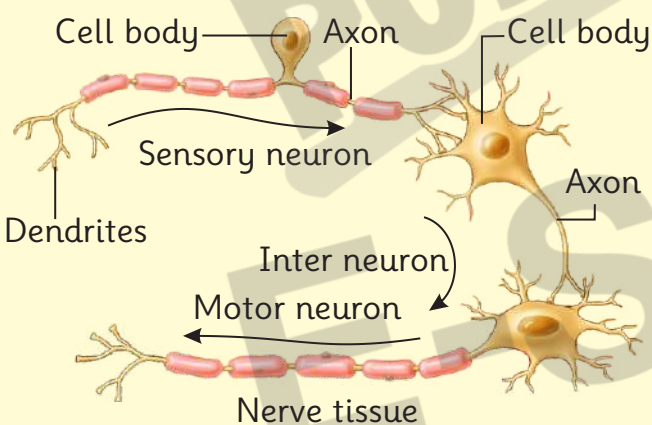
Cardiac muscles



Skeletal muscles



Smooth muscles

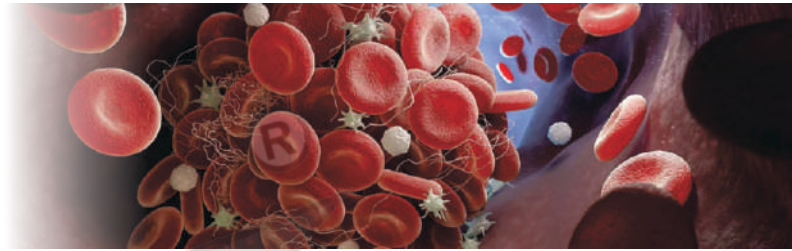


c. Nervous Tissue

Nervous tissue is a specialized tissue type that makes up the nervous system. They control and coordinates body functions. They are responsible for transmitting messages from one part of the body to another.

d. Blood Tissue

Blood is a fluid connective tissue flowing through vessels. It transport gases, nutrients and wastes; defend against infection and helps regulate temperature.



1.2.2 Plant Tissues

Following are three major tissue types occur in plants:

a. Epidermal Tissue

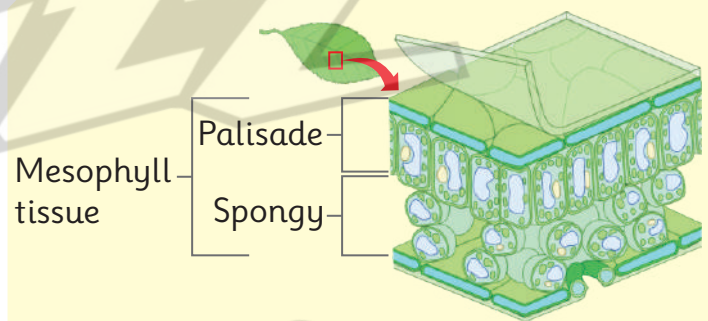
Epidermal means outer covering, which means these tissue covers the outer surface of plants. They are formed from epidermal cells. They protect the plant from drying out.



Epidermal tissue

b. Mesophyll Tissue

The word "mesophyll" means "middle of the leaf" because these tissues are found in the middle part of the leaf, between the top and bottom layers. Cells forming mesophyll tissues are called mesophyll cells. They play a very important role in making food for the plant through a process called photosynthesis.



There are two types of mesophyll tissues:

- Palisade mesophyll helps in absorption of sunlight for photosynthesis.
- Spongy mesophyll helps in gas exchange in leaves.

c. Vascular Tissue

Vascular tissue in plants works like roads and pipes, carrying water, food, and nutrients to different parts of the plant.

There are two main types of vascular tissue:

- Xylem carries water and minerals from roots to leaves. It moves water upward through the stem.
- Phloem carries food (sugar) made in the leaves to other parts of the plant. It moves food up and down, wherever the plant needs it.



Activity Time!

Objective: To observe how water moves through xylem in a plant.

Resources:

- Celery stick with leaves
- Clear glass & water
- Food colour (red or blue)
- Scissors

Instructions:

- Fill the glass halfway with water.
- Add 10–15 drops of food colour to the water and stir.
- Cut the bottom of celery at angle of 45° .
- Place it in the coloured water.
- Leave for a few hours or overnight.



a. What will you observe after a few hours?

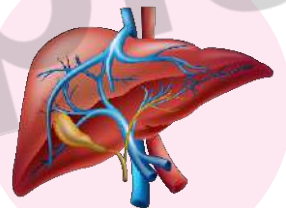
b. What evidence shows xylem is working?

1.3 Organs in Animals

In higher plants and animals, tissues organize to form organs, each specialised for a particular function.

a. Liver

The largest internal organ, located on the right side of the stomach under the ribs. It is reddish brown in colour. The main function of liver is to filters out toxins and waste from blood, produces bile for fat digestion and regulates nutrients.



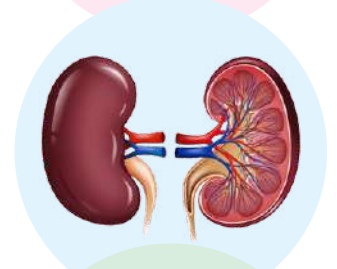
b. Heart

A strong, muscular organ about the size of a fist, it slightly to the left of centre in the chest. It pumps blood continuously throughout the body.



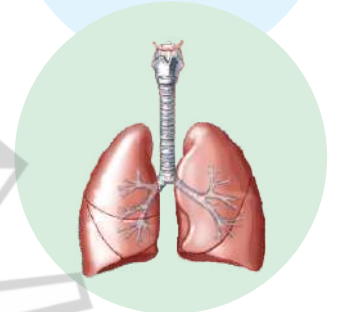
c. Kidneys

Kidneys are two small, bean-shaped organs in lower back on either side of the spine. The kidneys filter blood removing waste and excess water to form urine; they also help balance salt and pH.



d. Lungs

A pair of spongy organs protected by the rib cage. They enable gas exchange; oxygen is taken in; carbon dioxide is removed.

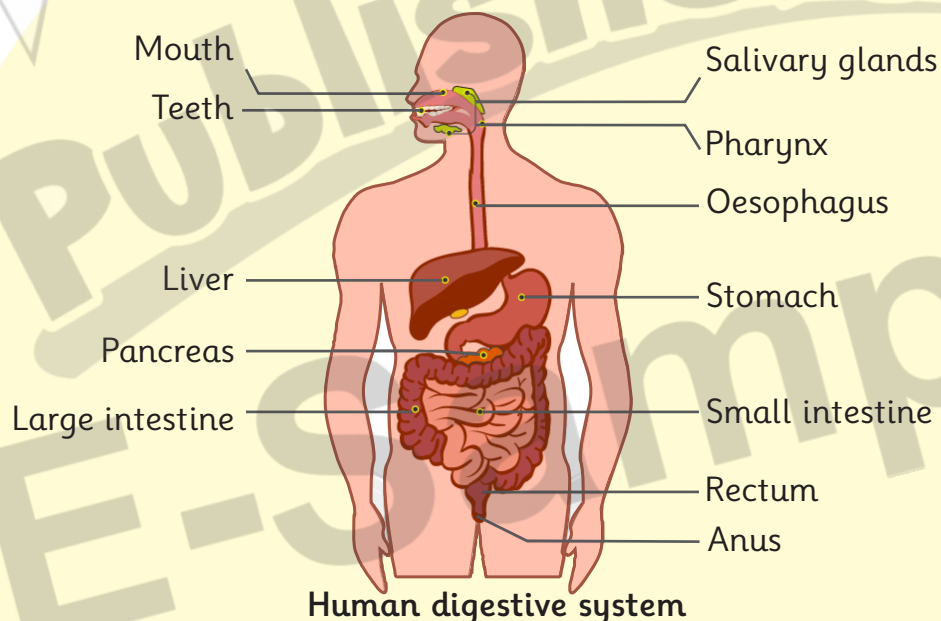


1.4 Organ Systems in Animals

An organ system is a group of organs working together to perform a major function. Some of the main organ systems of the human body are given below:

a. Digestive System

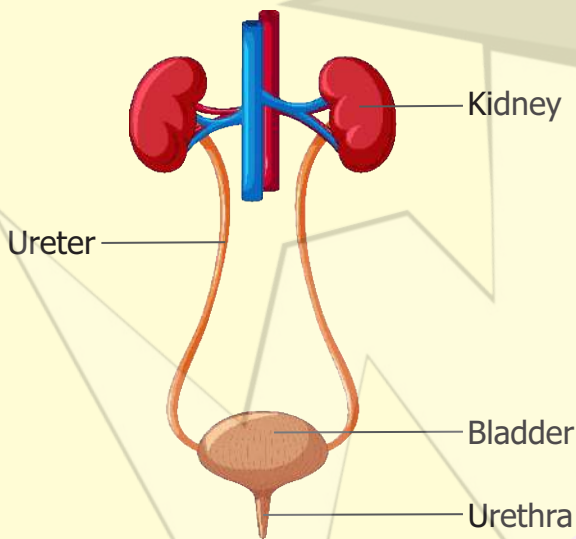
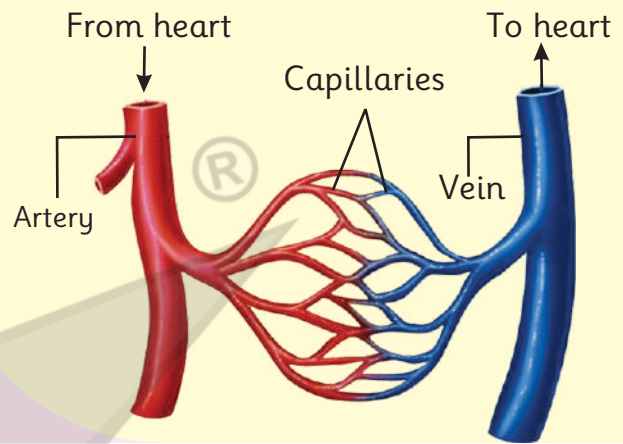
This system is responsible for breakdown of complex insoluble food into simpler soluble substances, with the help of enzymes, so nutrients can be absorbed.



b. Circulatory System

The circulatory system is like a body's transport network. It carries blood to every part of the body.

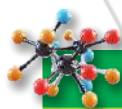
Blood carries oxygen (from lungs) and nutrients (from digestion) to cells and removes carbon dioxide and wastes.



c. Excretory System

The excretory system helps our body to get rid of waste. Just like a house needs a garbage system, our body needs one too, that is what the excretory system does.

The excretory system removes metabolic wastes and helps keep the blood clean and chemically balanced. Major organs include kidneys, ureters, bladder and urethra.

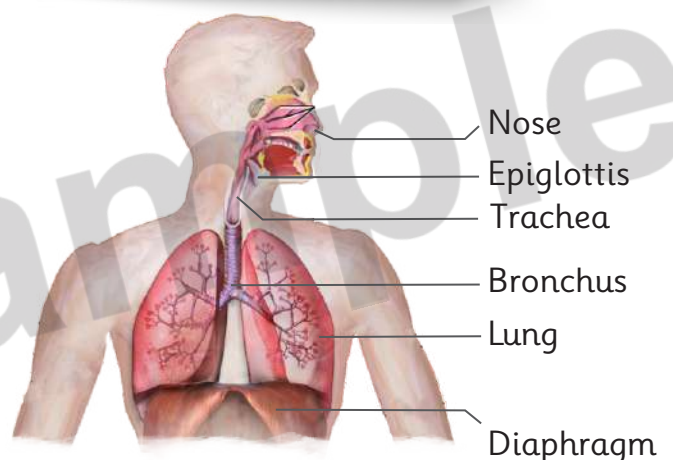


SciByte

Kidneys filter around, the two 200 litres of fluid daily and produce about 1-1.5 liters of urine in 24 hours.

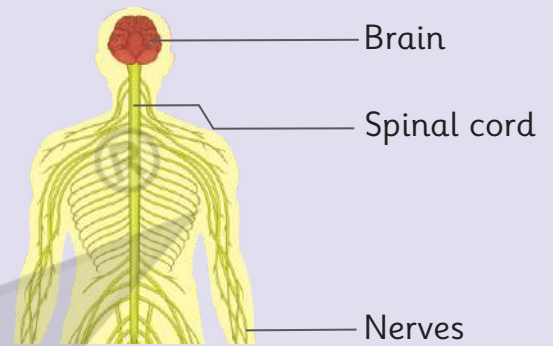
d. Respiratory System

The respiratory system enables breathing and gas exchange; it brings oxygen into the lungs and removes carbon dioxide from the blood.



e. Nervous System

The nervous system controls and coordinates body functions. It is made of specialized cells called neurons which have ability to send and receive messages between the brain and the body.



1.5 Organ and Organ Systems in Plants

Plants have organs, roots, stems, leaves and flowers that work together to keep the plant alive. The whole body of a plant can be divided into two main organ system:

a. Root System

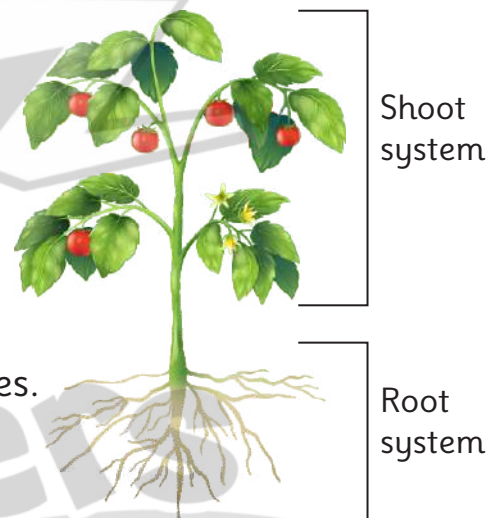
It is the part of a plant that grows below ground. It plays a very important role in keeping the plant alive and healthy. The system is important because of the following reasons:

- Anchor the plant firmly in soil.
- Absorb in water and minerals.
- Transport water minerals upward to stems and leaves.
- Often store food.

b. Shoot System

It is the part of a plant that grows above the ground. It includes the stem, branches, leaves, flowers and fruits. The system is important because of the following reasons:

- Supports the plant; transport water, food and nutrients.
- Leaves make food via photosynthesis.
- Flowers enable reproduction and seed formation.



Let's
Think Aloud

If the xylem of a plant were blocked, which organ system function would fail first and how would the plant appear?



What have you learnt?

- Cells are the smallest structural and functional units of life.
- Cells are living units that can feed, reproduce and respond to their surroundings.
- Cellular organization refers to the way various cells are structured and grouped in living organism to perform various functions efficiently.
- A group of similar cells working together performs a tissue.
- A group of tissues working together forms an organ and each organ has a specific job and structure.
- Different organs combine into organ systems, each performing distinct functions in the body.
- Organisms made up of one cell are called unicellular, while those made up of many cells are multicellular.
- A microscope helps us observe objects too small to see with the naked eye.
- Nerve cells transmit electrical signals throughout the body.
- Reproductive cells are special cells for sexual reproduction.
- Red blood cells contain hemoglobin, which transports oxygen and carbon dioxide.
- White blood cells fight infections and protect the body.
- Epidermal cells form a protective layer in plants and prevent water loss.
- Mesophyll cells are the main site of photosynthesis in plant leaves.
- Guard cells control gas exchange and water balance, surrounding tiny openings called stomata.
- Xylem carries water and minerals from roots to leaves.
- Phloem transports food (sugar) from leaves to other parts of the plant.
- The digestive system breaks down complex food into simpler substances.

- The circulatory system transports blood, oxygen and nutrients throughout the body.
- The excretory system removes waste products and purifies the blood.
- The respiratory system enables breathing and energy production in cells.
- The nervous system controls and coordinates all body parts by sending and receiving messages.
- The root system grows below the ground and anchors the plant.
- The shoot system grows above the ground and support leaves, flower and fruits.

Exercise

1 Choose the correct option.

- All living things reproduce, meaning they make copies of themselves by the process of _____.
 - reproduction
 - excretion
 - respiration
 - digestion
- Which of the following scientist discovered cells?
 - Einstein
 - Robert Hooke
 - Robert Brook
 - Neil Angstrom
- The material inside the nucleus is called _____.
 - cell membrane
 - cell wall
 - chloroplast
 - nucleoplasm
- What is the main role of chloroplast?
 - It helps in transpiration.
 - It helps in photosynthesis.
 - It helps in transportation.
 - It helps in evaporation.

- v. The nucleoplasm contains rod-shaped objects called_____.
- a vacuole
 - b chromosomes
 - c genes
 - d mitochondria
- vi. Which cell organelle is absent in animal cells?
- a Chloroplast
 - b Cell membrane
 - c Vacuole
 - d Nucleus
- vii. Which type of cell transports oxygen from the lungs to the body tissues?
- a Muscle cell
 - b Motor nerve cell
 - c RBCs
 - d Phloem
- viii. Motor nerve cells carry_____ around the body.
- a blood
 - b impulses
 - c messages
 - d nutrients
- ix. Which cells transport sugars from leaf cells to other parts of the plant?
- a Root Hair cell
 - b Xylem vessel
 - c Phloem
 - d RBCs
- x. A group of similar cells specialized for a specific function is called a_____.
- a Cell
 - b Organ
 - c Tissue
 - d Organ System
- xi. Which cell type is responsible for photosynthesis?
- a Epidermis
 - b Vascular Tissue
 - c Mesophyll
 - d Strengthening Tissue
- xii. It is bean shaped organ located on either side of the spine_____.
- a Liver
 - b Kidneys
 - c Stomach
 - d Lungs
- xiii. Which plant part contains seeds?
- a Stem
 - b Flower
 - c Leaf
 - d Root

xiv. Encircle the correct function of the digestive system.

- a It breaks down insoluble substances into soluble substances.
- b It breaks down food in the body cells to produce energy.
- c It is responsible to carry messages from one part of the body to another.
- d It helps to get rid of harmful and poisonous substances.

xv. The chlorophyll is in colour_____.

- a red
- b yellow
- c blue
- d green

xvi. Water is conducted from roots to leaves by_____.

- a xylem
- b epidermis
- c phloem
- d mesophyll

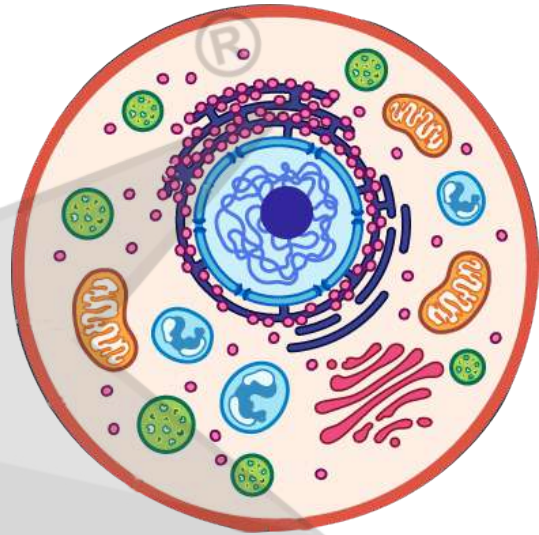
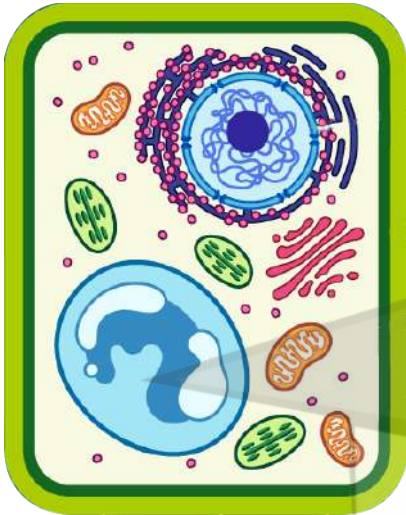
2 Complete the Venn diagram.

Organelles found
in animal cells

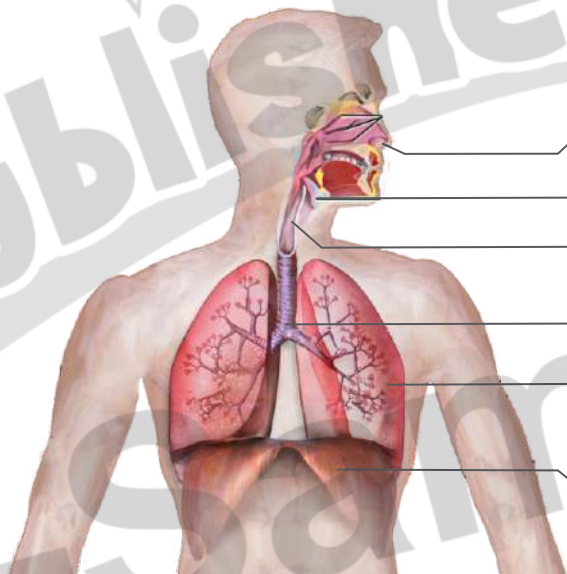
Organelles found
in plant cells

Organelles
found in both

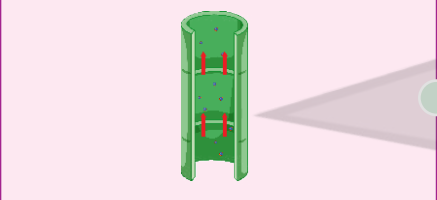
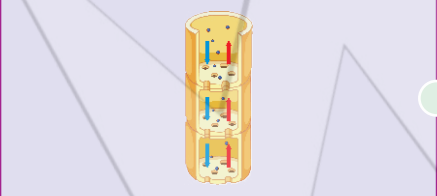
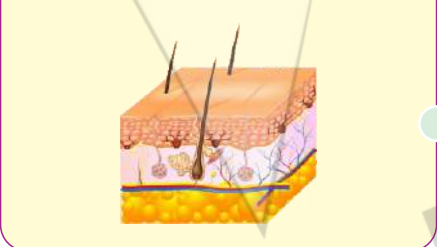
3 a. Identify and write down the type of cell. Also label their cell organelles.



b. Label the diagram of human respiratory system.



- 4 Identify cells given in Column A and write down their names in Column B. Then match with their function in Column C.

Column A (Diagram)	Column B (Name)	Column C (Function)
		They are tubular in shape and transport food from leaves to the rest of the plant.
		They are irregular in shape, moves flexibly to reach and fight infections.
		They are long and tubular in shape, transport water and minerals from roots to other parts of the plant.
		They are flat, tile shaped cells. They covers and protect body surfaces such as skin and organ linings.
		They are disc shaped and flexible. They contain hemoglobin to transport oxygen and carbon dioxide.

- 5 Answer the following questions.

i. Define the following:

- Cells Tissue
- Organ
- Organ system

ii. Differentiate between:

- Unicellular and Multicellular organisms
- Xylem and Phloem cell

- Cytoplasm and Nucleoplasm
- Root system and Shoot system

iii. Write down the function of the following:

- Cell membrane
- Chloroplast
- Kidney
- Liver

iv. In how many types mesophyll tissues divided into? Also write the difference.

v. What is cellular hierarchy? Explain with an example.



Constructed Response Questions

i. Do all cells in your body look the same? Why or why not?



PROJECT TIME



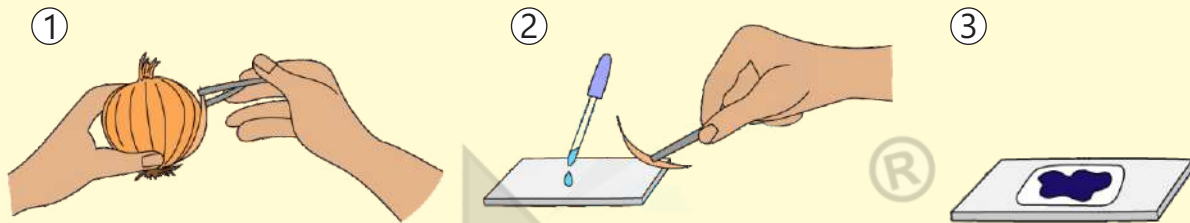
Objective: To prepare a slide of onion cells.

Resources:

- Tweezer
- Onion
- Iodine solution
- Coverslip
- Glass slide

Instructions:

- Take an onion and peel a thin layer of onion using a tweezer.
- Take a clean glass slide and put a drop of water in the middle of it.
- Now, place the peeled onion layer on the water drop.
- Add a drop of iodine solution on the onion layer.
- Gently place a coverslip on top.
- Observe under a microscope.



a. What parts of the cells can you see?

Draw what you observe.



Design:

- Create a simple home microscope, using the weblink given: <https://www.scienceinschool.org/article/2012/microscope/>
- You may take help from your teacher, parents or siblings.

Students' Learning Outcomes

All students will be able to:

- Identify the constituents of a balanced diet for humans as including protein, carbohydrates, fats and oils, water, minerals (limited to calcium and iron) and vitamins (limited to A, C and D) and describe the functions of these nutrients.
- Identify the essential nutrients, their chemical composition, and food sources.
- Identify and describe essential nutrients' deficiency disorders. Recognize that a healthy diet contains a balance of foodstuffs.
- Correlate diet and fitness.

Let's Start!

- Why is proper intake of food important?
- What will you suggest to eat for babies of age group between 1 to 10 months?



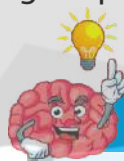
Food is anything we eat or drink that gives us energy and nutrients. It contains carbohydrates and fats, which act like fuel. Just as petrol gives power to cars, food gives power to our body. In addition to providing energy, food supplies with nutrients, that help our body function properly, grow and fight diseases.

We eat different types of foods, some give immediate energy, other help in growth and repair and some keep us healthy. To understand their role better, foods are divided into five groups based on the nutrients they provide.

3.1 Food Groups

Foods are classified into the following major groups:

- Carbohydrates
- Proteins
- Fats
- Vitamins
- Minerals



Let's

Think Aloud

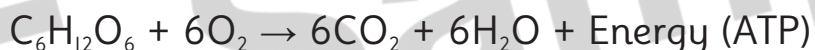
Why does our body need carbohydrates on a daily basis?

3.1.1. Carbohydrates (Energy Givers)

Carbohydrates are the primary and the quickest source of energy for our body. About 65% of our energy comes from carbohydrates.

All major organs of our body, need carbohydrates to function properly. Excess carbohydrates are stored in the liver and muscles, for later use.

Carbohydrates are made of carbon, hydrogen and oxygen. When digested, they break down into simple sugars like glucose, which are absorbed into the blood through small intestine. During blood circulation, these glucose molecules are transported to every cell of our body. In mitochondria, glucose is oxidized to release energy, carbon dioxide and water.



The main sources of carbohydrates are rice, bread, potatoes, maize, pasta, banana, sugarcane, sweets, fruits, beans, nuts and seeds.

3.1.2. Proteins (Body-Builders)

Proteins are also an energy source especially when carbohydrates are not available. They provide 10-35% of total energy and are vital for growth repair and immunity. Proteins consist of carbon, hydrogen, oxygen and nitrogen. Proteins build muscles skin, hair and enzymes and help heal wounds that's why they are known as body building foods. The main sources of proteins are eggs, meat, fish, beans, lentils, milk and nuts.



Let's

Think Aloud

Both plants and animals provide protein. Plant proteins like those in hides are even used to make leather.

3.1.3. Fats and Oils

Fats are concentrated source of energy and they are important for young children, who need more energy for growth. They help the body stay warm, protect organs and store vitamins.

Good sources of fat are meat, milk and its products.

There are two main types of fats: Saturated and Unsaturated. The classification of fats is helpful in deciding which fats can be consumed less as saturated fats are not good for a person's health.

Saturated Fats

They are usually solid (butter, ghee) at room temperature. Source of saturated fats are animal-based products, coconut oil and palm oil. Example includes; butter, cheese, red meat and dairy. Eating too much of them may lead to heart problems.

Unsaturated Fats

They are usually liquid (olive oil, sunflower oil) at room temperature. Source of unsaturated fats are plant-based products, nuts and seeds. Example includes; olive oil, canola oil, avocado and almonds.



Saturated fats

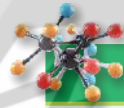


Unsaturated fats

Fats sourced from plants are better for health than the animal source, because animal fats contains more saturated fats.

3.1.4. Vitamins (Protectors)

In addition to carbohydrates, proteins and fats there are other substances which are needed in small amounts for normal body functioning. These substances are called vitamins. Vitamins are produced by the body, but most of the vitamins come from food. Each vitamin has a specific role and deficiency effect. Let's discuss some vitamins, their sources, functions and deficiency disorders.



SciByte

Vitamin K helps in blood clotting means it prevents excessive bleeding when you get a cut.



Vitamin A

Vitamin A keeps our skin and eyes healthy. It is found in carrots, spinach, broccoli, milk, egg, liver and fish. Deficiency of vitamin A is the major cause of night blindness in children worldwide.

Vitamin C

It is useful to fight many diseases and strengthen immunity. Source of vitamin C are citrus fruits, leafy green vegetables, beef liver, etc. Deficiency of vitamin C cause scurvy. Symptoms of scurvy includes muscle and joint pain, swollen and bleeding gums, slow wound healing and dry skin.





Vitamin D

It is needed for strong bones and teeth. Source of vitamin D are milk, fish, egg yolks, etc. Deficiency of vitamin D cause stunted bone growth. Symptoms include bone loss, hair loss and muscle pain.

3.1.5. Minerals (Body Regulators)

Minerals are inorganic substances needed in small amounts for growth and body function. They help build bones and teeth, make hormones and maintain muscles and nerve function.

	Calcium	Iron
Role in body	- Builds and maintains strong bones and teeth - Helps in muscle movement. - Supports proper functioning of nerve	- Helps in making haemoglobin (a part of red blood cells that carries oxygen throughout the body) - Helps in energy production. - Supports a healthy immune system
Deficiency effects	- Weak bones - Muscle cramps - Slow growth in children - Increased risk of bone fractures	- Anemia (low red blood cells). - Tiredness, weakness and pale skin - Difficulty in concentrating - Shortness of breath
Sources	- Milk, yogurt, cheese - Green leafy vegetables (like spinach) - Almonds	- Red meat - Spinach, beans, lentils - Eggs



Let's

Think Aloud

What would happen if your body lacked of water for several days.

3.2 Water and Dietary Fibre

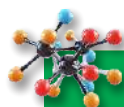
Water is an essential nutrient for all living organisms. It plays a vital role in the proper functioning of the body, including the digestion and absorption of food. Water also helps regulate body temperature through evaporation, for example sweating helps the body stay cool.

Almost 70% of the human body is made up water, while bones contains 31% water. A deficiency of water can lead to heart, digestive and kidney problems. Therefore, we must drink 6-8 glass of water every day.

Dietary fibre is the part of plant-based food that cannot be digested by the human body. It moves through the stomach and intestines undigested, helping in bowel movement and keeping the digestive system healthy.

There are two main types of fiber:

- **Insoluble fiber:** Found in wheat bran, whole-grain breads and the skin of fruits and vegetables . It helps prevent constipation by making faeces softer and easier to pass.
- **Soluble fiber:** Found in oats, apple, peas, and beans. It helps regulate blood sugar levels and lowers cholesterol.



SciByte

The condition in which the body loses more than it takes in water is called dehydration.

3.3 Nutrients Deficiency Disorders

Our body needs different nutrients for growth, repair and protection against disease.

A nutritional deficiency occurs when the body does not receive the required amount of nutrients from food. This can lead to health problems like digestion problems, skin disorders, stunted or defective bone growth, etc. Some common deficiency diseases are given below:

a. Marasmus

This disease is caused due to lack of carbohydrates and fats. Major symptoms are dry skin, pain in joints and lack of concentration.

b. Kwashiorkor

This disease is caused due to lack of proteins. This disease mostly occurs in children. Major symptoms are thin legs and swollen belly.

c. Anaemia

This disease is caused due to lack of iron in blood. Major symptoms are tiredness, weakness and loss of appetite.

d. Rickets

This disease is caused due to deficiency of Vitamin D and calcium. Major symptoms are soft bones and bowed legs.

To keep the body healthy, we need all nutrients in the required amount. No single food can provide every nutrients. For example, if we only eat junk foods such as burgers or cold drinks, we may get fats and sugar but no other nutrients. This can lead to obesity, diabetes and heart problems. Therefore, we should eat a variety of foods that together make a balanced diet.

3.4 Balanced Diet

A balanced diet is a diet that contains all the essential nutrients like carbohydrates, fats, proteins, minerals, vitamins in the correct proportions needed for the normal growth and development of the body. It includes energy foods (carbohydrates /fats), body-building foods (proteins), protective foods (vitamins/minerals) and water in proper proportions.

The healthy plate is a simple visual guide that shows how to build a balanced meal. It helps us understand what a healthy portion of food looks like on a plate.



3.5 Diet and Fitness

A good diet and fitness go hand in hand. Fitness means having enough strength, energy and flexibility to perform daily activities without feeling tired and this comes from eating a balanced diet. A good (balanced) diet includes:

- Carbohydrates
- Proteins
- Fats
- Vitamins and minerals
- Water



What have you learnt?

- Carbohydrates are the primary and the quick source of energy for our body.
Proteins help the body grow and repair itself.
- Fats provide energy, keep the body warm and protect internal organs.
- Vitamin A is essential for normal vision; its deficiency causes blindness.

- Vitamin C is strengthen immunity; its deficiency causes scurvy.
- Vitamin D helps build strong bones and teeth; its deficiency leads to stunted bone growth.
- Marasmus is occurs due to lack of carbohydrates and fats.
- Kwashiorkor is occurs due to lack of proteins.
- Anaemia results from iron deficiency in the blood.
- Rickets result from deficiency of vitamin D and calcium.
- A balanced diet contains all essential nutrients like carbohydrates, fats, proteins, minerals, vitamins in the correct proportion for the normal growth and development.

Exercise

1 Choose the correct option.

- Which of the following are called the building-blocks of muscles?
 - Carbohydrates
 - Vitamins
 - Fats
 - Protein
- Carbohydrates are usually stored in the body in the form of _____.
 - sucrose
 - glucose
 - lactose
 - fructose
- Protein provide almost _____ % of total energy requirement of our bodies.
 - 10-35
 - 15-35
 - 10-30
 - 15-30
- Bones are composed _____ % of water.
 - 31
 - 33
 - 35
 - 37

v. Kwashiorkor is caused by the deficiency of _____.

- | | |
|-----------------|------------|
| a carbohydrates | b proteins |
| c minerals | d vitamins |

vi. Scurvy is caused by the deficiency of _____.

- | | |
|----------|-------------|
| a iron | b zinc |
| c iodine | d vitamin C |

vii. Night blindness is caused by the deficiency of _____.

- | | |
|-------------|-------------|
| a vitamin B | b vitamin D |
| c vitamin C | d vitamin A |

2 Read each scenario carefully and answer the questions.

Scenario 1: Lunchbox Makeover

Ali's lunchbox contains:

- 2 chocolate chip cookies
- A chicken sandwich (white bread)
- A juice box

Questions:

- i. Which food groups are missing or not enough in Ali's lunch?
- ii. How can you improve Ali's lunch to make it a healthy plate?
- iii. What would you replace or add?

Scenario 2: Dinner Problem

Sara's family dinner:

- Fried potatoes
- White rice
- Cola drink

Questions:

- i. Which food groups are missing?
- ii. Suggest two healthy changes to make this dinner balanced.
- iii. What vegetable or protein could be added to improve the meal?

Scenario 3: Fast Food Choice

Ahmed is at a fast food restaurant and wants to eat healthy. He sees these options:

- Option A: Burger, fries, soft drink
- Option B: Grilled chicken wrap, fruit cup, water
- Option C: Pizza slice, soda, chips

Questions:

1. Which option is closest to a healthy plate? Why?
2. What improvements can be made to Option A or C?
3. How do your choices affect your energy and fitness?

3 Answer the following questions.

- i. Why do we need food?
- ii. Define balanced diet. Describe its importance.
- iii. Write down the sources and functions of carbohydrates and proteins.
- iv. How would you differentiate saturated fats from unsaturated fats?
- v. What could happen if there is a lack of water in the human body?
- vi. What are vitamins? Write in details the kinds and their functions.
- vii. What makes it important to eat a variety of foods from each food group?



Constructed Response Questions

- i. What might happen if a person doesn't get enough iron for a long period of time?
- ii. What clues might your body give you if you are lacking a certain nutrient?
- iii. How can a community prevent deficiency diseases through better diet planning?

Create a Diet Chart

Objective: To understand what a balanced diet looks like and how to plan meals that include all essential food groups.

Resources:

- Diet chart (sample template attached)

Instructions:

- Provide each student with a blank weekly diet chart that has the following columns:
- Breakfast
- Lunch
- Dinner
- Healthy snack
- Fill in each meal with foods from all food groups, ensuring balance and variety.

Discussion Questions:

Use the notebook to answer the following questions:

- Did students include items from all food groups?
- Are meals colourful with fruits and vegetables?
- How much water do you drink each day?
- What changes can you make for a healthier diet?

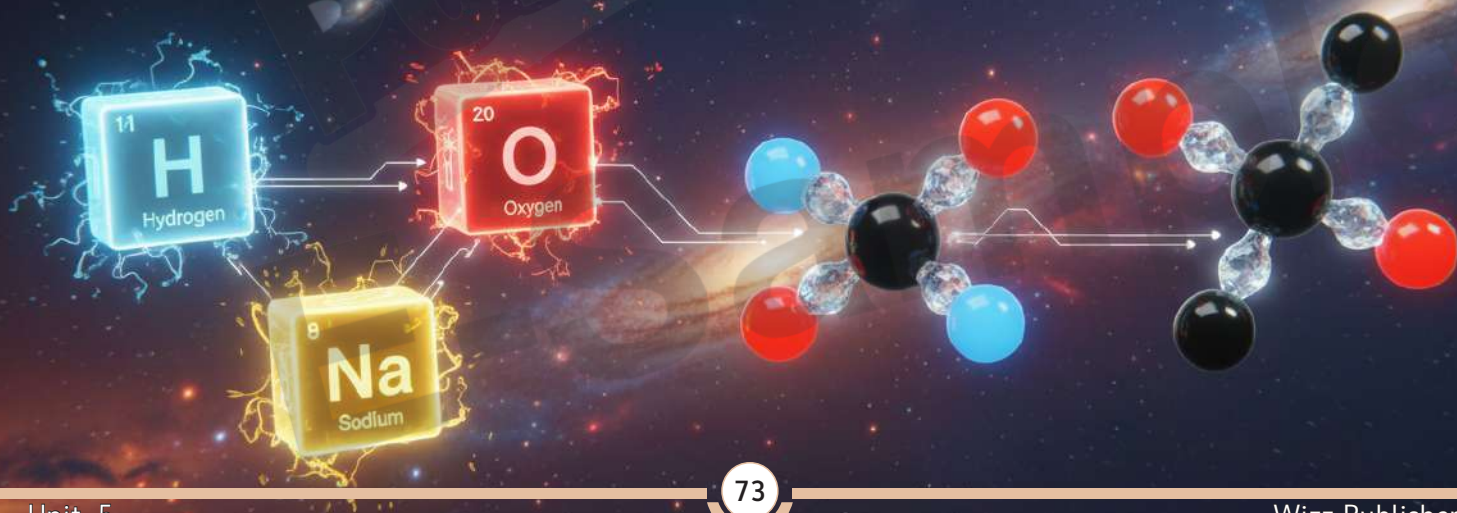


Students' Learning Outcomes**All students will be able to:**

- Describe the structure of matter in terms of particles (i.e., atoms and molecules).
- Describe molecules as combination of atoms (e.g., H_2O , O_2 and CO_2).
- Recognize the names and symbols for some common elements.
- Differentiate that some elements are made of atoms and some elements exist as molecules and have different properties to a single atom of the element.
- Explain that compounds are formed by different types of elements joining together chemically forming a new compound, e.g. burning magnesium or steel wool in air/ oxygen.
- Illustrate the formation of a compound with the help of a word equation.
- Distinguish between elements and compounds.
- Explore the common elements and compounds in our daily life (Carbon, Nitrogen, Hydrogen, Aluminium, Water, Common salt & Sugar).
- Categorise elements into metals and non-metals of the first 10 elements based on their physical properties.

Let's Start!

- What is the structure of matter?
- How are different states of matter different in terms of particle arrangement?



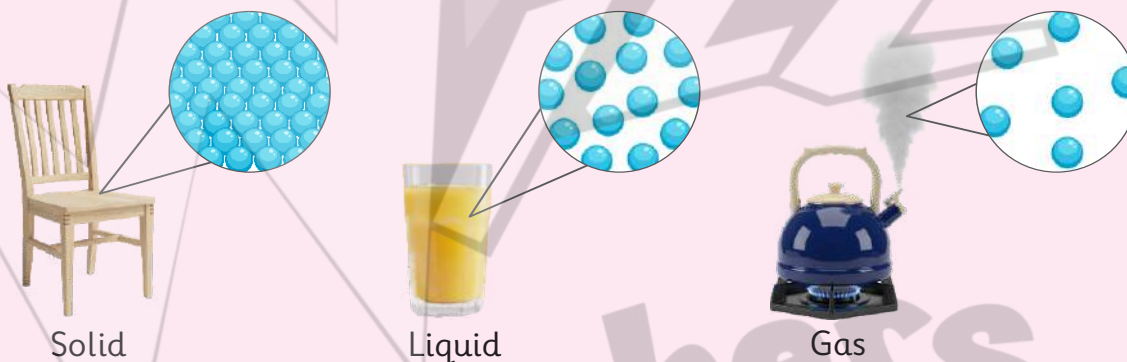
6.1 Matter

Look and tell what is the building unit of a wall?

The building unit of wall is a brick, when many bricks combine together, they form a strong and large structure such as a wall or a building.



Just like walls are made of bricks, all matter is made up of tiny particles called atoms. Everything around us is made up of matter, i.e., solids, liquids and gases.

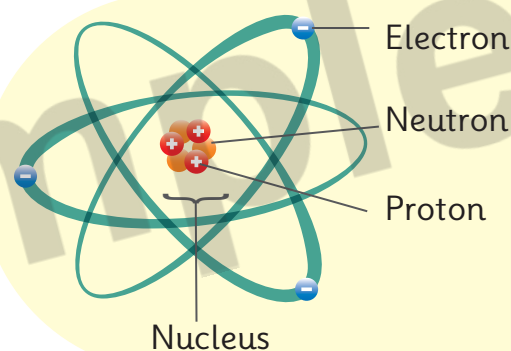


But, do you know the history and composition of an ATOM? Let's find out.

6.2 Atom

The word "atom" comes from the Greek word atomos, meaning "indivisible". The Greek philosopher Democritus (460–370 BCE) first suggested that matter is made up of countless tiny, uncuttable particles called atoms. Much later, it was discovered by John Dalton in 1808 who formulated the first modern atomic theory which states that "all matter is made of very small particles called atoms, which cannot be divided."

However, in the early 20th century, further experiments showed that atoms are not indivisible, they are made of even smaller



sub-atomic particles:

- **Protons:** They are positively charged particles, located inside the nucleus.
- **Neutrons:** They have no charge and located inside the nucleus.
- **Electrons:** They are negatively charged particles that revolve around the nucleus in fixed circular paths called orbits.

Protons and neutrons combine to form nucleus.



SciByte

James Chadwick
discovered neutrons in
1932.



Let's

Think Aloud

Why is an atom, as a whole,
electrically neutral ?



Activity Time!

Atom Simulation

Objective: To visualize the structure of an atom interactively.

Instructions:

- Visit the following link and explore "How to build an atom"?
https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html

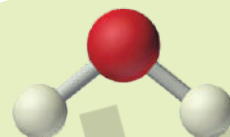
6.3 Molecules

Atoms do not exist independently (except noble gases), instead, they combine chemically to form molecules. Molecules are made up of two or more than two atoms joined chemically. A molecule is the smallest unit of a substance that retains all its properties.

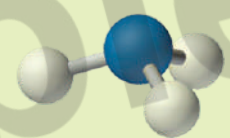


Teacher's Note:

Explain students that, number of electrons are always equal to number of protons which results in cancellation of charges and as a result the atom got no charge.



Water, (H₂O)

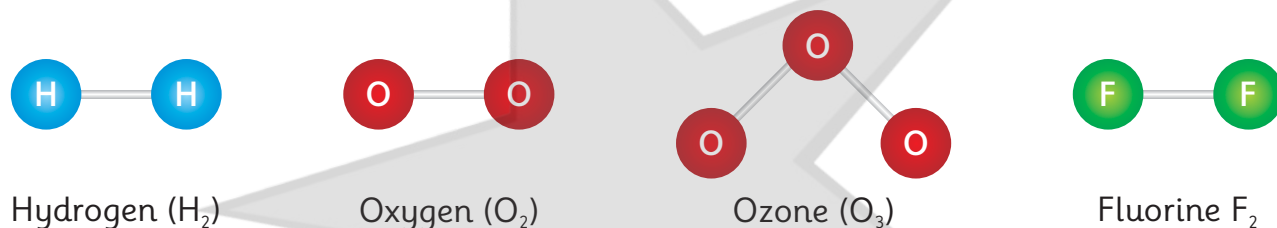


Ammonia, (NH₃)

6.3.1 Types of Molecules

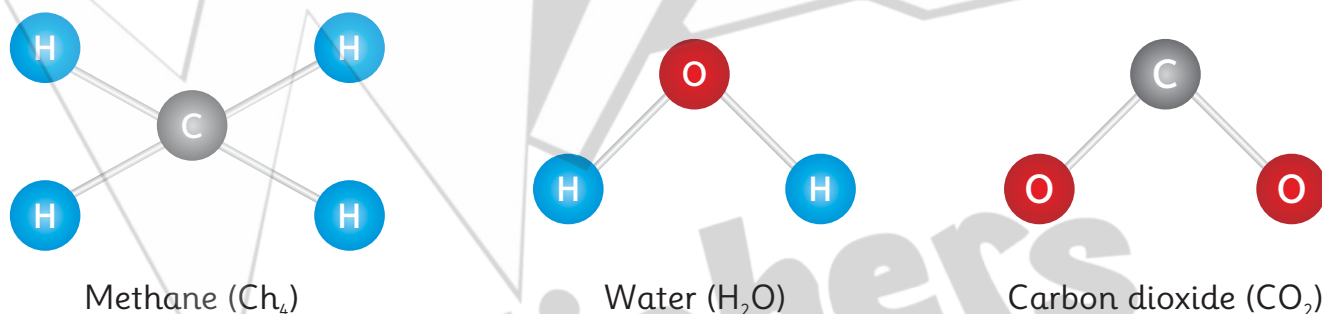
a. Molecule of Elements

When the same type of atoms join together, they form a molecule of an element. For example: Hydrogen (H_2), Oxygen (O_2), Ozone (O_3) and Fluorine (F_2), etc.



b. Molecule of Compounds

When two or more than two different types of atoms combine, they form molecule of a compound. For example: Methane (CH_4), Water (H_2O) and Carbon dioxide (CO_2), etc.



6.4 Elements

An element is a pure substance made up of only one type of atom. No matter how small a piece of the element you take, it will always contain the same kind of atom. **Examples:**

- Carbon contains only carbon atoms.
- Oxygen contains only oxygen atoms.
- Hydrogen contains only hydrogen atoms.



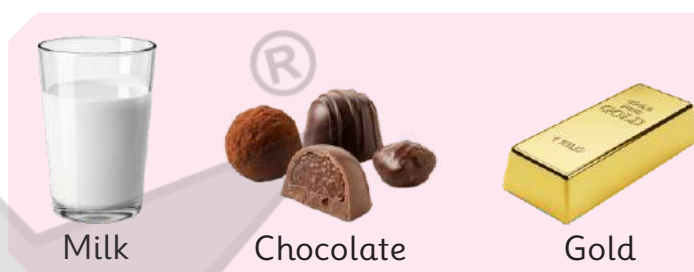
Coal
(made of carbon atoms)



Water
(made of oxygen and hydrogen atoms)

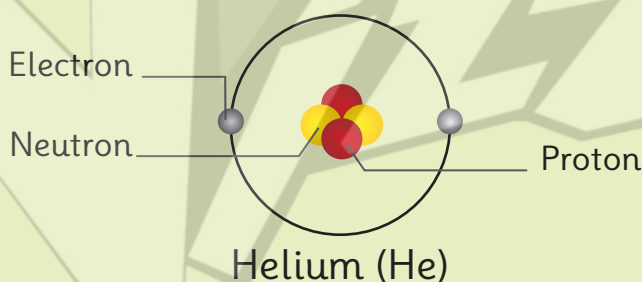
Because elements are made of only one kind of atom, even if you break them into smaller and matter pieces, they remain the same substance.

Think of an element like a chocolate bar made entirely of milk chocolate, if you break the bar into smaller and smaller pieces, every piece is still milk chocolate. Similarly, if you divide a gold bar, every piece will still contain only gold atoms.

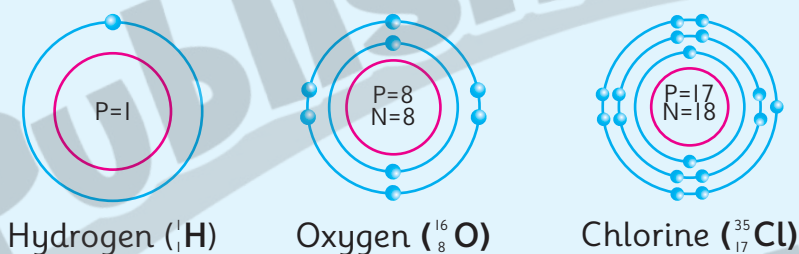


There are 118 known elements, which combine in various ways to form thousands of substances.

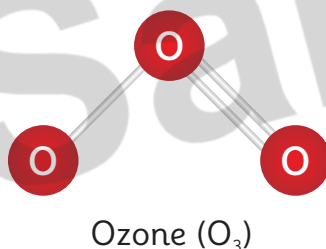
Elements are **monoatomic**, means they contain only one atom. Helium is an example of a mono-atomic element.



Some elements contain two atoms and they are called **diatomic** elements. Example includes: Hydrogen (H_2), Nitrogen (N_2) and Chlorine (Cl_2) because each contains two atoms.



Some elements contain three atoms like Ozone (O_3) and they are called triatomic elements.



6.4.1 Element and their Symbols

Scientists use chemical symbols to represent elements. Each element has a unique one or two letter symbol derived from its English or Latin name. There are 118 elements discovered so far. For example:

- S stands for Sulphur
- Si stands for Silicon

Some symbols derived from the Latin name of the element. For example:

- Au stands for Gold (from the Latin word aurum)
- Na stands for Sodium (from the Latin word natrium)

Complete list of elements and their symbols are listed below:

1	I H																																2 He	
2	3 Li		4 Be																		5 B		6 C		7 N		8 O		9 F		10 Ne			
3	11 Na		12 Mg																		13 Al		14 Si		15 P		16 S		17 Cl		18 Ar			
4	19 K		20 Ca		21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr														
5	37 Rb		38 Sr		39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe														
6	55 Cs		56 Ba			72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn														
7	87 Fr		88 Ra			104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Uut	114 Fl	115 Uup	116 Lv	117 Uus	118 Uuo														
Lanthanides					57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu															
Actinides					89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr															

Periodic Table of Elements



SciByte

Ununennium (Uue), is expected to be the 119th. A predicted, element in the periodic table.



Let's

Think *Aloud*

What do you think would happen if all elements were made of the same kind of atom?



Teacher's Note:

Show the following link to help students visualize and understand the Periodic Table. <https://www.youtube.com/watch?v=Zq6KeXsDVwY>

6.4.2 Common Elements and their Importance in Daily Life

The following table shows the names of the first ten elements in the periodic table, along with their symbols, uses and key physical properties:

Name of Element	Symbol	Common Uses in Daily Life	Physical Properties
Hydrogen	H	Used in making fertilizers and also as a rocket fuel	Gas
Helium	He	Used for welding metals	Inert gas (non-reactive)
Lithium	Li	Used in refining other metals like iron and copper	Soft solid
Beryllium	Be	Used to make tools	Soft solid
Boron	B	Used to make heat resistant glass	Amorphous solid
Carbon	C	Used in inks and paints	Solid
Nitrogen	N	Used in making fertilizers and explosives	Gas
Oxygen	O	Used to make glass and to melt and refine steel	Gas
Flourine	F	Used in nuclear power plants and also used in the manufacturing of plastics	Gas
Neon	Ne	Reddish orange coloured gas. It is used in advertisingsings and in television tubes.	Inert Gas (non-reactive)



Let's

Think Aloud

Can you explore few more elements from your surroundings?



Teacher's Note:

Explain students that Amorphous means "without a clear shape or form." An amorphous solid is a type of solid that does not have a regular or repeating pattern in the way its particles are arranged.

6.5 Metals and Non-metals

Elements can be broadly classified into two groups: Metals and Non-metals. They differ from each other in their appearance physical properties and ability to conduct heat and electricity.

Metals

Good conductors of heat and electricity

Have high melting and boiling points

Shiny in appearance

Can be drawn into wires (ductile)

Can be beaten into foil or sheets

Mostly solids (except mercury)

Examples: Aluminium, silver, gold, copper and lead, etc.

Non-metals

Poor conductors of heat and electricity

Have low melting and boiling points

Dull in appearance

Cannot be drawn into wires

Cannot be beaten into foil or sheets

Found in all three states (Solids, liquids and gases).

Examples: Carbon, oxygen, iodine and sulphur, etc.



Let's

Think *Aloud*

If you were asked to make wires out of a non-metal, what challenges would you face?

6.6 Compounds

A compound is a pure substance formed when two or more elements combine chemically in a fixed ratio. Once combined, the compound properties are

completely different from the original elements. We cannot easily separate a compound into the elements that made it.

Example: Formation of water:

Water is a compound formed when hydrogen gas react with oxygen gas. You cannot separate water back into hydrogen and oxygen easily and its properties are very different from both hydrogen and oxygen gases.



Look at the table given below comparing the properties of hydrogen and oxygen to produce water.

Reactants		Products
Hydrogen (Element)	Oxygen (Element)	Water (Compound)
(2H_2)	(O_2)	$(2\text{H}_2\text{O})$
Word equation: Hydrogen (2H_2) + Oxygen (O_2) $\rightarrow$ Water $(2\text{H}_2\text{O})$		
- Hydrogen is a colourless, odourless gas - Highly flammable - Very light - Does not support life	- Oxygen is a colourless, odourless gas - Supports burning (combustion) - Essential for life	- Water is liquid at room temperature - Not flammable - Needed for life and growth. - Has completely different properties from both hydrogen and oxygen.

Reactant is any substance that is consumed or used up during a chemical reaction. Whereas, the substance that is produced as a result of chemical reaction is called the product.

Reactants		Products
Carbon (Element)	Oxygen (Element)	Carbon dioxide (Compound)
C	O ₂	CO ₂
Word equation: C + O ₂ → CO ₂		
• Black solid • Helps in burning	• Colourless, odourless and tasteless gas. • Inhaled while breathing • Supports burning (combustion)	• Colourless, odourless and tasteless gas. • Exhaled during breathing • Extinguishes fire



Activity Time!

Formation of a Compound

Objective: To observe how two elements, combine to form a new compound with different properties.

Resources:

- Iron filings
- Sulphur powder (yellow)
- Test tube
- Magnet
- Burner

Instructions:

Before Reaction:

- Mix equal amounts of iron filings and sulphur powder in a test tube.
- Shake gently to mix.
- Use a magnet to separate the iron.
- Now heat the mixture carefully over a burner.
- The mixture glows red and forms a black solid (iron sulphide).

After Reaction:

- Let the test tube cool.
- Try using the magnet again, it won't attract the substance which shows that the new black substance iron sulphide (compound) is formed.

Questions:

a. What do you conclude?

b. Is the product formed a compound? Explain.

6.7 Uses of Compounds

Compounds play an important role in our daily life and industries. They are used in homes, medicines, agriculture and manufacturing.

Uses of chemical compounds				
Salt (NaCl)	Carbon dioxide (CO ₂)	Baking soda (NaHCO ₃)	Baking soda (NaHCO ₃)	Methane (CH ₄)
• Cooking • Food pre-servation • Body needs	• Used by plants • Fire extin-guishers • Fizzy drinks	• Baking • Cleaning • Treats acidity • Toothpaste	• Fertilizers • Cleaners • Medicines	• Fuel for cooking / heating • Energy source



Teacher's Note:

This activity should be done under teacher's supervision.

6.8 Difference between Elements and Compounds

Following table shows the difference between elements and compounds:

Elements	Compounds
Elements are pure and are made up of only one kind of atom.	Compounds are made up of two or more elements combined chemically.
Nearly 118 known elements (94 are naturally occurring).	Almost endless number of compounds.
Elements cannot be broken into simpler substances.	Compounds can be easily separated into elements.
Have the same properties throughout.	Have properties different from the elements that form them.
Represented by symbols. For example: Na, Cl, Fe, etc.	Represented by chemical formula. For example: NaCl, H ₂ O, CO ₂ , etc.



What have you learnt?

- Matter is made up of tiny particles called atoms.
- When two or more than two atoms combine together chemically they form molecules.
- Matter exist in three states i.e., solids, liquids and gases.
- Atoms are so small that we cannot see them through the naked eye.
- Modern atomic theory states that atom can be further divided into sub-atomic particles called protons, neutrons and electrons.
- An element is a pure substance that contains only one type of is atom throughout.
- Chemical symbol is a short notation derived from the scientific name of a chemical element.

- Elements can be divided into two main groups: metals and non-metals.
- A compound is a pure substance made when two or more elements chemically.
- Each compound is represented by a chemical formula.

Exercise

1 Choose the correct option.

- The smallest unit of an element is a _____.
 - molecule
 - compound
 - atom
 - cell
- Electrons revolve around the nucleus in fixed circular paths called _____.
 - chain
 - line
 - orbit
 - none of them
- Which philosopher suggested that matter is composed of tiny, invisible particles called atoms?
 - John Locke
 - Karl Marx
 - Democritus
 - Confucius
- What is the charge on a neutron?
 - Positive
 - Double positive
 - Negative
 - No charge
- How many elements are there in the periodic table?
 - 50
 - 118
 - 92
 - 150
- Identify the compound from the following _____.
 - oxygen
 - water
 - chlorine
 - helium

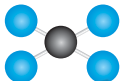
vii. What is the chemical formula for carbon dioxide?

- a CO
- b O₂
- c CO₂
- d C₂

viii. Which of the following is a property of metal?

- a They are poor conductors of heat and electricity.
- b They are dull.
- c They have high melting and boiling points.
- d They cannot be beaten into foil or sheet.

ix. Which of the following is a molecule of compound?

- a H₂ 
- b O₂ 
- c CH₄ 
- d S₈ 

x. Which of the following cannot be broken into simpler substances?

- a Carbon
- b Sodium chloride
- c Water
- d Hydrogen peroxide

xi. It is used in cleaning products _____.

- a carbon dioxide
- b ammonia
- c methane
- d oxygen

xii. Encircle the correct structure of methane.

- a $\begin{array}{c} \text{H} \\ | \\ \text{H}-\text{C}-\text{H} \\ | \\ \text{H} \end{array}$
- b $\begin{array}{c} \text{H} \quad \text{H} \\ | \quad | \\ \text{H}-\text{C}-\text{C}-\text{H} \\ | \quad | \\ \text{H} \quad \text{H} \end{array}$
- c $\text{H}-\text{C}\equiv\text{C}-\text{H}$
- d $\begin{array}{c} \text{H} \\ | \\ \text{H}-\text{C}\equiv\text{C}-\text{C}-\text{H} \\ | \\ \text{H} \end{array}$

xiii. What is the use of nitrogen?

- a Welding metals
- b Plastics
- c Inks and paints
- d Fertilizers and explosives

xiv. Which of the following is an inert gas?

- a He
- b B
- c H
- d C

- ② Look around your surroundings and list six materials. Classify each as metal or non-metal.

Object	Metals or Non-metals

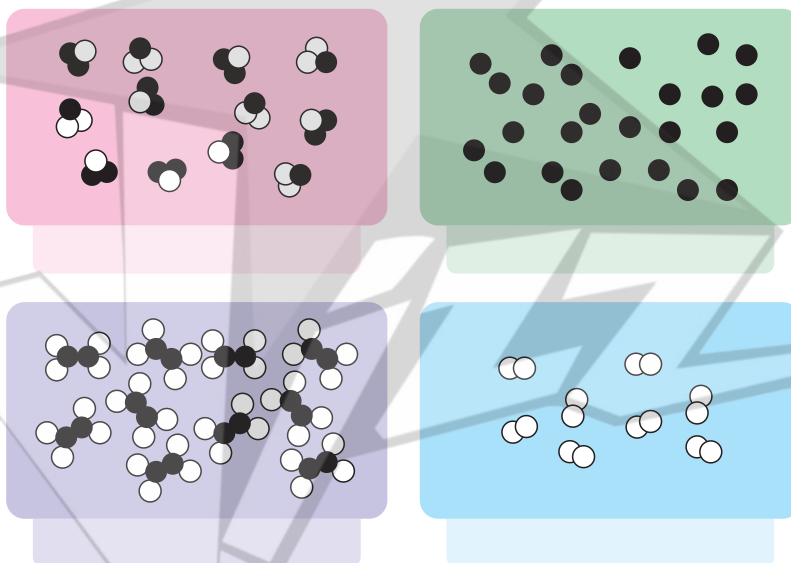
- ③ a. Draw two examples of molecules of elements.

- b. Draw two examples of molecules of compounds.

4 Read the statement and guess the compound.

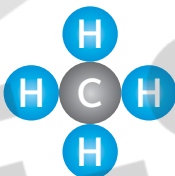
- i. Used in preservation of food.
- ii. Used in fire extinguishers.
- iii. Used in fertilizers.
- iv. Used to treat acidity.
- v. Used as a fuel for cooking / heating.

5 a. Look at the diagrams below and decide whether each represents an element or a compound.



b. Write formulas of the following and specify whether they are elements or compounds.





6 Answer the following questions.

- i. Define the following terms:
 - Atom
 - Molecule
 - Element
 - Compound
- ii. Differentiate between:
 - Reactants and products with an example.
 - Mono-atomic, di-atomic and tri-atomic elements with examples.
- iii. Write symbols of the following elements: Helium, Lithium, Beryllium, Boron, Neon
- iv. Write chemical formulas of any five compounds.
- v. Describe the physical properties of metals and non-metals.
- vi. List five differences between elements and compounds.



Constructed Response Questions

- i. Does the human body contain compounds? Name any two.
- ii. Differentiate how some elements exist as single atom and others as molecules.
- iii. How does a word equation help us understand chemical reactions?
- iv. Why is aluminium preferred for cooking utensils instead of iron or plastic?

Students' Learning Outcomes

All students will be able to:

- Demonstrate that mixtures are formed when two or more substances mix with each other without the formation of a new substance.
- Identify different types of mixtures.
- Describe the difference between elements, compounds and mixtures.
- Differentiate between pure substances and mixtures on the basis of their formation and composition.
- Describe alloys as mixtures of metals and some other elements.
- Identify and explain examples of common mixtures from daily life.
- Justify why air is considered as a mixture of gases.
- Demonstrate ways of separating different mixtures.
- Demonstrate the process of solution formation (using water as a universal solvent).

Let's Start!

- What is the building block of a matter?
- Can you differentiate pure matter from impure matter?



Write pure and impure in front of each one. Also write the reason of your choice.

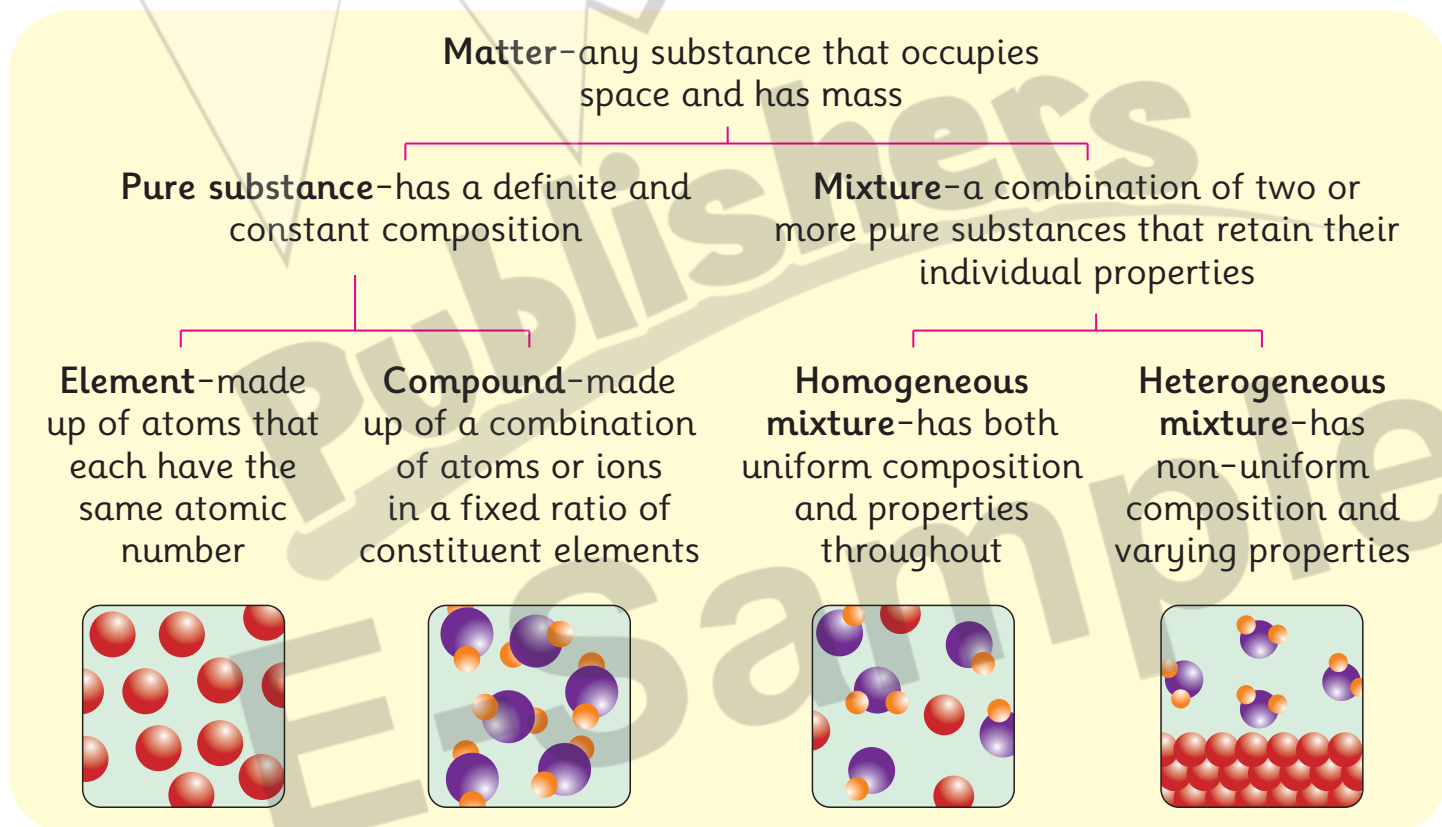
- Lemonade
- Fruit salad
- Hydrogen gas
- Water

Reason!

We have previously learned that everything around us is made up of matter. Matter can be classified as:

- **Pure matter** (Elements & Compounds)
- **Impure matter** (Mixtures)

In the examples given above, water is a compound and hydrogen gas is an element. Both are pure substances. Lemonade and fruit salad are mixture because they contain more than one substance physically combined together. In this chapter, we will learn about mixtures, their types, properties and methods of separation.



7.1 Mixture

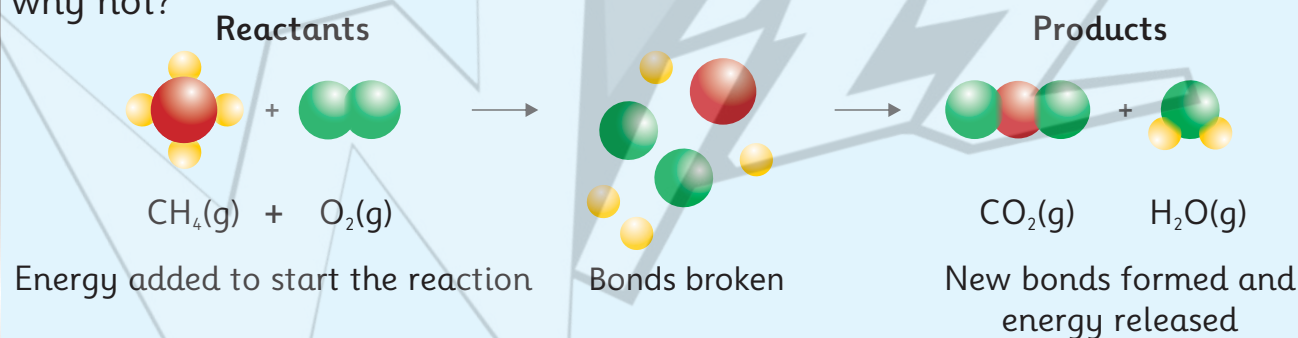
A mixture is formed when two or more substances are combined physically without forming a new substance. A mixture does not have a fixed composition, and the substances mixed together keep their original properties. A mixture has the following properties:

- The components of a mixture can be easily separated by physical methods.
- The original components keep their own properties.
- No new substance is formed in a mixture.
- The composition of the mixture may vary.



Think Aloud

When paper burns, it changes into ash and smoke. Is that a mixture? Why or why not?



Types of Mixture

Mixtures are mainly of two types:

7.1.1 Homogeneous Mixture

A mixture whose composition and properties are uniform throughout the sample that we cannot see the individual components. A homogeneous mixture is also called a solution. **Examples:**

- Salt dissolved in water
- Sugar in tea
- Air (mixture of gases)



Salt and water mixture



Sugar in tea



Air in a balloon

7.1.2 Heterogeneous Mixture

A mixture whose composition and properties are not uniform throughout the sample. The individual components can be seen and separated easily.

Examples:

- Sand and iron filings
- Fruit salad
- Oil and water



Sand and iron filings



Fruit salad



Oil and water



Let's

Think Aloud

Why is blood considered a heterogeneous mixture?

Feature	Homogeneous Mixture	Heterogeneous Mixture
Appearance	Looks the same throughout	Looks different in different parts
Visibility of components	Components cannot be seen	Components can be seen
Separation	Difficult to separate visually	Easier to separate

Comparison Table



Activity Time!

Making Mixtures

Objectives:

- To show that salt and water form a homogeneous mixture.
- To observe that sand and water form a heterogeneous mixture.

Resources:

- Transparent glass
- Water
- Sand & Salt
- Spoon

Instructions: (Objective 1)

- Ask students to work in groups.
- Provide the required materials.
- Fill the glass with water.
- Add one spoon of salt and stir well.
- Observe the mixture carefully.

a. What do you observe?

b. Write down the conclusion.

Instructions: (Objective 2)

- Ask students to work in groups.
- Provide the required materials.
- Fill the glass with water.
- Add one spoon of sand and stir well.
- Let the mixture settle for a few seconds and observe carefully.

a. What do you observe?

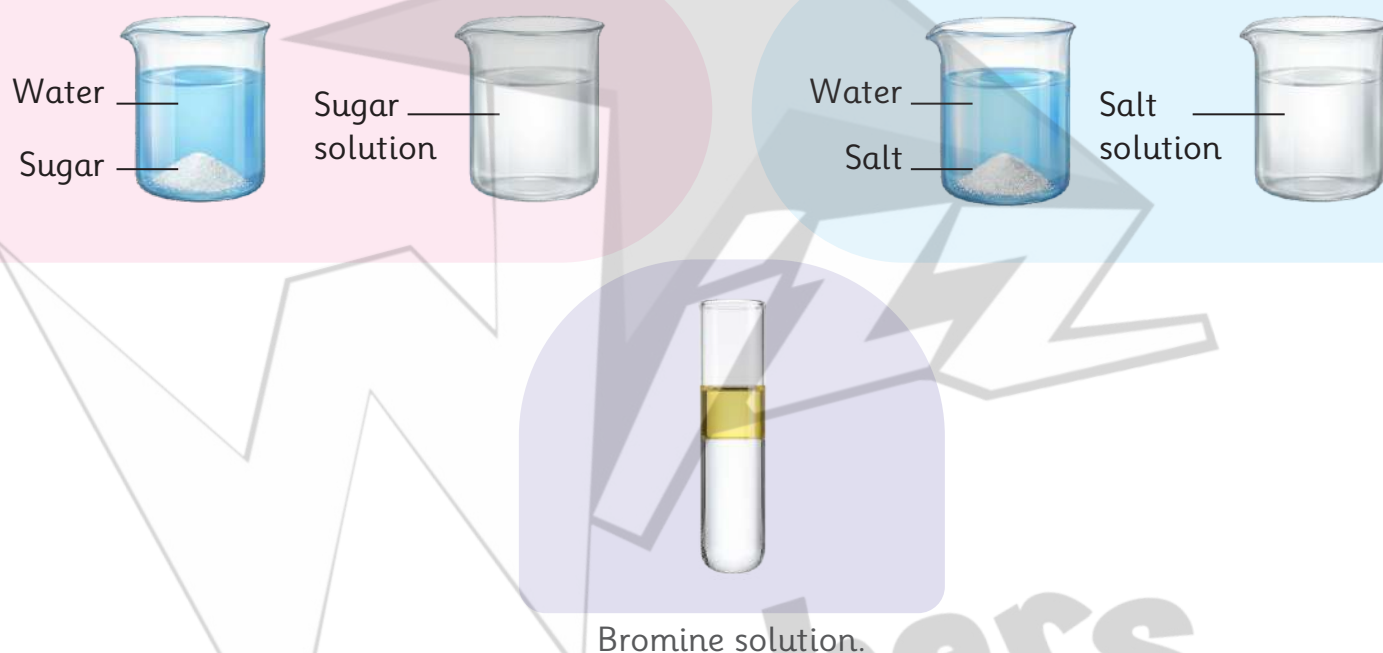
b. Write down the conclusion.

7.2 Solution

A solution is a homogeneous mixture formed when one substance dissolves in another substance resulting in a mixture that appears uniform throughout.

Examples:

- Salt dissolved in water
- Sugar dissolved in water
- Bromine in water



7.3 Components of a Solution

A solution consists of two main components:

- **Solute:** It is the substance that gets dissolved.
- **Solvent:** It is the substance that dissolves something the solute.

In the above given examples, salt, sugar and bromine are solutes, whereas, water is a solvent. Water is the most common and widely used solvent, because it can dissolve more substances than any other liquid, due to its strong solvent action. Due to this property of water, it is called a universal solvent. However, some substances such as grease, oil, wax and paint do not dissolve in water.

Solute and solvent can be combined in three different physical states:

State of solute	State of solvent	Examples of solution
Solid	Liquid	1. Salt solution (salt dissolved in water) 2. Amalgam (tin, gold or copper dissolved in mercury)
Liquid	Liquid	1. Alcoholic drinks (alcohol dissolved in water)
Gas	Liquid	1. Fizzy drinks (carbon dioxide dissolved in water) 2. Sea and river water (oxygen dissolved in water)
Gas	Gas	1. Air (oxygen, carbon dioxide, noble gases dissolved in nitrogen)
Solid	Solid	1. Brass (zinc dissolved in copper) 2. Bronze (tin dissolved in copper)

7.3.1 Types of Solutions

- Depending on whether the solvent is water or not, solutions are of two types:

Aqueous Solution: When a solvent used is water, the solution is called an aqueous solution. Examples: Salt in water, Sugar in water



Sugar in water



Salt in water

Non-Aqueous Solution: When a solvent used is other than water, the solution is called a non-aqueous solution. Examples: Iodine in carbon tetrachloride, Phosphorus in ethyl alcohol



Iodine in carbon tetrachloride

- Depending on the amount of solute added to the solvent, solutions are of two types:

Concentrated Solution: If there is a large amount of solute dissolved in small amount of a solvent, then the solution is said to be concentrated solution.



Dilute Solution: If there is a small amount of solute dissolved in a large amount of solvent, then the solution is said to be dilute solution.

- Depending upon the dissolution of the solute in the solvent, solutions can be categorized into:
 - ✓ **Unsaturated Solution:** It is a solution in which a solvent is capable of dissolving any more solute at a given temperature.
 - ✓ **Saturated Solution:** It is a solution in which a solvent is not capable of dissolving any more solute at a given temperature.
 - ✓ **Supersaturated Solution:** It is the solution which has large amount of solute than it can normally hold at a certain temperature. If the temperature drops or the solution is disturbed, the extra solute quickly forms crystals.



SciByte

The Dead Sea contains a very large amount of dissolved salts. Due to the density of water, object float more easily in it.





Activity Time!

Objective: To investigate how much solute can dissolve in water and understand the difference between saturated and unsaturated solutions.

Resources:

- Transparent beakers
- Sugar
- Stirrer
- Water (at room temperature)
- Tablespoons
- Marker

Instructions:

- Divide the class into groups and provide the required materials.
- Ask each group to take two transparent beakers.
- Label the beakers as 1 & 2 using a marker.
- Fill both beakers with water up to the small level.
- Add two tablespoons of sugar to beaker 1 and stir well.
- In beaker 2, continue adding sugar gradually while stirring.
- Observe carefully and note the point at which the sugar stops dissolving and begins to settle at the bottom.
- Record your observations in the table below.

Inquiry questions	Answer
Which solution is more concentrated (sweeter and stronger)?	
Why is the solution in beaker 2 more concentrated than the solution in beaker 1?	
What happens when we continue adding sugar to water?	
Is there a limit to how much sugar can dissolve in water?	
What do we call a solution that cannot dissolve any more sugar (solute)?	

What do you think will happen if the same experiment is performed using warm water? Give a the reason for your answer.

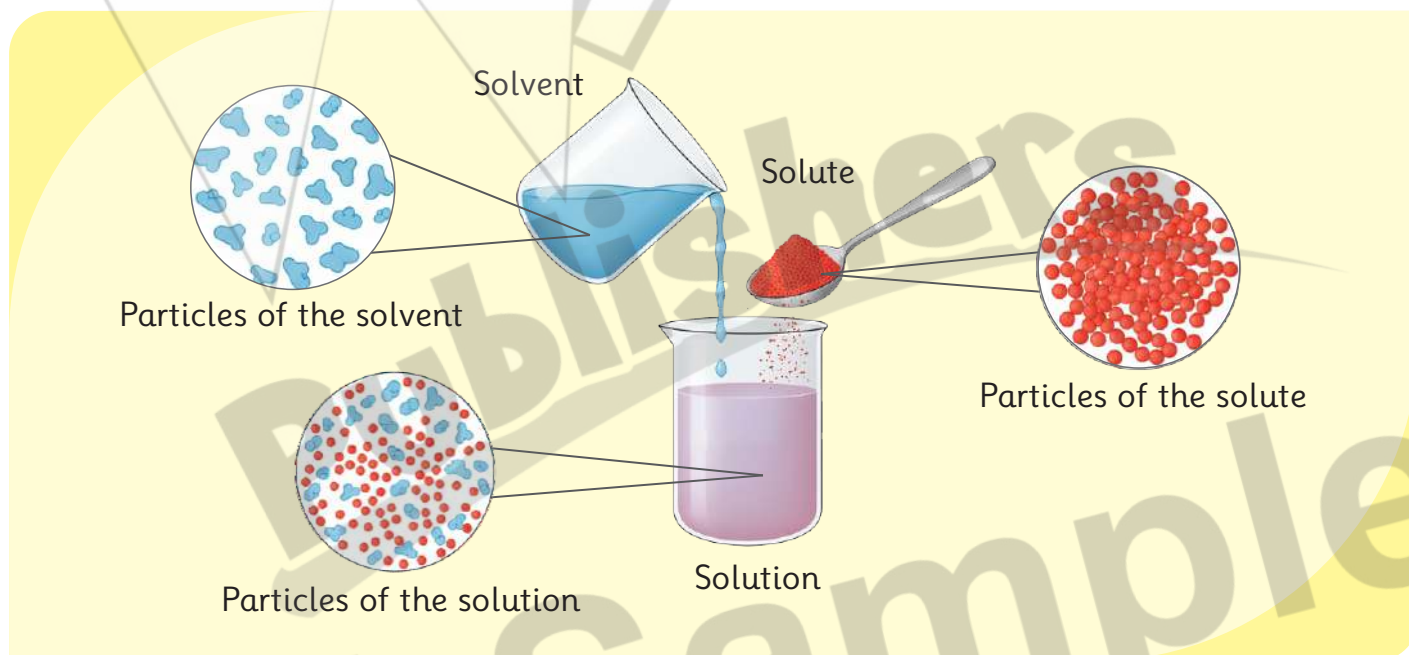


7.4 Particle Model of Solution

We have previously learned that matter consists of tiny particles. These particles are constantly show specific behaviour. This model helps us understand how substances dissolve to forms solutions.

Let us understand the particle model of a solution using salt and water as an example.

- When salt is added in water, it breaks into tiny particles.
- Water particles move around the salt particles.
- The forces of attraction between water and salt particles, pull the salt particles apart.
- The separated salt particles distribute evenly among the water particles.
- As a result, a homogeneous mixture called a solution is formed.



There are spaces between the particles of matter. When a substance is heated, its particles gain energy and move faster. This increased movement helps more solute dissolved in the solvent.

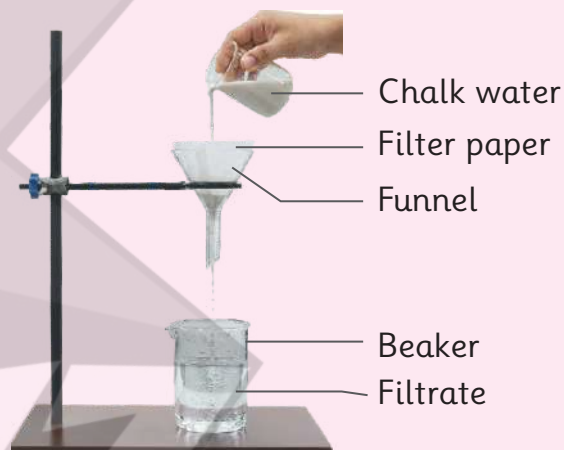
7.5 Methods of Separating Mixtures

A mixture is made up of two or more substances that are physically combined and can be separated by physical methods. Different methods are used to separate mixtures depending on the properties of their components.

7.5.1 Filtration

Filtration is the method used to separate an insoluble solid from a liquid. When a mixture is passed through filter paper, the solid particles are left behind on the filter paper and the clear liquid passes through it. This liquid is called the filtrate. The solid particles left behind on the filter paper are called the residue. The complete process is called filtration.

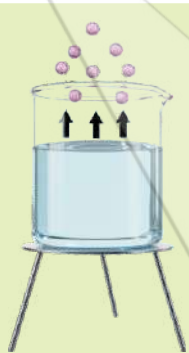
Real life example of filtration is separating tea leaves from tea using a strainer.



7.5.2 Evaporation

Evaporation is used to separate a dissolved solid from a liquid. When the solution is heated the liquid changes into vapours and escape into the air. The dissolved solid remains behind.

Real life example of evaporation is obtaining salt from seawater in salt pans.



7.5.3 Sieving

Sieving is a method used to separate solid substances of different particle sizes using a tool called a sieve. A sieve has tiny holes. It allows smaller particles pass through and keeps larger particles on the sieve.

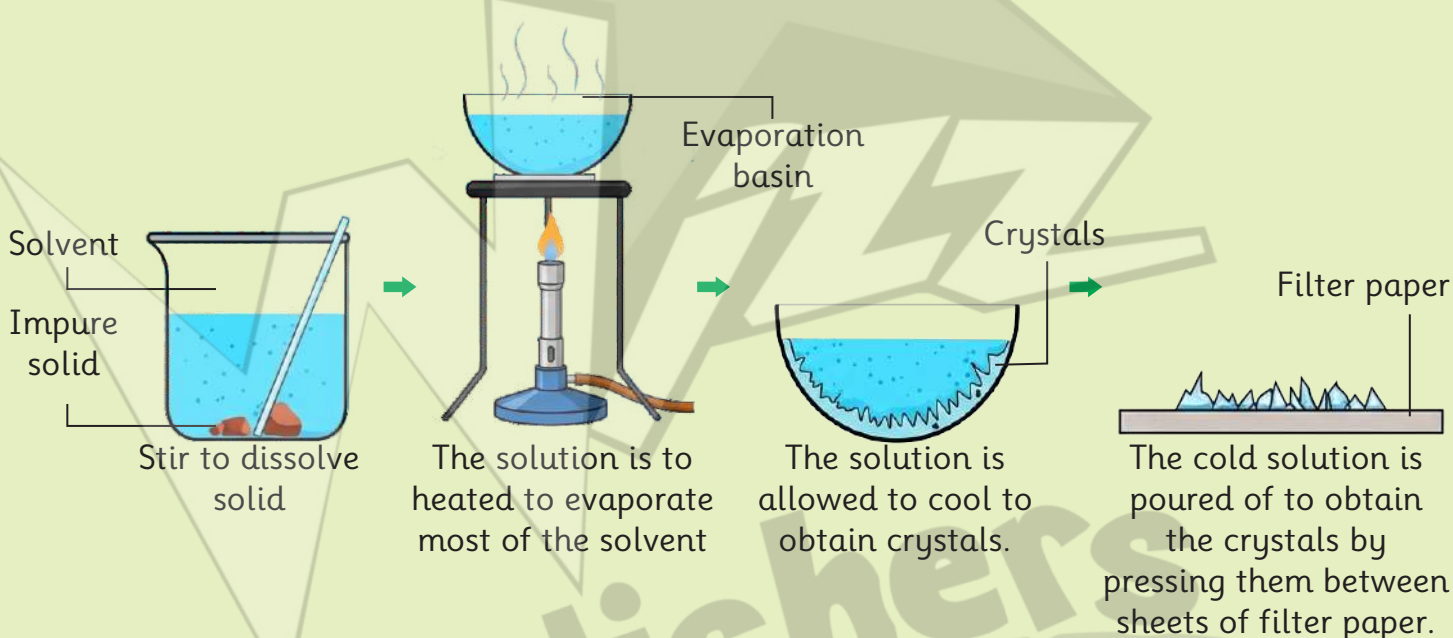
Real life example of sieving is removal of lumps or larger particles from flour during baking.



7.5.4 Crystallization

Crystallization is used to obtain pure solid in the form of crystals from a solution. This method works because soluble solids become less soluble at lower temperatures.

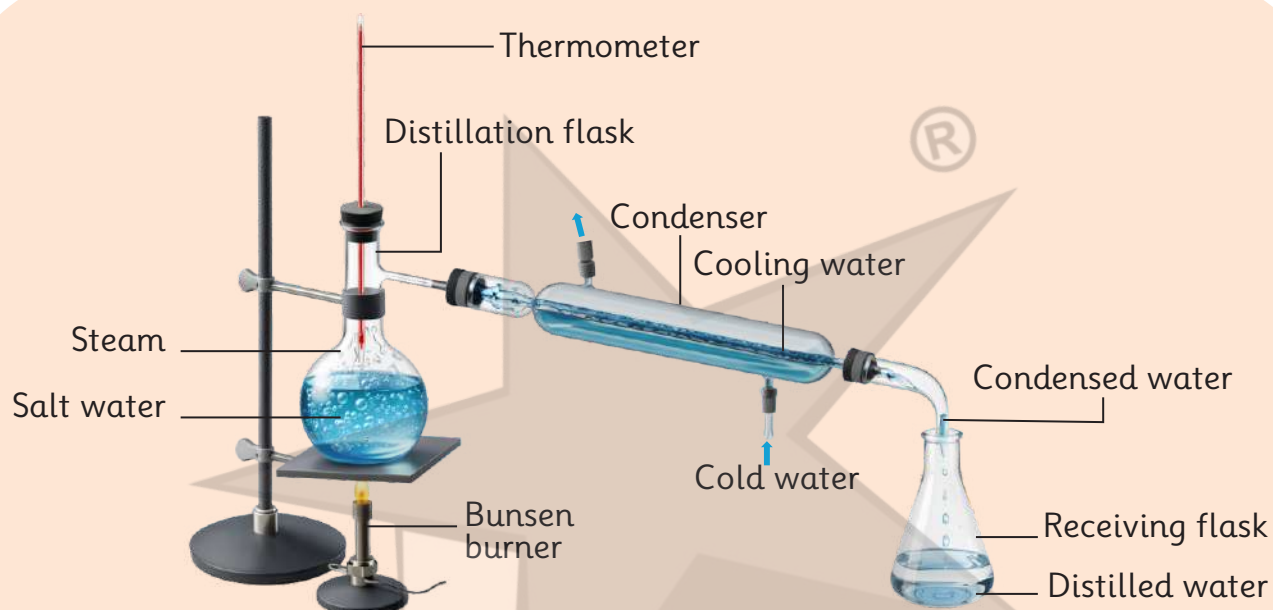
When a solution is heated until most of the solvent evaporates, a concentrated mixture is left behind. The solution is then allowed to cool slowly so that crystals are formed. These crystals can be removed and dried carefully between folds of filter paper.



Real life example of crystallization is formation of sugar or salt crystals.

7.5.5 Distillation

It is a method used to separate liquids based on differences in their boiling points or to obtain a pure liquid from a solution. The process of distillation works when the liquid mixture is heated in the flask. The liquid with the lower boiling point changes into vapour first into the condenser. The condenser is cold, so the vapour condenses into water inside it. The process in which vapours becomes liquid again is called condensation. The pure water collected in the beaker is called distilled water or distillate.



Real life example of distillation is separation of alcohol from mixtures in factories.

7.5.6 Sublimation

Some solids change directly from solid to gas on heating without passing through the liquid state. This process is called sublimation. Sublimation can be used to separate certain mixtures of solids.

For example, a mixture of iodine and sand can be separated by sublimation. The mixture is placed in a petri dish and covered with an inverted funnel. On heating, iodine changes directly into vapours. The iodine on the inner walls of the funnel sand remains behind in the petri dish.



Separation of ammonium chloride by sublimation



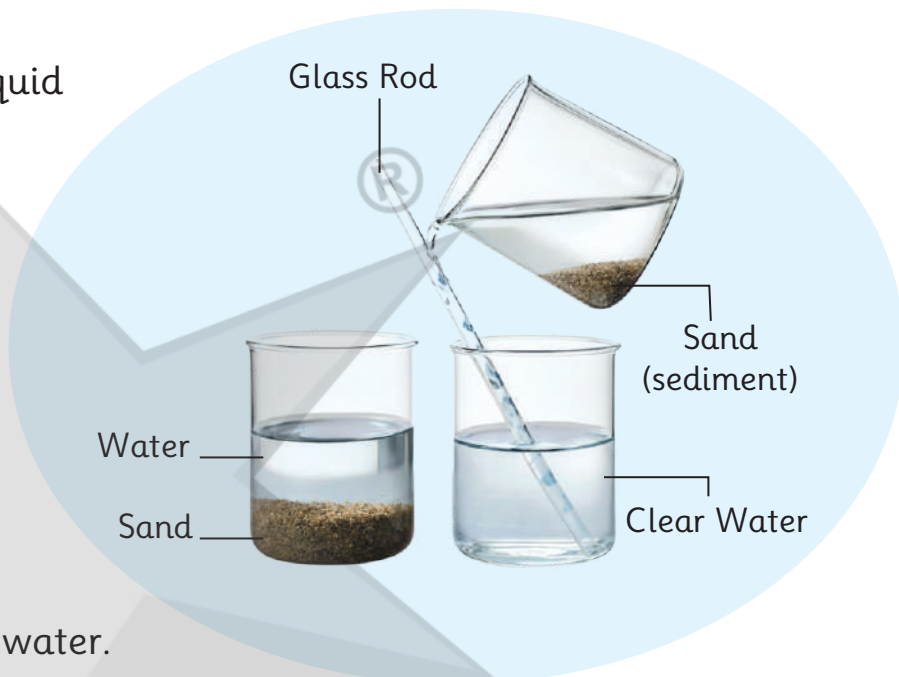
Residue containing sand and common salt dissolved in water

Sublimation is used in freeze-drying to preserve food products such as coffee, snacks and instant meals.

7.5.7 Decantation

It is a method used to separate a liquid from an insoluble solid (or another liquid) after the solid has settled at the bottom of the container. In this process the heavier solid particles settle down at the bottom. Then gently pour off the clear liquid from the top without disturbing the settled particles.

Real life example of decantation is separating clear water from muddy water.



7.5.8 Chromatography

It is a technique used to separate the coloured components of a mixture. In this method different solutes are dissolved in the same solvent as components of the mixture. When the solution is made to move on chromatographic paper or some other stationary phase, the dissolved components (solute) move on the paper along with the solvent at different rates. In this way, the coloured components become separated on the paper.





Activity Time!

Colour Split Detective

Objective: To explore how different colours are made of mixtures and how chromatography can be used to separate them using paper and water.

Resources:

- Chromatography paper
- Beaker
- Pencil
- Scissors
- Dropper (optional)
- Black ink
- Water
- Ruler
- Tape or paper clips

Instructions:

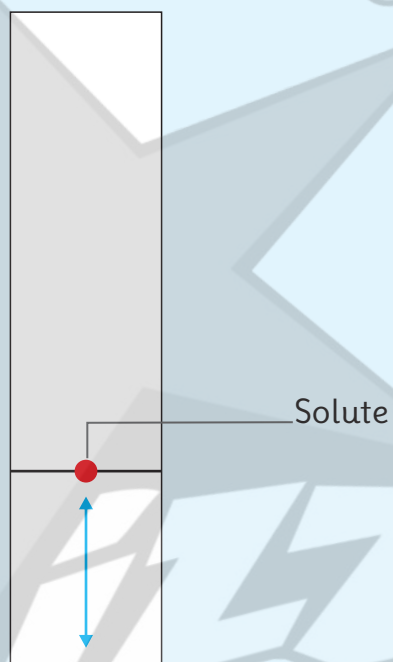
- Cut the chromatography paper into strips (approximately 2 cm wide and 10 cm long).



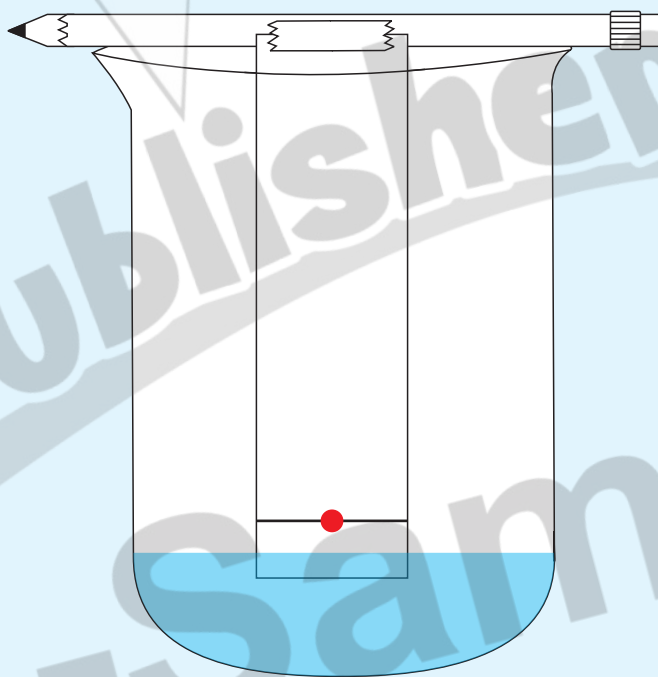
10 cm

2 cm

- Using a pencil and ruler, draw a light horizontal line about 2 cm from the bottom of each strip.
- Place a small dot of black ink at the center of the line.



- Pour a small amount of water (about 1 cm deep) into a beaker.



- Tape or clip the top of the paper strip to a pencil placed across the top of the cup.
- Make sure the bottom of the paper touches the water, but the ink dot remains above the water level.
- Leave the setup undisturbed for 10–15 minutes.
- Observe the water moving upwards through the paper.
- Notice how the water carries different colours of ink along with it.
- Remove the paper carefully when the colours have separated.
- Allow the paper to dry and observe the different colours bands. For example, black ink may separate into blue, red or green colors.

Inquiry questions:

a. What happened to the ink as the water moved?

b. Did all colours move in the same way?

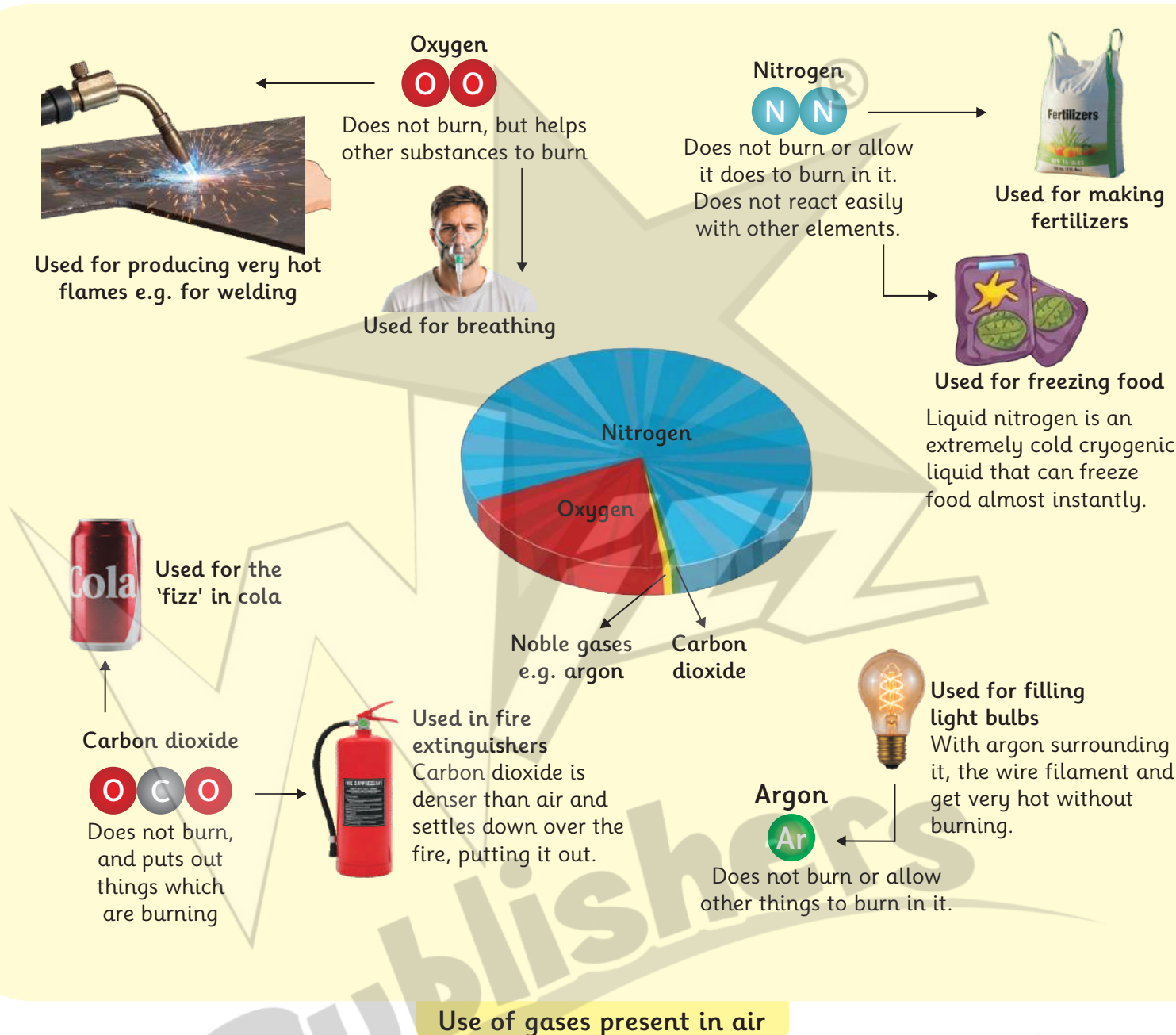
c. What does this experiment tell us about how colours are made?

7.6 Examples of Mixtures

Mixtures are everywhere around us. Following are few examples of mixtures from our daily life:

- Lemonade consist of water, sugar, flavouring and carbon dioxide gas.
- Breakfast cereal mixed with milk is a mixture.
- Vinegar is a mixture containing water and acetic acid.
- Milk is a mixture of water, proteins, fats and other substances.
- Air is not a single substance. It is a homogenous mixture of different gases. The major gases present in air are: Nitrogen (78%), Oxygen (21%), Argon (0.9%), Carbon dioxide (0.04%), and other gases.

Different gases present in air are useful in industries and daily life:



- An alloy is a mixture of a metal with other metals or non-metals to improve its properties such as strength, hardness and resistance to rust.
- Alloys are used in many industries from constructions to automobiles to aerospace to make jewellery and surgical tools. Commonly known alloys include steel (iron and carbon), sterling silver (silver and copper), white gold (gold and silver), brass (copper and zinc). Pewter and bronze are examples of alloys with multiple constituents and combinations.

Pewter

- 91% Tin
- 7.5% Antimony
- 1.5% Copper
- Small amounts of bismuth or other metals

Bronze

- 88% Copper
- 12% Tin
- Some types of bronze may also contain aluminium, arsenic, silicon, phosphorous or manganese.



Let's

Think *Aloud*

Your gold is an alloy made from equal parts of copper and silver combined with a greater amount of gold. Identify each component of yellow gold as a solute or solvent.

7.7 Difference among Elements, Compounds and Mixtures

Feature	Element	Compound	Mixture
Definition	A pure substance made up of only one type of atom	A pure substance formed when two or more elements combine chemically.	A physical combination of two or more substances
Composition	Contains only one kind of atom	Contains different elements in a fixed ratio	Contain substances in any ratio
Examples	Oxygen (O ₂), Gold (Au), Iron (Fe)	Water (H ₂ O), sodium chloride (NaCl), Carbon dioxide (CO ₂)	Air, salt water, fruit salad, soil
Properties	Has its own set of characteristic properties	Has properties different from the elements that form it	Components keeps the individual properties

Separation	Cannot be broken down into simpler substances by chemical means	Can be broken down into elements by chemical methods	Can be separated by physical methods such as (filtration and evaporation).
Type of Substance	Pure substance	Pure substance	Mixture (Impure substance).



Activity Time!

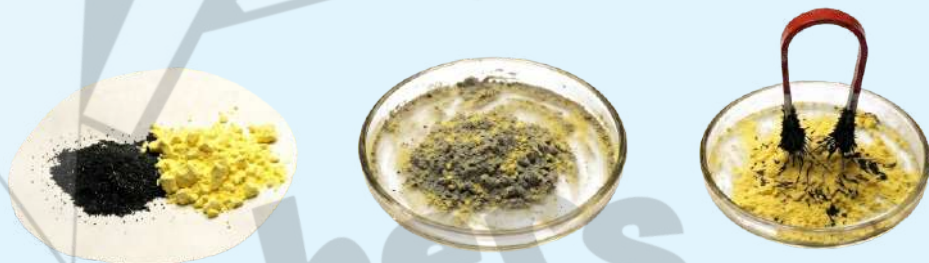
Mix and Make

Objectives:

- To differentiate between mixtures and compounds.
- To observe changes during physical and chemical combinations.
- To use inquiry to explore the nature of substances.

Resources:

- Iron filings
- Sulphur powder
- Magnet
- China dish
- Candle and metal spoon (for heating – teacher assisted heating)
- Spoon or spatula
- Safety goggles



Inquiry questions:

- How are mixtures formed?
- How are compounds formed?
- How can we distinguish between a mixture and a compound through observation and simple tests?

Instructions (Phase I – Before Heating):

- Mix iron filings and sulphur powder in a china dish (physical mixing only).
- Stir gently to ensure proper mixing.
- Observe the mixture carefully.

Observation: (Table I)

Questions	Reply
Do you observe any reaction?	
Has a new substance formed? What is it? • Mixture • Element • Compound	
Can you still see both substances separately?	
Is this a pure substance?	
What type of mixture is it? • Heterogeneous • Homogeneous	
Why is it heterogeneous?	
How can the substances be separated? (Hint: Magnet)	
Write conclusion of phase I. 	

Instructions (Phase 2 - After Heating):

- Heat the mixture of sulphur powder and iron filings strongly in a china dish. It will change into black mass.
- Allow the substance to cool grind the black mass gently into powder.
- Observe whether the particles of sulphur and iron can still be identified separately.
- Bring a magnet near the substance and observe carefully.

Observation: (Table 2)

Questions	Reply
What changes did you observe after heating?	
What happened to sulphur and iron fillings upon heating?	
What is this black substance formed?	
Is it the same as the original mixture of iron and sulphur?	
Is this a pure substance?	
Can iron be separated from sulphur by using a magnet how?	
Do sulphur and iron still keep their individual properties in the black mass of iron sulphide?	
Write conclusion of phase 2. 	

Compare and Conclude

Fill in the comparison chart below:

Feature	Mixture (Iron + Sulphur)	Compound (Iron Sulphide)
Appearance		
Can be separated?		
Effect of magnet		
Type of change		



What have you learnt?

- A mixture is formed when two or more substances are combined physically, not chemically.
- A mixture does not have a fixed composition and its components keep their original properties.
- A solution is a homogeneous mixture formed when a solute dissolves in a solvent.
- A mixture whose composition and properties are uniform throughout the sample is called homogeneous.
- A mixture whose composition and properties are not uniform throughout the sample is called heterogeneous. Homogeneous mixture is also called solution.
- Solute is the substance that gets dissolved.
- Solvent is the substance that dissolves something.
- When a solvent used is water, the solution is called an aqueous solution.
- If there is a large amount of solute dissolved in small amount of a solvent, then the solution is said to be concentrated solution.
- If there is a small amount of solute dissolved in a large amount of solvent, then the solution is said to be dilute solution.
- The solution in which a solvent is capable of dissolving any more solute at a given temperature is called unsaturated solution.
- The solution in which a solvent is not capable of dissolving any more solute at a given temperature is called saturated solution.
- The solution which has large amount of solute than it can normally hold at a certain temperature is called supersaturated solution.
- An alloy is a mixture of a metal with other metals or non-metals to improve its properties.

Exercise

1 Choose the correct option.

- i. What is a mixture?
- a A pure substance
 - b A combination of two or more pure substances
 - c A chemical reaction
 - d A homogeneous substance
- ii. Which of the following is a homogeneous mixture?
- a Sand and water
 - b Oil and water
 - c Salt and water
 - d Iron filings and sulphur
- iii. Which of the following is NOT a pure substance?
- a Oxygen
 - b Gold
 - c Air
 - d Water
- iv. Which method is best for separating sand from water?
- a Filtration
 - b Distillation
 - c Evaporation
 - d Chromatography
- v. What is the main characteristic of a heterogeneous mixture?
- a Uniform composition
 - b Non-uniform composition
 - c Transparent appearance
 - d High density
- vi. Air is an example of a _____.
- a compound
 - b homogeneous mixture
 - c heterogeneous mixture
 - d element
- vii. A solution is a type of _____.
- a homogeneous mixture
 - b heterogeneous mixture
 - c pure substance
 - d compound

viii. Which method is effective in separating the colours present in ink?

- a Filtration
- b Distillation
- c Chromatography
- d Evaporation

ix. Mixtures can be made up of substances in_____.

- a any ratio
- b fixed ratio
- c equal ratio
- d chemical ratio

x. Oil and water form a_____.

- a homogeneous mixture
- b heterogeneous mixture
- c compound
- d element

xi. In a heterogeneous mixture, the components are_____.

- a uniformly distributed
- b not uniformly distributed
- c always gas
- d chemically combined

xii. What type of mixture is formed when sugar is dissolves in water?

- a Homogeneous mixture
- b Heterogeneous mixture
- c Compound
- d Element

xiii. What is an alloy?

- a A pure metal
- b A mixture of metals with other elements
- c A non-metal
- d A compound of gases

xiv. Which of the following is an alloy?

- a Copper
- b Iron
- c Bronze
- d Aluminium

xv. Bronze is an alloy of:

- a Copper and tin
- b Iron and carbon
- c Aluminium and copper
- d Nickel and chromium

- xvi. What is the most abundant gas in Earth's atmosphere?
- a Oxygen
 - b Nitrogen
 - c Carbon dioxide
 - d Argon
- xvii. Which gas is used in fire extinguishers?
- a Carbon dioxide
 - b Nitrogen
 - c Carbon monoxide
 - d Argon
- xviii. What is a solution?
- a A pure substance
 - b A heterogeneous mixture
 - c A homogeneous mixture
 - d Chemical compound
- xix. In a solution, the substance present in a larger amount is called the:
- a Solute
 - b Solvent
 - c Dissolvee
 - d Solubility

2 Match the following definitions with the correct vocabulary words.

Vocabulary Words	Definition
Solution	A substance that dissolves a solvent.
Dissolving	A substance that dissolves another substance.
Solute	When a solute is completely dissolved into a solvent.
Solvent	When a substance is added to a solvent and seems to disappear but is really small and suspended between the particles of the solvent.
Insoluble	A substance that is not able to dissolve into a solvent.
Soluble	A substance that can dissolve into a solvent.

3 For each of the following scenarios, identify the solvent and the solute.

i. Mary dissolved salt in water to make a saline solution.

Solute: _____

Solvent: _____

ii. Sarah poured vinegar into a bowl of olive oil.

Solute: _____

Solvent: _____

iii. Alex dissolved baking soda in water for a science experiment.

Solute: _____

Solvent: _____

iv. Emma added food coloring to a glass of water.

Solute: _____

Solvent: _____

v. David combined flour and water to make dough.

Solute: _____

Solvent: _____

vi. Lisa mixed lemon juice and sugar in a pitcher of water to make lemonade.

Solute: _____

Solvent: _____

4 Fill in the table to show the differences among elements, compounds and mixtures.

Feature	Element	Compound	Mixture
Definition	_____ _____ _____ _____	_____ _____ _____ _____	_____ _____ _____ _____

Composition			
Examples			
Properties			
Separation			
Type of substance			

5 Answer the following questions:

- i. Define mixture. Also write down the properties of mixture.
- ii. Differentiate between:
 - a. Solute and solvent

- b. Homogeneous and heterogeneous mixtures with at least two examples.
- c. Crystallization and chromatography
- d. Saturated and Unsaturated solutions
- iii. Write at least four uses of mixtures.
- iv. What is alloy and how is it made? Give two examples.
- v. Write a shortnote on distillation with the help of a labelled diagram.
- vi. Name any two methods used to separate mixtures.



Constructed Response Questions

- i. a. How can we make this solution diluted?



- b. Which solution is more concentrated and why?



- ii. Explain why air is considered a mixture.



PROJECT TIME



- Prepare a salt-water solution at home. Recover the salt using the method of evaporation.
- Write your observations in your notebook.
- Paste picture showing the salt left behind after evaporation.

Students' Learning Outcomes

All students will be able to:

- Explain the phenomena of static electricity in everyday life.
- Recognize electric current as a flow of charges.
- Describe a simple circuit as a path for flow of charges.
- Differentiate between open and closed circuits.
- Draw and interpret simple circuit diagrams (using symbols).
- Describe the characteristics of series and parallel circuits.
- Draw and construct a series and parallel circuits.
- Identify the use of series and parallel electric circuits in daily life.
- Investigate the factors that affect the brightness of bulbs or speed of motors:
 - ✓ Number of batteries
 - ✓ Number of Bulbs
 - ✓ Type of wire
 - ✓ Length of wire
 - ✓ Thickness of wire
- Assemble and operate a trip wire security alarm system using simple items. (STEAM)

Let's Start!

- How is electricity produced?
- Why does your hair sometimes stand up after removing a woollen cap?
- What do you think happens inside a wire when you switch on a torch?



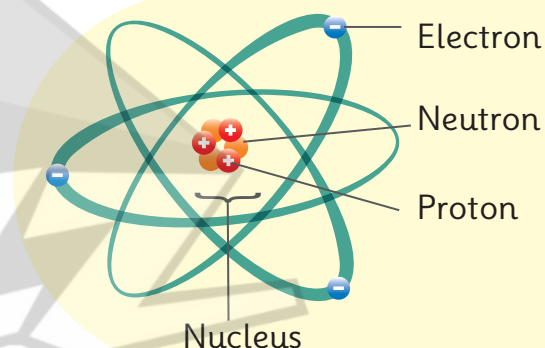
Electricity

Electricity is a form of energy that helps many things around us work. When you switch on light or ring a doorbell, electricity that makes the light glow and the doorbell ring.

But have you ever wondered how electricity works? Before understanding electricity, we first we need to understand the structure of an atom.

Structure of an Atom

All materials are made up of tiny particles called atoms. Contains even smaller charged particles inside them. At the centre of each atom, is a nucleus, which is made up of protons and neutrons. Tiny particles called move around the nucleus called electrons.



Let's

Think *Cloud*

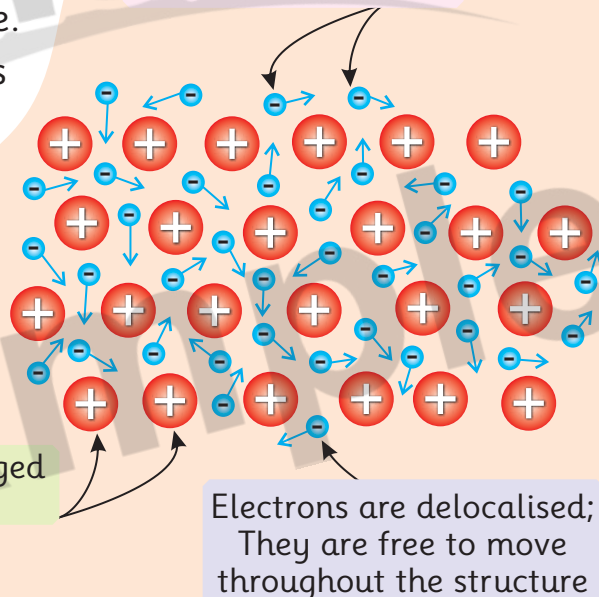
Why do metals allow electrons to move freely?

Where does electric charge come from?

Protons and electrons both carry electric charge. Electrons have a negative charge, while protons have a positive charge which is equal in size to the charge on the electron. Neutrons have no charge.

In metals, electrons can move freely throughout the structure. This creates a "sea of electrons" moving around the fixed positive metal ions. This makes them a good

Electrons from outer
Shell of metal atoms



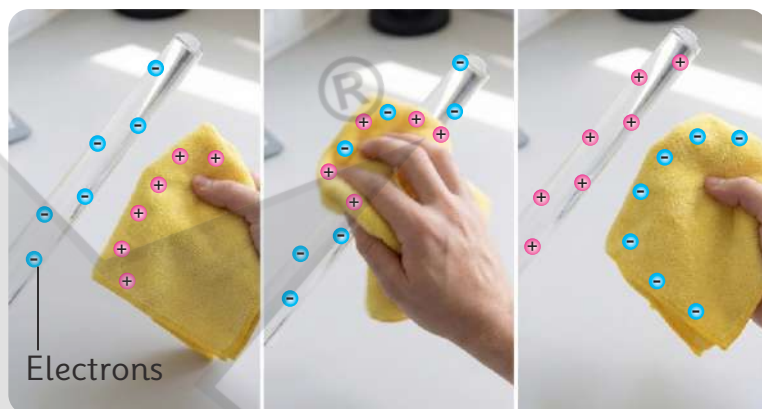
Positively charged
metal ions

Electrons are delocalised;
They are free to move
throughout the structure

conductor of electricity. Electrons flow easily through metal wires connected to cells and batteries.

When we rub a metal rod with a piece of cloth, the rod gains electrons from the cloth. As a result, the rod becomes negatively charged. While the cloth becomes positively charged because it has lost electrons.

Materials that gain electrons becomes negatively charged (rod), whereas materials that lose electrons becomes positively charged (cloth).

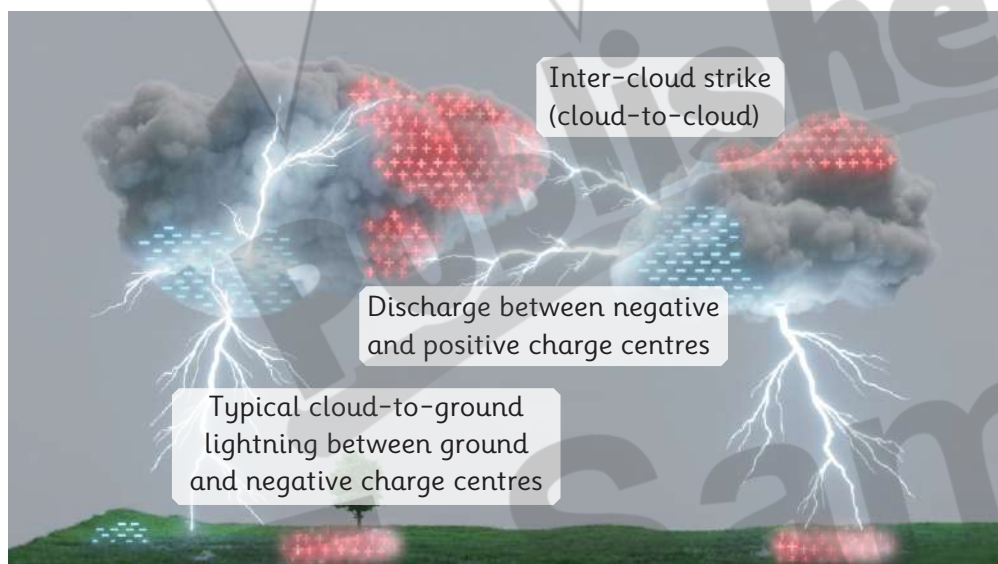


Whenever there is an excess or flow of electrons through atoms, it is known as electricity. There are two types of electricity:

Types of Electricity

a. Static electricity

Static electricity is the build-up of electric charge on the surface of an object. These charges do not move continuously like the electricity that powers lights or fans. That is why it is called "static," which means not moving.



Static electricity usually occurs when two objects rub against each other, causing electrons to move from one object to another.

Lightning is an example of static electricity.

When clouds rub against the air, a huge charge is gathered on

them. When oppositely charged clouds approach or meet, a big spark is produced, which is called lightning.



Activity Time!

Balloon and Paper Magic

Objective: To observe static electricity and understanding how rubbing object can create electric charges.

Resources:

- 1 balloon
- Small bits of paper (hole-punched paper or tissue pieces)

Instructions:

- Blow up the balloon and rub it on your head or a wool sweater for 10–15 seconds.
- Bring the balloon close to the paper pieces.
- Watch the paper jump up and stick to the balloon.
- Is there a way to make his process more efficient and use it in your daily life?

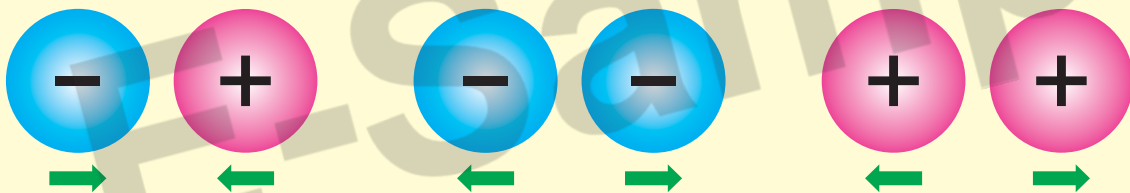


Let's

Think Aloud

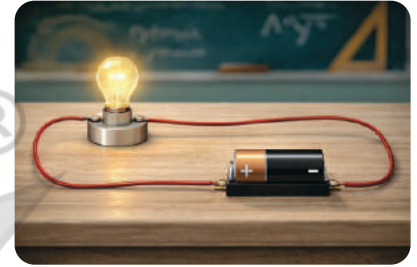
What makes the balloon to become negatively charged when it is rubbed with a woolen cloth?

When the balloon is rubbed against the sweater it picks up negative charges from the sweater, becoming negatively charged. When the negatively charged balloon is brought close to any surface, its negative charges move away to the other side, making it positively charged. This makes the two surfaces attract to each other.



b. Current electricity

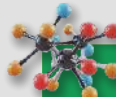
When the positive terminal of a battery is connected to its negative terminal through a copper wire, electrons begin to flow through the wire. The electricity produced by the flow of charges (electrons) is called current electricity.



The flow of electrons is only possible through conductor.



Why can electrons not pass through the plastic coating around a wire?



SciByte

The world's biggest light bulb is located in Edison, New Jersey. It is 14 feet tall, weighs eight tons and sits on top of the Thomas Edison Memorial Tower.



Electric circuit

An electric circuit is like a loop or a closed path through which electric current flows. A simple electric circuit consists basic components:

Basic components of an electric circuit

Component	Symbol	Purpose
Battery (Cell)		Power source
Wires		Conductors that carry the electric current. Usually made of copper.
Switch		A device to open or close the circuit (turn it on or off).
Bulb		A device that uses electricity to give light.
Resistor		Slows down or controls the flow of electric current.

Let's understand the difference between an open and closed electric circuit using a simple setup.



Activity Time!

Light It Up : Open and Closed Electric Circuit

Objective: To observe the difference between an open and closed electric circuit using a simple electric setup.

Resources:

- A small battery (1.5V or 9V)
- A bulb (torch bulb or LED)
- 2 or 3 insulated wires with ends stripped
- A paperclip or switch (for opening/closing the circuit)
- Tape or battery holder



Instructions:

- Connect one wire from the positive end of the battery to the metal base of the bulb.
- Connect another wire from the metal tip of the bulb to the negative end of the battery.
- Observe what do you observe happens to the bulb?

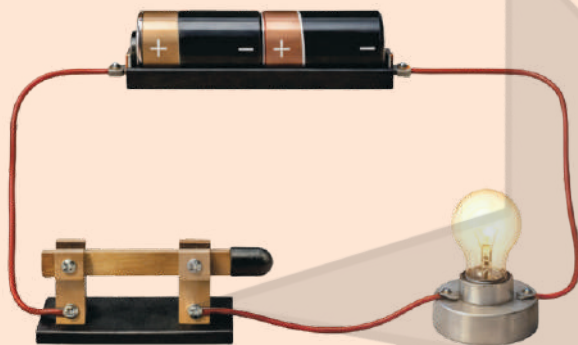
- Now, disconnect one wire from the circuit.
- Observe what happens to the bulb?

Questions:

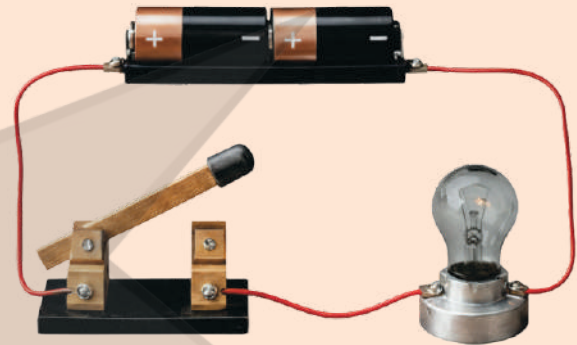
- What happened when the circuit was closed?

- Why did the bulb stop glowing when a wire was disconnected?

At first, the bulb lit up because the circuit was complete, allowing electric current to flow through it. Whereas, the circuit became open (incomplete), so electricity could not flow and the bulb turned off.



Closed circuit



Open circuit

When the current is switched on, electrons flow from the battery through the bulb and other components in the circuit, such as the ammeter. The amount of current flowing through the circuit is indicated by the ammeter. A current is measured in amperes (A).

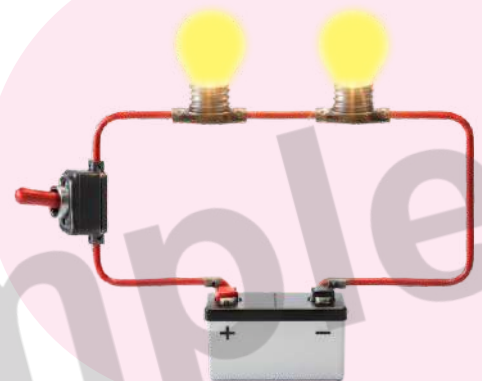
Types of Circuits

Based upon the ways the electric devices are connected in the circuit, electric circuits are of two main types, i.e., series and parallel circuit.

- Series circuit
- Parallel circuit

a. Series circuit

In a series circuit, all components are connected one after another in a single path. There is only one path for electric current to flow. The same current flows through all components. Therefore, if one component stops working, the entire circuit stops. Every time an identical bulb is added, the bulb glows less brightly because all the bulbs in a series circuit share the same current, each bulb receives less current and less energy, causing them to glow less brightly.

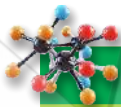
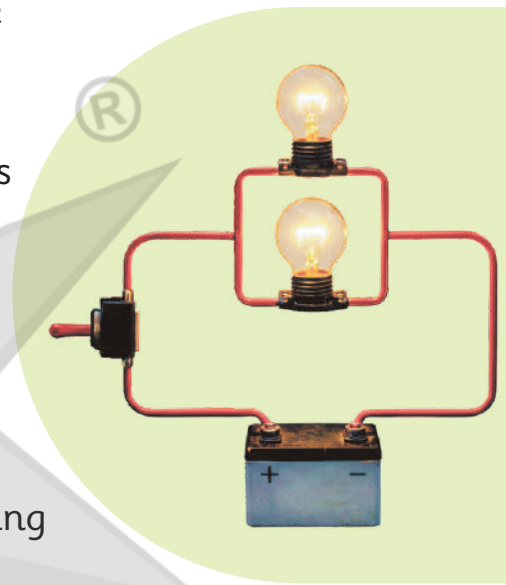


An example of a series circuit is a string of fairy lights. Water heaters, freezers and refrigerators also use series circuits.

b. Parallel circuit

In a parallel circuit, there are multiple paths for the current to flow. Bulbs are joined by separate wires attached to the same source of current. Whenever another identical bulb is added to the circuit, it does not make any difference to the brightness of the other bulbs because the total current is divided among the branches. If one component stops working, the others can still work.

An example of a parallel circuit is home wiring, lights and appliances connected in parallel, so turning off one does not affect the others.



SciByte

Electric eels can produce up to a 600-volt electric shock.



Advantages of Series circuit

- They are easy and simple to design and build.
- Series circuit use fewer wires.
- Good for safety triggers, if one part fails, the whole system turns off (useful in alarms).

Advantages of Parallel circuit

- In parallel circuit each device gets full voltage, all bulbs or appliances work at full brightness.
- Parallel circuit operates independently which means, if one device fails, the remaining will not be affected.
- This type of circuit is more reliable for complex systems like home or office electricity.



Activity Time!

Series and Parallel Circuit

Objective: To understand the difference between series and parallel circuits by observing how bulbs light up in each type of circuit.

Resources:

- 1 battery holder with 2 AA batteries
- 3 small light bulbs with holders
- Electrical wires with alligator clips (or wire ends)
- A switch (optional)

Series Circuit Demonstration

Instructions:

- Connect the positive end of the battery to one terminal of the first bulb.
 - Connect the second terminal of the first bulb to the first terminal of the second bulb.
 - Repeat the process for the third bulb.
 - Connect the second terminal of the third bulb back to the negative end of the battery.
 - What do you observe?
-
-

Parallel Circuit Demonstration

Instructions:

- Connect the positive end of the battery to one first terminal of all three bulbs using a junction or separate wires.
 - Connect the second terminals of all three bulbs together.
 - Connect this combined wire back to the negative end of the battery.
 - What do you observe?
-
-

Conclusion:

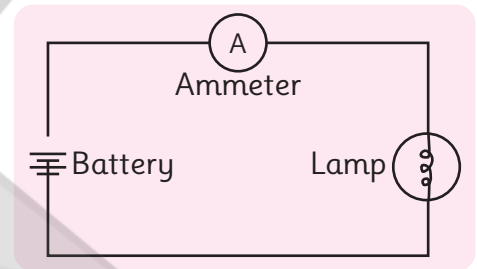
Feature	Series Circuit	Parallel Circuit
Path of Current		®
Bulb Brightness		
Effect of One Bulb		

Current

In a circuit containing a light bulb, we can estimate the size of the current by observing the brightness of the bulb. A large current makes the bulb glow brightly. But this is not correct enough for scientific work, so an instrument called an ammeter is used to measure the current.

The size of the current tells us how much charge flows through a circuit in one second. The unit of charge is the coulomb (C) and current is measured in amperes (A).

An ammeter is a measuring device used to measure the electric current in a circuit. It is always connected in series with a device so that the same current pass through it.



Let's

Think Aloud

Have you ever tried drinking through a very thin straw? What happens and how does this relate to the flow of electricity through a wire?

Resistance

Resistance is the opposition to the flow of electric current in a circuit. It is the difficulty that electric current faces while passing through a material, just like juice through a straw. The thinner or longer the wire (or the more resistive the material), the harder it is for current to pass and vice-versa. Resistance is measured in ohms (Ω).

If we take two wires, one is made up of copper while other is made up of nichrome. Nichrome wire has more resistance as compared to copper

wire. Therefore, more energy has to be spent to force electrons through it and the wire becomes hot. The resistance of any wire depends on:

The length of the wire

Add following values of A against different wires:

- Long wire: 0.1A
- Short wire: 0.3A

The diameter of the wire

Add following values of A against different wires:

- Thin wire: 0.1A
- Thick wire: 0.4A

The material from which it is made up of

Add following values of A against different wires:

- Copper: 0.6A
- Nichrome wire: 0.4A

Voltage

Voltage is defined as the push or pressure that makes electric charges move in a circuit. If we are providing more voltage, which means more energy available to move the charges. Voltage is measured in volts (V).



A multimeter is a device used to measure voltage, current and resistance. It is also called VOM (volt-ohm-milliammeter) or AVO (ampere-volt-ohm meter).

Following formula is used to show the relationship between voltage, resistance and current.

$$V = I \times R$$

Where:

- V = Voltage (volts)
- I = Current (amperes)
- R = Resistance (ohms)



$$V = IR$$



Let's

Think Aloud

Why is the total resistance higher in series circuit as compared to parallel circuit?

Factors that affect the brightness of bulbs or speed of motors

Following are the factors that affect the brightness of bulbs or speed of motors:

a. Number of Batteries (Voltage)

If the number of batteries connected in a series circuit is increased, the bulb lights up brighter and the speed of motor increases.

More batteries means more higher voltage, which increases the energy supplied, as a result bulb shine brighter and motor spins faster.

b. Number of Bulbs

If the number of bulbs connected in a series circuit is increased without increasing the number of batteries, it makes the bulbs dimmer. Whereas, in a parallel circuit, each bulb gets full voltage, therefore no change in brightness.

c. Type of Wire (Material)

Some materials resist current more than others. Copper is a better conductor than nichrome, because copper wire has low resistance as compared to nichrome wire.

d. Length of Wire

Longer wires add more resistance than shorter wires. This reduce the current making bulbs dimmer or motors slower.

e. Thickness of Wire

Thicker wires carry more current as compared to thin wires. Thin wires resist current more and may cause devices to run dim or slow.



What have you learnt?

- Static electricity is the build-up of electric charge on the surface of an object.
- Lightning is an example of static electricity.
- The electricity produced by the flow of charges is called current electricity.
- An electric circuit is like a closed loop through which current flows.

- In a series circuit, components are connected one after another in a single path.
- In a parallel circuit, components are connected in multiple paths.
- Electric current is measured in amperes (A).
- An ammeter measures electric current in a circuit.
- Resistance is the opposition to the flow of electric current and is measured in ohms (Ω).
- Voltage is the push that moves electric charge and is measured in volts (V).
- A multimeter measures voltage, current and resistance.

Exercise

1 Choose the correct option.

- All substances are made up of tiny particles called _____.
 - atoms
 - molecules
 - photons
 - rays
- The centre of the atom is called _____.
 - nucleus
 - proton
 - electron
 - neutron
- What causes static electricity?
 - Flow of electrons
 - Static charges
 - Magnetic fields
 - Electrical circuits
- When two objects with different charges are brought close together, what happens?
 - They repel each other
 - They attract each other
 - They create a magnetic field
 - Nothing happens

- v. When an object gains electrons, it becomes_____.
- a positively charged
 - b negatively charged
 - c electrically neutral
 - d none of them
- vi. Lightning is caused by_____.
- a static electricity
 - b positivly charged particles
 - c current electricity
 - d negativly charged particles
- vii. The rate of flow of electric charge in a circuit is called_____.
- a electric current
 - b electric flow
 - c electric path
 - d electric circuit
- viii. In a closed circuit, the flow of electric current is _____.
- a interrupted
 - b allowed to flow continuously
 - c reversed
 - d slowed down
- ix. What happens in an open circuit?
- a Electric current flows
 - b No electric current flows
 - c Resistance decreases
 - d Voltage increases
- x. What happens to the brightness of a light bulb in an open circuit?
- a It becomes brighter
 - b It remains the same
 - c It becomes dimmer
 - d It goes out
- xi. Which device is used to measure electric current in a circuit?
- a Voltmeter
 - b Ammeter
 - c Oscilloscope
 - d Multimeter
- xii. In a series circuit, how is the current affected as more resistors are added?
- a Increases
 - b Decreases
 - c Remains the same
 - d Becomes zero
- xiii. If one bulb in a series circuit goes out, what happens to the other bulbs?
- a They remain lit
 - b They also go out
 - c They become brighter
 - d They become dimmer

xiv. What is the effect on the brightness of bulbs in a parallel circuit if one bulb goes out?

- a They all go out
- b They remain lit
- c They become dimmer
- d They become brighter

xv. What type of circuit is used in household wiring?

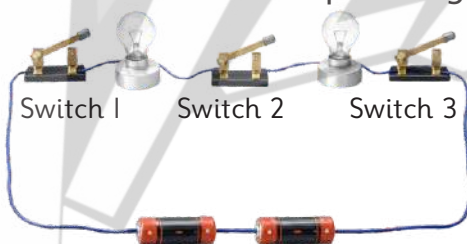
- a Series circuit
- b Parallel circuit
- c Combination of series and parallel circuits
- d Closed circuit

xvi. Resistance is measured in:

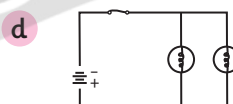
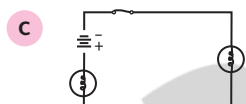
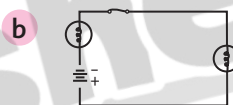
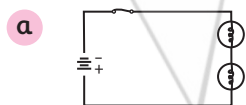
- a Ampere
- b Ohms
- c Watt
- d Calories

xvii. Which switches must be closed for the lamps to light up?

- a Only switch 2
- b Switches 1 & 2
- c Switches 2 & 3
- d Switches 1, 2 & 3

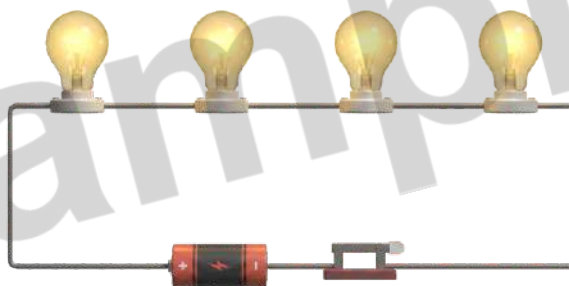


xviii. In which of the following circuits the bulbs are NOT connected in series.



xix. If one more bulb is added in series to the following circuit, what happens to the other bulb?

- a They will get brighter
- b They will get dimmer
- c They will turn off
- d They will stay the same

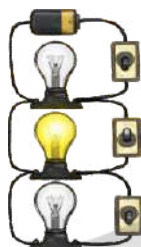


xx. Identify the parallel circuit form the following diagrams.

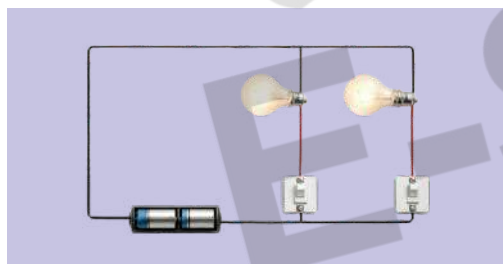
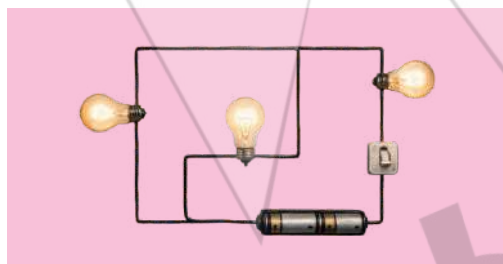
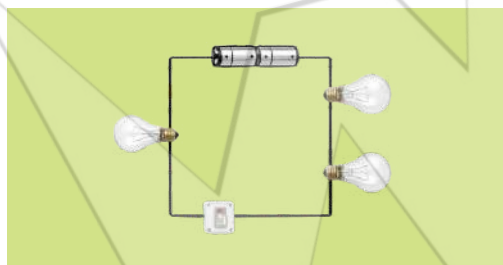
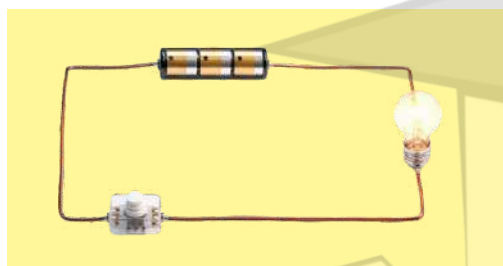
a



d



2 For each of the pictures given below, draw the corresponding circuit diagrams using standard circuit symbols.



3 Read each scenario carefully and write answers in the space provided.

a. Scenario 1: The Dim Room

You are helping your little brother build a model house. He connects two bulbs in a series circuit using one battery. But both bulbs are very dim.

i. Why do you think the bulbs are not glowing brightly?

ii. What changes can you suggest to make the bulbs brighter?

b. Scenario 2: Wiring a Bedroom

Ali wants to wire his bedroom so he can turn each of his two lamps on and off separately. He also wants them to shine with full brightness.

i. Should Ali use a series or a parallel circuit? Why?

ii. What could go wrong if he uses a series circuit for this setup?

c. Scenario 3: The Battery Experiment

A group of students connects three bulbs in series to one battery. In another setup, they connect three bulbs in parallel to one battery.

i. Which setup will make each bulb glow brighter? Why?

ii. In which setup will the battery run out of power faster? Explain your reasoning.

d. Scenario 4: Electric Toy Car

You connect a motor and a light in series in your electric toy car. The light is dim and the motor runs slowly.

i. Why is the motor running slowly?

ii. How would connecting the motor and light in parallel affect the performance?

a. Scenario 5: Emergency Circuit Fix

Your school has an emergency alarm system wired in series. During a test, one alarm does not work and the whole system fails.

i. What is the risk of using a series circuit for an alarm system?

ii. How would a parallel circuit improve safety and functionality?

4 Answer the following questions.

i. Define the following:

- a. Current
- b. Voltage
- c. Resistance

ii. Differentiate between:

- a. Static and current electricity.
- b. Open and closed circuit.
- c. Conductors and insulators (with at least three examples).

iii. Write the formula showing the relationship between voltage, resistance and current.

- iv. How can a series circuit be changed into parallel circuit? Explain with the help of a diagram.
- v. Explain in detail the factors that affect the brightness of a bulb in series and parallel circuits.
- vi. Explain in detail the phenomenon of lightning.



Constructed Response Questions ||

- i. Have you ever felt a small shock after touching a doorknob or another person? Why do you think that happens?
- ii. Why do wires need to be connected in a complete loop for a bulb to glow?
- iii. What might happen if there is a break or gap in a circuit? Can the bulb still light up? Why?
- iv. Why do some lights in your home stay on when others
- v. are switched off?
Can the brightness of bulbs tell us something about the circuit?



PROJECT TIME



Trip Wire Security Alarm System

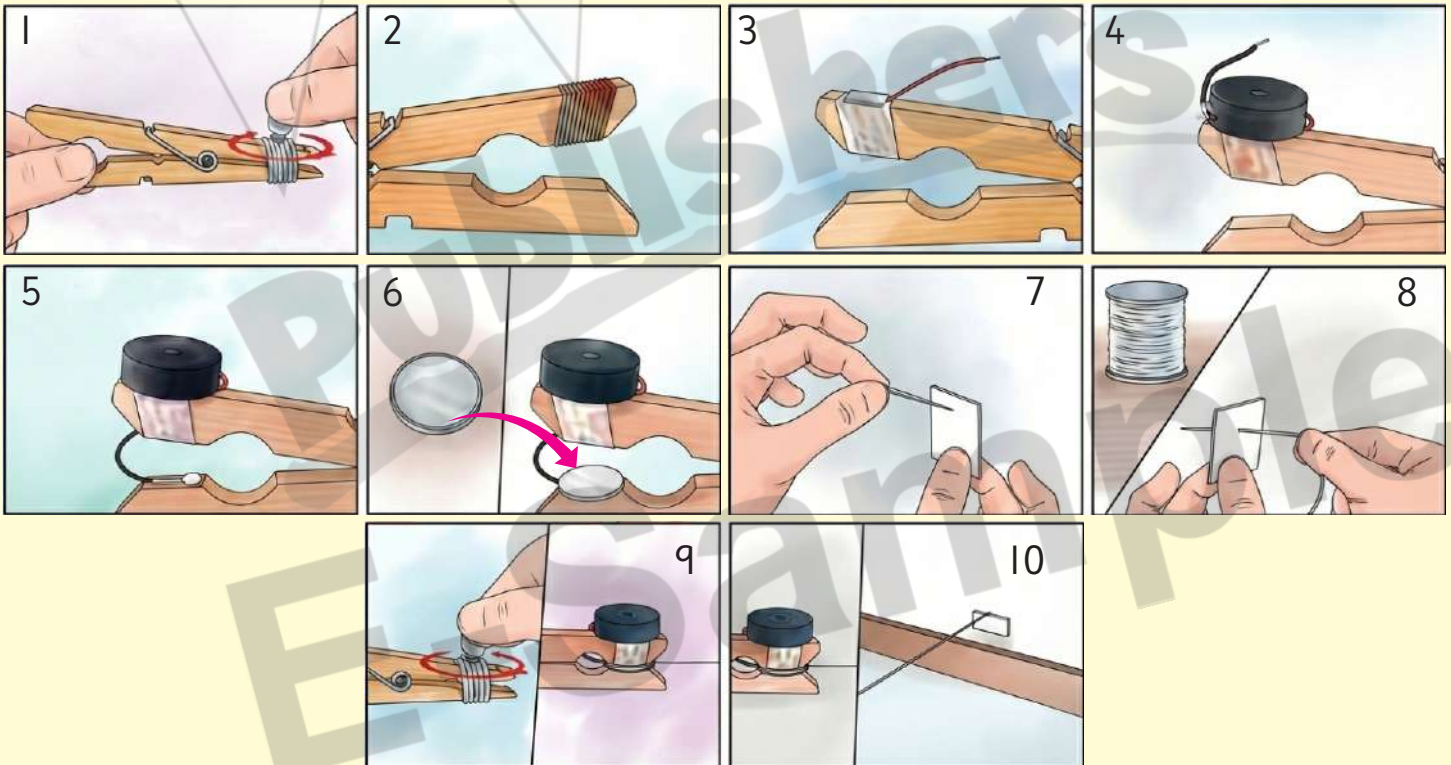
Objective: To build a simple security alarm that is triggered when someone trips over a wire.

Resources:

- Clothes clipper
- Electronic buzzer
- Lithium battery
- Double sided adhesive pads
- Twist ties
- Copper tape

Instructions:

- Squeeze the ends of on clothes clipper using the thread.
 - Wrap the copper tape around one open end of the clothes clipper.
 - Stick a black wire to top of the copper tape.
 - Attach a buzzer to the copper tape.
 - Place a sticky pad on the inside end of the clothes clipper and stick the black wire on its top.
 - Place the lithium cell on top of the black wire, keeping its negative side towards the black wire.
 - Take a 3cm thin cardboard, make a hole in it using a needle and mouth of the tie a strong thread around the hole.
 - Place the cardboard inside the clothes clipper.
 - Release the twist tie at the back of the clothes clipper and attach the thread to the wall.
 - Stretch the thread across the doorway ensuring it is tight but not so tight that it pulls the cardboard out.
 - What will happen when someone crosses the thread?
-
-



Students' Learning Outcomes

All students will be able to:

- Grow seasonal plants and vegetables in earthen pots and demonstrate the effect of use of fertilizers on the growth of plants.
- Prepare yogurt and cheese from milk to demonstrate the beneficial microorganisms.
- Design a solar oven to convert solar energy into heat energy.
- Assemble a circuit to demonstrate the working of an electric bell.

Let's Start!

- How are science and technology integrated?
- What is the role of fertilizers in agriculture?
- What are microorganisms and where can we find them in everyday life?



Technology and Science

Technology has a strong connection with science and helps make scientific work quicker, easier and more effective. Scientists use special tools like microscopes to observe tiny objects and telescopes to explore distant stars and planets. Computers and modern machines help carry out experiments faster and with better accuracy.

Learning science has also become more interesting thanks to videos, interactive games and educational applications. Through the internet, scientists can easily share their research and ideas with people all over the world. Most importantly, technology helps solve real-life challenges such as treating illnesses, protecting nature and discovering clean energy sources.

Science today would not be as advanced or exciting without the help of technology.

Seasonal plants and vegetables

Seasonal plants and vegetables are those that grow best in a certain time of the year. Some plants like cool weather and grow in winter, such as spinach, carrots, and peas. Others need warmth and sunshine and grow in summer, like tomatoes, cucumbers, and corn. These plants need the right temperature, sunlight, and water to grow well. Farmers and gardeners' plant seasonal vegetables at the right time so they can grow healthy and strong. Eating seasonal vegetables is also good for our health because they are fresh and full of nutrients. Seasonal plants are divided into two types:

Summer Plants

They are generally grown between February – March and harvested in September – October.



Summer vegetables



Summer Plants

Winter Plants

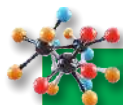
They are generally grown between September – October and harvested in February – March.



Winter vegetables



Winter Plants



SciByte

Fertilizers are made of natural and synthetic substances so they are not always completely harmless.

Role of Fertilizers in growing seasonal plants and vegetables

Fertilizers are useful for helping plants grow quicker, stronger and healthier. They provide essential nutrients like nitrogen, phosphorus and potassium, which support the growth of roots, leaves and fruits.

When we grow seasonal vegetables and plants, fertilizers improve the soil quality and support better development. For example, they can help tomato plants produce more fruit or make spinach leaves larger and greener.

Without fertilizers, plant growth may be slow or weak. That is why fertilizers are important, they plants with the nutrients they need for proper growth.



Activity Time!

Effect of use of fertilizers on the growth of plants

Objective: To compare the growth of plants with and without the use of fertilizer.

Resources:

- 2 small recycled containers
- Same type of soil
- Same type of seeds (e.g., mustard, or spinach)
- Water

- Organic fertilizer
- Ruler

Instructions:

- Label one container "With Fertilizer" and the other "Without Fertilizer."
- Fill both containers with the same amount of soil.
- Plant the same number and type of seeds in each container.
- Add fertilizer only to the container labeled with "With Fertilizer" as directed.
- Water both containers equally every day.
- Place both containers them in the same spot to ensure get equal sunlight.
- Observe the plants daily and measure their height every 2–3 days.
- Record the number of leaves, colour and height of both plants.
- After 2–3 weeks, compare the growth and health of the plants.

Data Analysis:

Day	Container	Plant Height (cm)	Number of Leaves	Leaf Colour	Overall Plant Health (Strong/Weak)
Day 1	With fertilizer				
Day 1	Without fertilizer				
Day 3	With fertilizer				
Day 3	Without fertilizer				
Day 6	With fertilizer				
Day 6	Without fertilizer				
Day 9	With fertilizer				
Day 9	Without fertilizer				
Day 12	With fertilizer				
Day 12	Without fertilizer				
Day 15	With fertilizer				
Day 15	Without fertilizer				

Day	Container	Plant Height (cm)	Number of Leaves	Leaf Colour	Overall Plant Health (Strong/Weak)
Day 18	With fertilizer				
Day 18	Without fertilizer				
Day 21	With fertilizer				
Day 21	Without fertilizer				

Questions:

Write the answers in your notebook.

- Which plant grew better? Why?
- What difference did you notice in leaf colour and size?
- What does this tell us about the role of fertilizers?



Let's

Think Aloud

What do we use to see microorganisms?

Beneficial Microorganisms

Not all microorganisms are harmful, some are very useful and helpful to us. These tiny living things are called beneficial microorganisms. We cannot see them through naked eyes, so we use a microscope to observe them.

They perform important tasks:

- They are used to turn milk into yogurt and cheese, which are easier to digest. Some of these good bacteria are also called probiotics. Probiotics are live microorganisms that help keep our stomach and digestive system healthy.
- Some beneficial organisms live inside our bodies, especially in the stomach, where they help digest food and protect us from harmful germs.
- In farming, helpful microorganisms in the soil improve plant growth by providing nutrients to plants.

- In the environment, they break down dead plants and animals and convert them into compost, making the soil fertile and rich.



Activity Time!

Prepare Yogurt and Cheese from Milk

Objective: To show how helpful microorganisms (like bacteria) turn milk into yogurt and cheese.

Resources:

For making Yogurt

- Warm milk (not boiling)
- One spoon of plain yogurt
- Clean bowl with lid
- Towel

For making Cheese

- Milk (2 cups)
- Lemon juice
- Pan and stove (under adult supervision)
- Strainer and cloth

Instructions: for making yogurt

- Slightly warm the milk.
 - Pour the milk into a clean bowl.
 - Add one spoon of yogurt into the warm milk and stir gently.
 - Cover the bowl and wrap it with a towel to keep it warm.
 - Leave it in a warm place for 6–8 hours or overnight.
 - Check the next day and write down your observations.
-
-

For making cheese

- Boil the milk in a pan with the help of an adult.
- When it starts boiling, slowly add lemon juice.
- Stir gently until the milk separates into solid curds and liquid whey.
- Pour it through a strainer lined with cloth to collect the curds.
- Press the curds gently to remove extra water. This solid part is cheese.

Discussion Questions:

Use notebook to answer the questions given:

- What caused the milk to change in both cases?
- How are good bacteria helpful in yogurt making?
- Why is yogurt good for our health?

Energy Conversion & its Importance

Energy is the force that powers movement, lights and machines. It exists all around us in different forms as heat, light, sound and motion. Energy conversion is the process of changing energy from one form to another. This transformation happens constantly in our everyday lives. For example, when you turn on a fan, electrical energy changes into motion energy, causing the blades spin. Similarly, when we eat food, our bodies convert the chemical energy stored in food into energy that powers our muscles and brain.

This ability to change energy forms one form to another is very useful. It allows perform work and live comfortably. Devices such as televisions, lights and washing machines operate by converting one kind of energy into another. Burning fuels like wood or gas changes stored chemical energy into heat, which we use for cooking or heating. Solar panels absorb sunlight and convert solar energy into electrical energy than can be used in homes. Cars also convert the chemical energy in fuel into motion energy allow us to travel from one place to another.



Activity Time!

Solar Oven

Objective: To design a solar oven to convert solar energy into heat energy.

Resources:

- 1 cardboard box (like a pizza box or a small carton)
- Aluminium foil
- Clear plastic wrap or a transparent plastic sheet
- Black paper or black chart paper
- Tape or glue

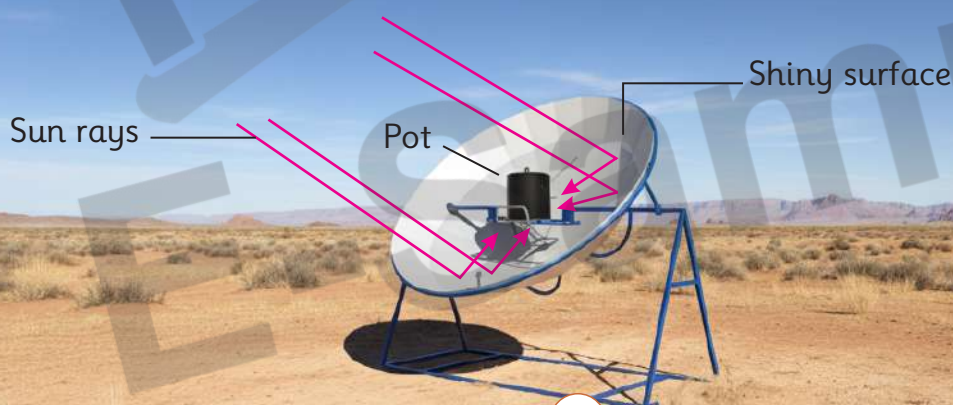
- Scissors
- A sticks, pencil, or straw to prop open the lid
- Old newspaper (optional, for insulation)

Instructions:

- Take a cardboard box with a lid (a pizza box works great).
- Cut a flap in the lid, leaving about 2 cm from the edge on three sides. Leave one side uncut to make a hinge.
- Cover the inside of the flap with aluminium foil. This will reflect sunlight into the box.
- Line the bottom and inner sides of the box with aluminium foil to trap and reflect heat.
- Place black paper on the bottom of the box because black surface absorbs more heat.
- Tape clear plastic wrap across the opening under the flap. This keeps the heat inside while allowing sunlight to enter.
- Crumple old newspaper and place it around the inside edges of the box for insulation.
- Place your solar oven in direct sunlight.
- Use a stick, pencil or straw to prop the foil flap open so it reflects sunlight into the box.

Working of Solar Oven

Shiny surfaces reflect the light falling on them while black surface absorb heat effectively. The aluminium foil reflects sunlight into the box and the black paper at the bottom absorbs the heat. The plastic wrap traps the warm air inside, creating enough heat to warm or cook food.





Activity Time!

Electric Bell

Objective: To assemble a simple circuit to demonstrate the working of an electric bell.

Resources:

- Wooden block
- Battery
- Wire connector
- Small bottle cap or lid
- Glue
- DC motor
- Wires
- Hex nut
- Small steel bowl
- Switch
- Screwdriver

Instructions:

- Connect a wire to the hex nut. Insert the wire into the wire connector. Inset the DC motor into the other end of the connector and tighten the screw using a screwdriver.
- Take a small plastic bottle cap or lid and make a hole in it. Stick the motor onto the cap using glue.
- Paste the steel bowl, onto a small piece of wood using glue.
- Connect the battery, switch and DC motor using wires to complete the circuit.
- Switch on the circuit. The hex nut will rotate, strike the steel bowl and produce a sound.
- Your electric bell is ready.

Working of an Electric Bell

When the switch of an electric bell is turned on, electricity from the battery flows to the DC motor. This coil works like an electromagnet and pulls a metal strip toward it. The metal strip has a hammer attached to it, and when it moves, the hammer hits the bell and produces a ringing sound. As the metal strip moves, it also breaks the electric circuit, so the current stops flowing. This causes the electromagnet to turn off, and the metal strip goes back to its original position. Then the circuit is complete again, and the process starts over. This happens very quickly, which makes the bell ring continuously until the switch is released.



What have you learnt?

- Seasonal plants and vegetables are grown on a large scale to our fulfil food needs.
- Fertilizers increase yield soil fertility and help produce better agricultural.
- Beneficial microorganisms turn the milk into yogurt and cheese.
- Electromagnets are used in many electrical devices. An electric bell works on the principle of making and breaking an electric circuit repeatedly through an electromagnet.
- Solar ovens use solar energy from sunlight to cook food or heat food.

Exercise



1 Choose the correct option.

- i. The summer season vegetables are generally grown in _____.
- a february – march b june – july
c september – october d december – january
- ii. The winter season vegetables are generally grown in _____.
- a february – march b june – july
c september – october d december – january
- iii. Why are fertilizers important?
- a To make the soil dry b To increase nutrients in the soil
c To remove plants from the soil d To stop plant growth
- iv. What happens first when the switch of an electric bell is pressed?
- a The bell breaks
b The circuit turns off
c Electricity flows through a coil of wire
d The hammer hits the bell immediately

2 Answer the following question.

- i. Define fertilizers.
- ii. Why are fertilizers important?
- iii. List three examples of each of the following:
- Summer Season Vegetables
 - Winter Season Vegetables
- iv. What is pro biotics?