Vande Mataram

Vande Mataram!

Sujalam, suphalam, malayaja shitalam,

Shasyashyamalam, Mataram!

Vande Mataram!

Shubhrajyotsna pulakitayaminim,

Phullakusumita drumadala shobhinim,

Suhasinim sumadhura bhashinim,

Sukhadam varadam, Mataram!

Vande Mataram, Vande Mataram!

- Bankimchandra Chatterji

వందేమాతరం

వందేమాతరం!
సుజలాం సుఫలాం మలయజ శీతలాం,
సస్యశ్యామలాం మాతరం!
వందేమాతరం!

శుభ్రజ్యోత్స్న పులకితయామినీం,
ఫుల్లకుసుమిత ద్రుమదళ శోభినీం
సుహాసినీం సుమధుర భాషిణీం,
సుఖదాం వరదాం మాతరం!
వందేమాతరం!

- బంకించంద్ర ఛటర్జీ

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Pledge | ప్రతిజ్ఞ

"India is my country. All Indians are my brothers and sisters.
I love my country and I am proud of its rich and varied heritage.

I shall always strive to be worthy of it.

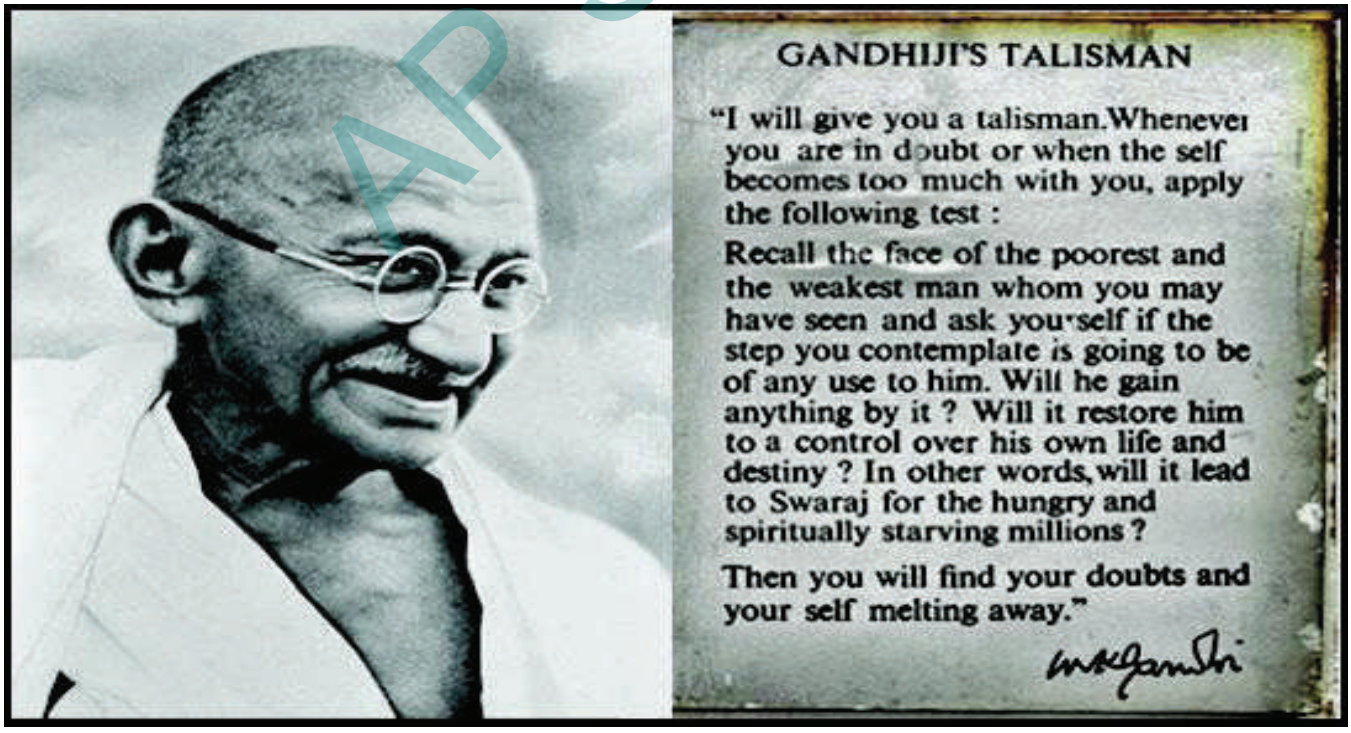
I shall give my parents, teachers and all elders respect,
and treat everyone with courtesy. I shall be kind to animals.

To my country and my people, I pledge my devotion.
In their well-being and prosperity alone lies my happiness."

- Pydimarri Venkata Subba Rao

"భారతదేశం నా మాతృభూమి. భారతీయులందరూ నా సహోదరులు.
నేను నా దేశాన్ని ప్రేమిస్తున్నాను. సుసంపన్నమైన, బహువిధమైన నా దేశ వారసత్వ సంపద నాకు గర్వకారణం.
దీనికి అర్హత పొందడానికై సర్వదా నేను కృషి చేస్తాను.
నా తల్లిదండ్రుల్ని, ఉపాధ్యాయుల్ని, పెద్దలందర్ని గౌరవిస్తాను. ప్రతివారితోను మర్యాదగా నడుచుకొంటాను.
జంతువులపట్ల దయతో ఉంటాను.
నా దేశంపట్ల, నా ప్రజలపట్ల సేవానిరతితో ఉంటానని ప్రతిజ్ఞ చేస్తున్నాను.
వారి శ్రేయోభివృద్ధులే నా ఆనందానికి మూలం."

- పైడిమర్రి వెంకట సుబ్బారావు



Curricular Goal	Description	Competencies
CG - 2	Explores the physical world around them in scientific and mathematical terms	C-2.1 Describes one-dimensional motion (uniform, non-uniform, horizontal, vertical) using physical quantities (position, distance, time - speed, and changes in speed) through mathematical and diagrammatic representations C-2.2 Describes how electricity works through manipulating different elements in simple circuits, and demonstrate the heating and magnetic effects of electricity C-2.3 Describes the properties of a magnet (natural and artificial, earth as a magnet) C-2.4 Demonstrates rectilinear propagation of light from different sources of light (natural, artificial, reflecting surfaces), and verify the laws of reflection through manipulation of light source and objects, and use of apparatus and artefact (plane and curved mirrors, pinhole camera, kaleidoscope, periscope) C-2.5 Observes and identifies celestial objects in the night sky using simple telescope and images (planets, stars, natural and artificial satellites, constellation, comets), and explains their role in navigation, calendars, and phenomena (phases of the moon, eclipse, life on earth)
CG - 3	Explores the living world around us. And its interaction with the inanimate world in scientific terms.	C-3.1 Describes the diversity of living things observed in the natural surroundings (insects, earthworms, snails, birds, mammals, reptiles, spiders, diverse plants, and fungi), and at a smaller scale (pond water, animal and plant bodies, other microscopic organisms) C-3.2 Distinguishes the characteristics of living organisms (need for nutrition, growth, and development, need for respiration, response to stimuli, reproduction, excretion, cellular organization) from non-living things. C-3.3 Analyses patterns of relationship between living organisms and their environment in terms of dependence on and response to each other. C-3.4 Explains the conditions suitable for sustaining life on earth and other planets (atmosphere; suitable temperature-pressure, light; properties of water)
CG - 4	Understands the components of health, hygiene and well-being	C-4.1 Undertakes a nutrition-based analysis of food components with reference to Indian and modern dietary and culinary practices, and explain the effect of nutrition on health C-4.2 Examines different dimensions of diversity of food - sources, nutrients, geographical, social, time-period based, diets C-4.3 Describes biological changes (growth, hormonal, reproductive) during adolescence, and measures to ensure overall well-being C-4.4 Recognizes and discuss substance abuse, viewing school as a safe space to raise these concerns
CG - 7	Communicates own questions, observations and conclusions related to science.	C-7.1 Uses scientific vocabulary to communicate inferences and ideas about science accurately in oral and written form, and through visual representation C-7.2 Designs and build simple models to demonstrate scientific concepts C-7.3 Represents real world events and relationships through diagrams and simple mathematical representations

1 World of Science

As human beings, we have always been curious about our surroundings. We start exploring our surroundings and asking questions right from our childhood. Did you enjoy discovering and exploring the world around you in the Preparatory Stage of school? As you enter the Middle Stage, we will continue this fascinating journey, trying to explore and understand the beautiful world we live in. And for that, we have a new subject, Science. Welcome to the wonderful world of Science!

M8R6K4

What is Science?

Science is a way of thinking, observing and doing things to understand the world we live in and to uncover the secrets of the universe. Think of it as a big adventure—we ask questions, explore the world and try to understand how things work. For this, the most important thing is to have 'Curiosity',

Whether it is studying tiny grains of sand or massive mountains, a leaf of grass or a vast forest, there is always something new and exciting to discover. Have you ever looked up at the night sky and wondered why the stars shine? Or watched a flower bloom and wondered how it knows when to open?

These are just a few of the many mysteries that science helps us unravel. The most wonderful thing about science is that it is everywhere. From the depths of the ocean to the vastness of outer space, from what is cooking in the kitchen to what is happening on the playground, some of the most groundbreaking discoveries have often come from unexpected places.

A mountainous region

Science is like a giant and unending jigsaw puzzle. Every new discovery we make adds

A Desert

A Coast

another piece to that puzzle. And you know the best thing about this puzzle? There is no limit to what we can discover, since every new piece of knowledge leads to more questions and more things to find out. Sometimes, we find that a piece of this puzzle has been put in the wrong place and needs to be moved. New discoveries often change our understanding of the world.

An underwater view of an Ocean

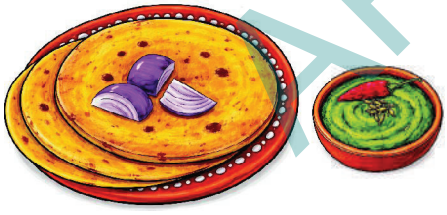
A Galaxy

As you go through this book, you will encounter interesting ideas, Do some thought-provoking experiments, and see how some of what we will find out is useful in our daily lives. Guess what happens as we discover more and more? We start realising that these ideas are all connected. We will start off by looking at our home, planet Earth. It is the only planet we know that supports life, and it has an environment that we must protect.

There is an amazing variety of life on Earth—plants and animals that have managed to survive and thrive in different regions on this planet. You might have seen a seed grow into a plant, a caterpillar transform into a beautiful butterfly and many more such observations. How do these plants and animals grow?

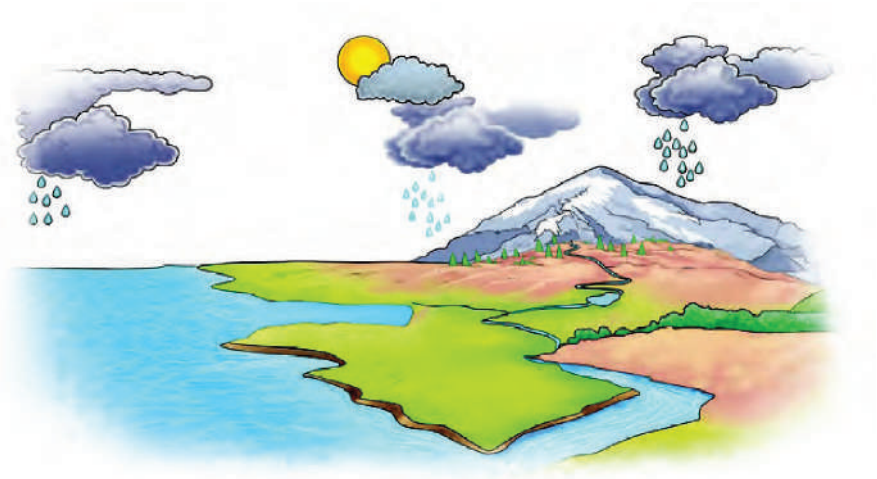
What will we explore with the help of this book?

Of course, to grow, we need food to eat, and especially in a large and diverse country like India, food is so fascinating. Across the country, we have different cuisines with their many tasty dishes. What are they made of? How do we find out?



Along with food, we need water to survive. Water is such a delightful substance. Have you ever jumped in a puddle when it rained? Do you ever wonder why and how it rains?

Have you noticed that water freezes and becomes ice when we cool it and boils and becomes steam when we heat it? Do you enjoy drinking cool water in the summer or showering with warm water in the winter? How do we understand hot and cold? Whether it is water, or our own body when we have fever, finding out how hot something is can be important!



Then again, there are so many different things around us—the paper we write on, the metal key, the plastic ruler and the rubber eraser in our box, the magnet that keeps the box closed, the clothes we wear, the cup we drink milk in and so many other things. What are they made of? Are they made of different materials? How do we separate different materials from one another?

We will have an almost unending list of questions about everything on Earth as we further explore this book. But why limit our questions to the Earth alone? We can ask questions on things beyond—the Sun, the Moon, and the millions of stars that shine in the sky!

Whether you are learning about the structure of a leaf, discovering how things move, or separating the skin of a peanut seed, we hope each chapter of this book will ignite your spirit of inquiry. And hopefully you will have lots of questions on your mind!

How can we try to find answers to our questions on our own?

Even though you may have not realised, you have already been finding answers to many of your questions. Suppose your pen stops writing. What would you do? You would ask yourself the question, "Why did my pen stop writing?" You might guess that the ink finished.

You would then test this guess by opening the pen and checking the ink refill. If it is empty, you would know that your guess was correct. But suppose you found that the ink was not finished. Now what would you do? You would make another guess—perhaps the ink might have dried up. To test if this guess is correct or not, you will try something else.

This is exactly how Science works! The way you tried to find out why your pen stopped writing is an example of the **scientific method.**

Activity 1.1: Let us think and write

- Write about a similar problem that you tried to solve.
- What steps did you take?

Science is not just about memorising facts and figures or doing experiments. It is about following a step-by-step process that helps us find answers to our questions. So what are the steps that we can follow?

First, we observe something that we find interesting or we do not understand.

This makes us wonder and perhaps think of a question about it.

Then, we guess a possible answer to that question.

We test this guess through experiments or more observations.

We then try to analyse the results to see if it actually answers our question.

Scientists are people who follow the scientific method to solve problems or to discover new things.

But anyone who follows the scientific method is working like a scientist. Someone cooking food may be wondering why the *dal* has spilled out of the cooker—was there too much water?.

Think of a bicycle repair person trying to find out why a tyre is flat—from where did the air leak out? Or an electrician trying to find why a light bulb is not working—is there some problem with the bulb or the switch? When we try to ask questions and find out answers, we are all, in a way, scientists!

Activity 1.2: Let us think and write

- Describe a daily life situation where you think someone was following a scientific method.

Do you now realise that there are several daily-life situations where we knowingly or unknowingly apply the scientific method? Though we all apply the scientific method to some extent, learning science will develop our capabilities for finding solutions to bigger problems and solving more mysteries of the universe. And to be able to learn science well, the first and foremost thing is to be curious and observe your surroundings keenly. And when we are curious, we start posing questions, asking how and why? Just remember, the world is full of things we do not know, things that are waiting to be explored.

Activity 1.3: Let us think and write

- If you have to ask "Why?" about something, what would you ask about?
- Try to write down how you would attempt to find an answer to your question.

Science is rarely done alone. Scientists across the world work together, often

in large teams. So, if you cannot find an answer yourself, ask your friends to help you out! It is always more fun to discover things together.

Of course, remember that you will not find answers to all your questions in class 6. Do not worry, you are embarking upon a journey of science for the next five years or even beyond!

Much like children enjoying the rain, science is all about joyful exploration. Enjoy your scientific journey, keep exploring and never stop wondering about the amazing mysteries of the universe and asking questions.

After all to be a wise person, you must be a "whys" person!

Are you ready to embark upon the exciting journey of science? Let us get started!!

2 Diversity in the Living World

Learners will be able to...

B9A4C2

- Defines diversity and biodiversity.(CG-3)
- Explains adaptations in living organisms.(CG-3)
- Classifies plants and animals based on specific characteristics.(CG-3)
- Identifies the relationship between leaf venation and types of roots.(CG-6)
- Appreciates the role of nature in sustainable living.(CG-3)
- Prepares scrapbooks and posters on plants and animals.(CG-7)

It is a pleasant morning after yesterday's refreshing rain. Dr Raghu and Seetharam mamayya (uncle) have been invited to the school by the science teacher, Madam Suneela, to facilitate an exciting nature walk. Dr.Ravi is a scientist at the nearby Research Laboratory and Seetharam mamayya is an elderly person from a nearby community. Seetharam mamayya is an expert in mimicking bird calls. He is also brilliant at identifying a variety of plants and animals.

To prepare them for the nature walk, Dr.Ravi informs the students that the objective of this walk is to experience the beauty and variety of plants and animals in the nature. The students are excited to join them. They are curious to interact and learn from them. The teacher advises the students to carry a notebook, a pen and a water bottle.

As they walk, they begin exploring the plants and animals around them. Dr.Ravi advises the students to notice the variety of smells in the park and emphasises respecting all living creatures and observing them without

disturbing. Seetharam mamayya tells the students to not only observe different plants and animals but also to carefully listen to different sounds. The students come across a variety of plants, including grasses, bushes, and large trees. They also observe a variety of birds sitting on the branches of trees, butterflies moving from flower to flower and monkeys jumping from one tree to another. They record their observations in their notebooks and discuss them with Dr.Ravi and Seetharam mamayya.

The students can hear the chirping of birds. Dr.Ravi informs them that each bird has a unique chirp. This is an example of diversity in nature. Dr.Ravi requests Seetharam mamayya to mimic calls of some birds. Seetharam mamayya mimics different bird calls. The students enthusiastically start copying him.

Have you ever observed different plants and animals around you? Share and discuss your observations with your friends and teacher.

2.1 Diversity in Plants and Animals Around Us

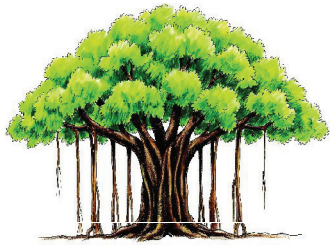
Activity 2.1: Let us explore and record

- Plan a nature walk with your teacher to a park or a nearby forest.
- While on the nature walk, observe different plants, insects, birds, and other animals. Also, note the weather conditions, whether it is hot, cold, windy and so on. Why is it necessary to observe the weather during a nature walk.
- You can collect different types of fallen leaves or flowers and create a scrapbook.
- Take care of the plants and animals in nature. Ensure that you do not disturb the plants and animals in the park. Do not pluck leaves and flowers.
- Record your observations in Table 2.1 about the features of stems, leaves, flowers and anything interesting in various plants. Some examples have been given for you in Fig. 2.1 and Table 2.1.

Know more

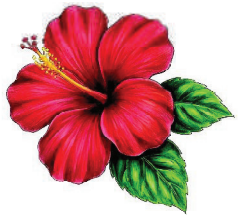
Weather influences the behavior of plants and animals. Butterflies and bees active on sunny days while earth worms come out from soil after rain.

(a) Grass



(b) Banyan Tree

(c) Tulasi



(d) Hibiscus

Fig. 2.1: Examples of different features of some plants

Table 2.1: Observations of different plants around us

S. no.	Local name of plant	Stem	Leaves (shape/ arrangement of leaves)	Flowers	Any other observations and features
1.	Common grass	Soft and thin	A single leaf grows alternatively from different points on the stem		Green leaves
2.	*Tulsi*	Hard and thin	Arrangement of a pair of leaves in the opposite directions	Pinkish purple	
3.	Hibiscus	Hard			
4.	Neem	Hard and thick			Leaves with smooth surface
5.	Any other				

What similarities and differences did you find among the plants that you observed?

You must have observed that plants have a variety of features such as—

- tall/short, hard/soft stem
- different shapes of leaves and their arrangement on the stem or branches
- flowers varying in colour, shape, and scent

Now, create a list of animals you observed during this walk or from your previous experiences. Record the places where they live, the food they eat and the way they move around in Table 2.2. Some examples have been provided for you.

Table 2.2: Observations of different animals around us

Name of the animal (local name)	Place where they live	Food they eat	The way they move around	Any other observations and features
Crow	Tree	Insects	Fly and walk	Carrying a twig in its beak
Ant	Nest in soil and burrow	Leaves, seeds and insects		Have six legs
Cow		Grasses, leaves		
Any other				

What are the similarities and differences among the animals that you have observed and recorded in Table 2.2?

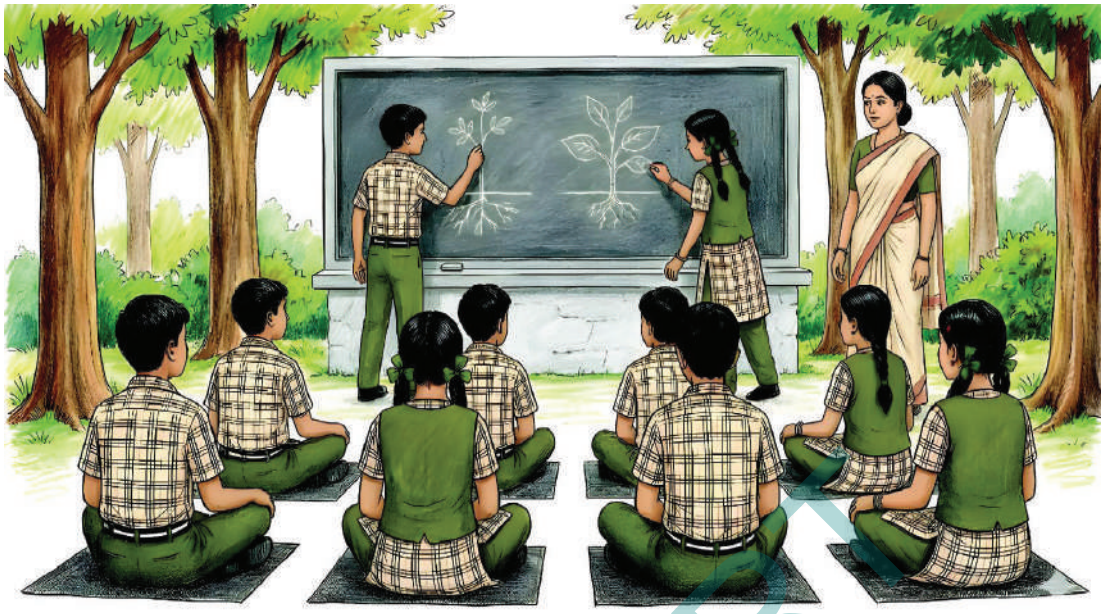
You would have observed that some animals live on land while some others live on trees. Birds live on trees. Fish live in water and some animals like frogs live on land as well as in water. Animals consume a diverse range of foods and exhibit a variety of movements.

Sketch the plants and animals observed by you in your notebook or prepare a scrapbook with leaves, flowers from different plants and feathers from animals. Write all the details you have gathered about them.

While travelling to and from school, observe your surroundings and look out for a variety of plants and animals. Add the name of any plant or animal that you have not listed before in Tables 2.1 and 2.2.

Activity 2.2: Let us appreciate

- Close your eyes for 30 seconds and think of one plant and one animal that you have closely observed and appreciated very much.
- Now each one of you can draw the plant and animal that you thought of on the blackboard.
- What are your observations about the various plants and animals that have been drawn?



- How many different plants and animals did the entire class draw on the blackboard?
- Do you think that there may be many more varieties of plants and animals other than those drawn on the board?

The variety of plants and animals found in a particular region contributes to the **biodiversity** of that region.

Can you imagine that there is another living world beyond our naked eyes,

Each member in the biodiversity of a region has a different role to play. For example, trees provide food and shelter to some birds and other animals, animals help in spreading seeds after eating fruits, and so on. Can you think of more such examples? Why do butterflies and honeybees roam around the flowers? By helping in pollination they contribute to diversity, so plants and animals are dependent on each other.

2.2 How to Group Plants and Animals?

How would you arrange your books and notebooks in groups? Would arranging them in groups help you better organise your school bag?

Now, let us look at the world around us. We are surrounded by a variety of plants and animals with different features about which you have learnt in section 2.1. We can group them based on similarities and differences among them.

Activity 2.3: Let us group

- Collect pictures of various other plants and animals. Cut their pictures from old magazines, newspapers, charts and other sources. Paste each of these pictures on a different card.
- Divide your class in groups of 5–6 students each.
- Pool the cards prepared by the students in your group.
- Observe various features of plants and animals shown on the cards.
- Recall the features of plants and animals that you have listed in Tables 2.1 and 2.2.
- **Group** them on the basis of common features.
- Share and discuss the basis of grouping you have made with other groups in your class.

You will be surprised to see that the basis used by different groups may vary. What do you think are the reasons behind it? Different students might have chosen different common features for the grouping. For example, some students may have chosen the height of plants as the basis for grouping while others might have chosen presence or absence of flowers as the basis for grouping of plants (See Fig. 2.2).

Fig. 2.2: Some possible criteria of groupings of plants and animals

You may have grouped animals based on varied features, such as what they eat, where they live, what colour they have and how they move.

What is the importance of grouping? Grouping makes it easier to understand and study plants and animals on the basis of their similarities and differences.

You will learn more about the importance of grouping in our daily lives in the chapter, 'Materials Around Us'.

2.2.1 How to group plants?

You must have noticed that plants show variation in the features related to stems, leaves, flowers, and more. The stems of different plants vary in thickness, height, and hardness, while the leaves vary in shape, colour, size and arrangement. You might have tried grouping the plants in Activity 2.4 using one of these features.

You might have also learnt in earlier classes that plants can be grouped into herbs, shrubs, and trees based on their height and types of stem. Let us study the features of plants in more detail and group them on that basis.

Activity 2.4: Let us group

- Let us go on a nature walk again for some more interesting observations.
- Look closely at the height of different plants. Are these plants shorter than you, as tall as you, or taller than you?
- Is the stem brown or green? Touch and feel the stems and try to bend them gently. Can you bend the stem easily, or is it stiff? Take care that the stems do not break.
- Also, observe from where the branches of the plants arise—whether they arise close to the ground or higher up on the stem. Fill in your observations in Table 2.3. A few examples are already given.

Table 2.3: Grouping of plants based on height and nature of stem

S. no.	Name of the plant	Height	Nature of stem			Appearance of branches		Name of plant group
		Short/ Medium/ Tall	Green/ Brown	Tender/ Hard	Thick/ Thin	Close to the ground	Higher up on the stem	
1.	Mango	Tall	Brown	Hard	Thick		Yes	Tree
2.	Rose	Medium	Brown	Hard	Thin	Yes		Shrub
3.	Tomato	Short	Green	Tender	Thin	Yes		Herb

(a) Tree

What differences do you observe among herbs, shrubs, and trees? How can you group plants as herbs, shrubs, and trees based on the data entered in Table 2.3?

Some plants grow really tall and have hard, thick, brown, and woody stems. Their branches typically start higher up on the stem and away from the ground. These plants are called trees. For example, mango and neem trees (Fig. 2.3 a).There are also Some trees without branches. Examples , coconut and palm (Fig 2.3 d).

(b) Shrub

(c) Herb

(d) Tree without branches

Fig. 2.3: Types of plants

Some plants are not as tall as trees. These plants often have many brown woody stems that start branching very close to the ground. These stems are hard but not as thick as the stem of a tree. These plants are called shrubs. For example, a rose plant is a shrub (Fig. 2.3b).

Money Plant

Some plants are typically small with soft and green stems. These are known as herbs. For example, a tomato plant is a herb (Fig. 2.3c).

Some plants with weak stems need support to climb and grow, and are called climbers. For example, a money plant is a climber, some plants creep along the ground and are called creepers. For example, a watermelon plant is a creeper.

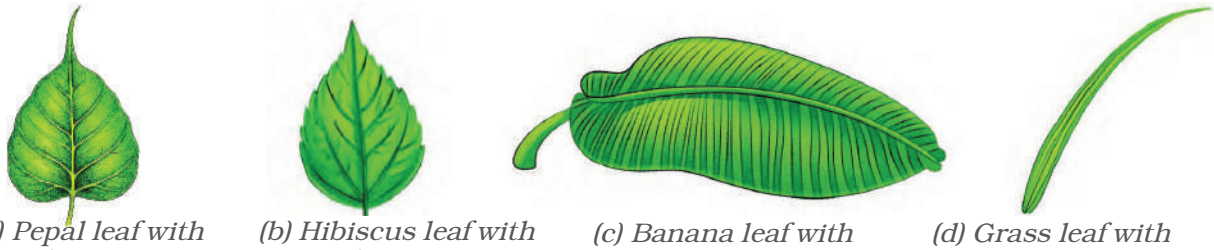
Watermelon plant

What can be other features on the basis of which you can group plants? Let us perform another activity.

Activity 2.5: Let us compare

- Look at the leaves of different plants collected by you, during the nature walk.
- Do you notice any variation in the shape and structure of these leaves?

You may observe thin lines on the leaves of the plants (Fig. 2.4a). These are **veins**. The pattern of veins on the leaf is called **venation**. What differences do you see in the veins of leaves shown in Fig. 2.4(a) and Fig. 2.4(d)?



(a) Pepal leaf with reticulate venation | (b) Hibiscus leaf with reticulate venation | (c) Banana leaf with parallel venation | (d) Grass leaf with parallel venation

Fig. 2.4: Leaves showing different types of venation

In some leaves, you can observe a net-like pattern of veins on both sides of a thick middle vein. This pattern is called reticulate venation. For example, leaves of hibiscus exhibit reticulate venation (Fig. 2.4a). In some leaves, you may observe that the veins run parallel. This pattern is called parallel venation. For example, the leaves of banana plants and grasses exhibit parallel venation (Fig. 2.4b and Fig. 2.4c). Plants grow in windy or sunny areas often have stronger midribs and denser venation for protection.

Do you think that plants can be grouped on the basis of venation present in their leaves? Now, let us try to explore roots of the plants. Do all plants have roots? Are these roots similar?

Activity 2.6: Let us find out

- Visit an open area where wild herbs and grasses are growing. You may use small herbs for this exercise.
- Using a *khurpi* (trowel), carefully dig out a few different herbs without damaging the roots. To do this, you may wet the soil and loosen it.
- Wash the roots with water and observe them.
- After you are done observing, make sure to replant the herbs so that they may continue to thrive and grow.

What are the similarities and differences in the roots of the plants collected by you? What differences do you see in the roots of plants shown in Fig. 2.5(a) and Fig. 2.5(b)?

(a) Taproot system in a mustard plant | (b) Fibrous root system in common grass

Fig. 2.5: Types of roots

Carefully observe the roots of a mustard plant in Fig. 2.5(a). The roots of this plant consist of one main root and small side roots arising from it. The main root is called **taproot**. Another example of a plant having taproots is hibiscus observed by you in Activity 2.1. The plant in Fig. 2.5(b) is a common grass plant. The roots of this plant appear as a bunch of similar-sized thin roots arising from the base of the stem. Such roots are called **fibrous roots** (Fig. 2.5b). Does your collection include any other grasses? What kind of roots do they have?

Is there any relation between the type of leaf venation and the type of root of the same plant? How do we find this out?

Activity 2.7: Let us relate and analyse

- Collect saplings of five common plants from your school nursery or any other nurseries to plant in your school garden. Examples of such plants can include lemongrass, marigold, *sadabahar* (periwinkle), and others.
- Before planting them, observe their roots and the venation in their leaves.
- Record your observations in Table 2.4.

Table 2.4: Types of leaf venation and roots

S. no.	Name of the plant	Type of leaf venation (reticulate/ parallel)	Type of root (fibrous/tap)
1.	Common grass	Parallel	Fibrous
2.			
3.			
4.			
5.			

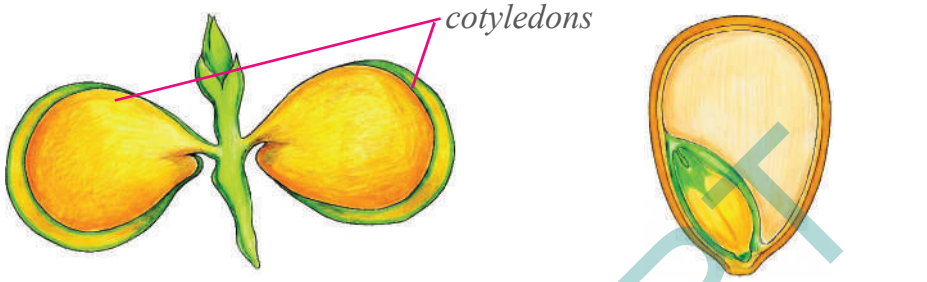
Do you observe any relation between the leaf venation and types of root in these plants? A sadabahar plant has a taproot and its leaves have reticulate venation. Do other plants with reticulate venation have taproots too? Lemongrass, on the other hand, has fibrous roots and its leaves have parallel venation. Do other plants with parallel venation have fibrous roots too? Generally, plants with reticulate venation have taproots while those with parallel venation have fibrous roots.

Chickpea (chana) is another example of a plant with taproots and reticulate venation in leaves. Wheat is an example of a plant with fibrous roots and parallel venation in its leaves.

Is there any relation among the seed of a plant, types of root and leaf venation? Are all seeds similar?

Activity 2.8: Let us compare

- Soak some chickpea and maize seeds in water for two or three days.
- Remove the seed coat of a chickpea. Now, observe the structure of the chickpea and maize seeds. Are they similar or different?



(a) Dicot seed (chickpea) *(b) Monocot seed (maize)*

Fig. 2.6: Dicot and monocot seeds

You would notice that chickpea seeds are split into two parts (Fig. 2.6a). Each part is called a **cotyledon**. Plants that have seeds with two cotyledons are called **dicotyledons (dicots)**. Maize has a single thin cotyledon (Fig. 2.6b). Plants with such seeds are called **monocotyledons (monocots)**.

What relation do you observe among leaf venation, root types and the number of cotyledons in seeds of a plant? **Dicot plants** have reticulate venation and a taproot system while **monocot plants** have parallel venation and a fibrous root system.

You have learnt about some features used for grouping plants. Now, let us explore the grouping of animals in more detail.

2.2.2 How to group animals?

Just like plants, animals too are significantly different from one another. How can we group such a wide variety of animals? What features can you think of to group them? In Activity 2.3, you have already set some bases for grouping animals. Let us explore a few of these in more detail.

Activity 2.9: Let us find out

You have recorded the movement of a few animals in Table 2.2. You may have also observed how other animals move from place to place. Let us now think about the types of movement in animals. A number of animals are shown in Fig. 2.7. You can add more animals that you may have observed and create a poster on the variety of animals. Which body parts are used by the animals in the poster you created and those in Fig. 2.7 for movement?

Fig. 2.7: Diversity in animals

- List these animals in Table 2.5.
- Note the ways in which these animals move and name the body parts used for movement. Some examples are given in Table 2.5.

Table 2.5: Movements in animals and their body parts involved

S. no.	Name of the animal	Type of movement	Body parts used for movement
1.	Ant		Legs
2.	Goat	Walks and jumps	Legs
3.	Pigeon	Walks and flies	Legs and wings
4.	Housefly	Walks and flies	Legs and wings
5.	Fish		Fins
6.	Any other		
7.			
8.			

What conclusions can you draw from the data given in Table 2.5?

Different animals have different types of movement. Animals can fly, run, crawl, walk, hop or jump, and so on. They use different body parts for moving from one place to another. They may use wings, legs, and other parts that help them to move. Here, we have identified animals based on the types of movement and the body parts used for movement. How can we group animals based on their movements? Additionally, many animals differ from each other in shape, size, structure, colour, and other features. Some of these features can also be used to group animals in various ways. Like plants, grouping of animals is important for understanding their diversity.

Know a scientist

Janaki Ammal (1897–1984) was an Indian botanist dedicated to environmental work and helped to document and preserve India's rich plant biodiversity. She played a key role in the 'Save Silent Valley' movement. As the head of the Botanical Survey of India, she initiated programmes to document the plant diversity of India.

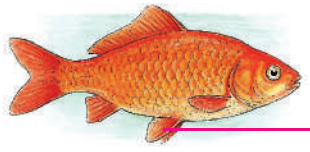
Success Story—Save Silent Valley Movement

This is a real story of a forest in the Palakkad district of Kerala. It is about preserving untouched beauty of a moist evergreen forest and its rich biodiversity. The now-famous Silent Valley was saved by a remarkable movement led by common people who were not even residing in the vicinity of the forest. The battle against the proposal of a hydroelectric dam across the Kunthipuzha river persisted for 10 years. At that time, people used all possible available means, such as widespread awareness programmes, letters to editors, articles in, newspapers, seminars, and petitions and appeals in court. The movement was successful in saving the Silent Valley.

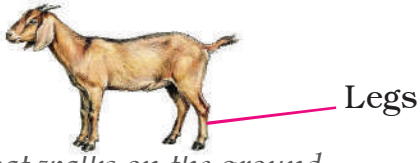
More to know!

2.3 Plants and Animals in Different Surroundings

You might have observed during nature walks that different animals live in different surroundings. You have also recorded movement of animals in Table 2.5. Does the movement of these animals depend upon their surroundings? Let us consider fishes and goat as examples. Fish lives in water. They have streamlined bodies and fins for movement in water (Fig. 2.8a). Goats live in grassy areas and move with the help of legs (Fig. 2.8b). The sizes and shapes of animals also differ from one another.



(a) A fish swims in water with the help of fins



(b) A goat walks on the ground with the help of legs

Fig. 2.8: Body parts used by animals for movement

Activity 2.10: Let us compare and analyse

- Look at Table 2.6. Recreate a similar table on the blackboard.
- List the names of plants and animals you or your classmates have observed in the regions given in the table or already know about. A few examples are given. You can add more.

Table 2.6: Animals and plants found in different surroundings

S. no.	In the desert	On mountains	In the ocean	In the forest	Any other region
1.	Camel	Deodartree	Fish	Lion	
2.	Any other				
3.					

Fig. 2.9: Cactus with thick and fleshy stems in a desert

What are your observations regarding plants and animals found in various regions? Discuss your observations with your classmates.

You might observe from Table 2.6 that the plants and animals found in one kind of region are different from those found in another kind of region.

During a discussion in the classroom, Alex recalls that he observed cactus plants with thick and fleshy stems in the deserts of Rajasthan (Fig. 2.9). Maya shares that she saw deodar trees in the Himalayas of Himachal Pradesh (Fig. 2.10(a)). These trees are conical in shape and have flexible and sloping branches. Jaya says that she noticed mangroves(Fig. 2.10(b)) in coastal areas of Andhra Pradesh. These trees grow in marshy soils tolerating salt water.

Fig. 2.10(a): A deodar tree

Fig. 2.10(b): A mangrove tree

Notice that these three types of plants found in different regions are different from each other. Why is it so? Why does the biodiversity of a region vary from that of another? Let us find out.

There is very little water available in the deserts. A hot desert is typically very hot during the day and very cold at night. Therefore, you will find plants and animals in these areas that can tolerate and survive both the hot conditions during the day and cold conditions at night. The fleshy stems of plants found in the desert can store water and help them tolerate the hot conditions in these places.

The mountains in extremely cold regions experience frequent snowfall. In order to survive in such conditions, some of the trees have the ability to let the snow slide off easily. Conical shape and sloping branches of deodar trees enable them to do so easily. In plateau regions many plants like neem and banyan are in umbrella shape to receive more sunlight.

You must have understood by now that the biodiversity varies from region to region because of diverse conditions.

Look at the images of a camel from the hot desert of Rajasthan (Fig. 2.11) and a camel from the cold desert of Ladakh (Fig. 2.12). What are the differences you observe between them? What advantages do these differences provide to these camels?

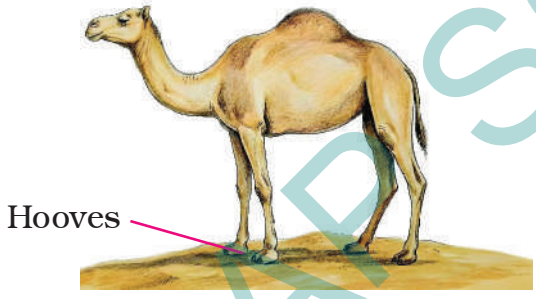


Fig. 2.11: A camel living in the hot desert of Rajasthan

Fig. 2.12: A camel living in the cold desert of Ladakh

The camel of the hot desert has long legs with wide hooves. Alex shares that his grandmother told him that the long legs and wide hooves help these camels to walk on the sandy desert without sinking into the sand. On the other hand, the height and legs of camels of a old desert are comparatively shorter than those found in a hot desert. hese short legs allow them to walk easily in mountainous regions.

In deserts, food is not available easily. Camels store food in their humps. Camels found in the hot desert have one hump each that helps them to survive during the scarcity of food. Camels found in the cold desert have two humps each. These two humps shrink in late

winters because there is not much food available in the cold desert and they have to use food stored in their humps during that time. Moreover, they grow long hair from head to neck, which help them survive the cold winters of Ladakh.

What other features can help camels to survive in the desert?

Other students also start sharing their observations. Kashi from Rajasthan says that camels excrete small amounts of urine, their dung is dry, and they do not sweat. As camels do not lose much water from their bodies, they can survive for many days without drinking water.

Maya talks about seeing plants with beautiful bright flowers, **rhododendrons**, in the Shola forests of Nilgiris. Here, rhododendrons are of shorter height and have smaller leaves to survive through the heavy winds on mountain tops. However, Pema, who is from Sikkim, mentions that she has observed rhododendrons in the nearby mountains to be taller (Fig. 2.13). So, even plants such as rhododendrons may exhibit different features in different regions to survive the conditions of those regions.

Fig. 2.13: Different features of rhododendrons

Sagar tells his classmates that he went to the Andaman and Nicobar Islands with his parents for a special event. He saw huge whales and colourful fish in the ocean. His father explained that the streamlined body of fish helps them to swim in water.

We have learnt that the plants and animals living in a particular region have special features that make them fit to survive there. The special features that enable plants and animals to survive in a particular region are called **adaptations.**

The shape of the deodar tree and the height of the rhododendron are adaptations that enable them to survive in the mountainous regions.

The place where plants and animals live is called their **habitat.** For example, the habitat of sea turtles is the sea or the ocean. The habitat of a camel is the hot or the cold desert, and the habitat of a rhododendron is the mountains. The habitat of plants and animals provides them food, water, air, shelter and other needs for their survival. Many types of plants and animals may share the same habitat. Habitat plays an important role in shaping the biodiversity of a region.

Know a scientist

Salim Ali (1896–1987) travelled across India to observe diversity in birds. He prepared a list of birds and documented their travel routes and habitats. He recorded the regions with high diversity of birds and took measures to conserve these regions. Keoladeo National Park in Bharatpur, Rajasthan and Ranganathittu Bird Sanctuary in Mandya, Karnataka are examples of regions he preserved. He wrote a landmark series of 10 books on birds of the Indian Subcontinent. He is referred to as the 'Birdman of India'. He was awarded Padma Vibhushan in 1976.

The Rollapadu wildlife Sanctuary, located in the Kurnool district of Andhra Pradesh, is renowned for its dry grassland ecosystem. It was established to protect the endangered Great Indian Bustard, as well as other wildlife such as Black Bucks and Foxes. Migratory birds are also found in abundance in this conservation centre. Therefore, this is considered an important place for bird lovers and nature enthusiasts.

Do you know?

What are the different ways in which you can group plants and animals based on their habitats? One way is to group them into those 'that live on land' and those 'that live in water'.

The plants and animals that live on land are said to live in terrestrial habitats. Some examples of **terrestrial habitats** are forests, deserts, grasslands, and mountains.

Fig 2.14: Animals living in different habitats

The plants and animals that live in water are said to live in aquatic habitats. Some examples of **aquatic habitats** are ponds, lakes, rivers, and oceans.

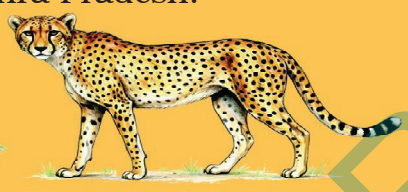
Some animals, such as frogs, can live in water as well as on land. These are called **amphibians.** Some animals like birds spend most of their time flying are said to live **aerial habitat**. Some animals like monkeys that live, rest or move mostly on trees are said to be **arboreal habitat.**

What would happen if the habitat of a plant or an animal is damaged? What would happen if a goat does not get grass to eat? Can a fish survive without water?

Check with your parents, grandparents, and neighbours to know about the plants, birds, insects or any other animal they used to see frequently in their childhood but do not see as often now. These changes often happen when habitats are damaged. The damage to habitats of plants and animals results in loss of their homes, food, and other resources. This leads to the loss of biodiversity.

The population of the Bengal Tiger, Cheetah, and Great Indian Bustard has declined in India due to loss of natural habitats caused by human activities. The Government of India has initiated several projects to conserve our biodiversity. 'Project Tiger' was initiated in 1973 to protect the declining population of the Bengal Tiger. The 'Cheetah Reintroduction Project' was initiated in 2022 to restore the population of the Cheetah. Similarly, habitats of the Great Indian Bustards have been declared as Protected areas in the states of Gujarat, Rajasthan Maharashtra and Andhra Pradesh.

Bengal Tiger



Cheetah

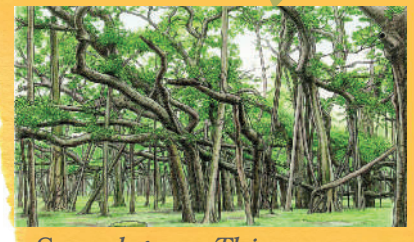
Great Indian Bustard

Do you know?

Traditionally Protected Forests: Sacred Groves

Sacred groves are undisturbed patches of forests. Their sizes may vary from quite small to very large. Sacred groves are found all over India. They are home to different kinds of plants and animals, including numerous medicinal plants. These are protected by the local community and no one is allowed to harm any animals and cut trees in these groves, or disturb the area. This way, sacred groves are a community protected treasure of biodiversity. Find out about the sacred groves in your region.

Thimmamma marri manu (world's largest banyan tree) is one of the sacred groove of Andhra pradesh is located at gooty bayalu (near Kadiri) in Sri Satyasai district. It serves as an important biodiversity repository. Culturally, it sustains traditional practices, with communities often believing that their welfare and security depend on the blessings of the grove's deity.



Sacred grove-Thimmamma marrimanu

More to know!

We must protect biodiversity to ensure our planet is full of life, helping plants and animals to survive and thrive.

Keywords

Adaptation	Monocot plants	Herbs
Amphibians	Reticulate venation	Parallel venation
Aquatic	Sacred groves	Biodiversity
Cotyledon	Shrubs	Tree
Fibrous root	Taproot	Dicot plants
Habitat	Venation	Terrestrial

Summary

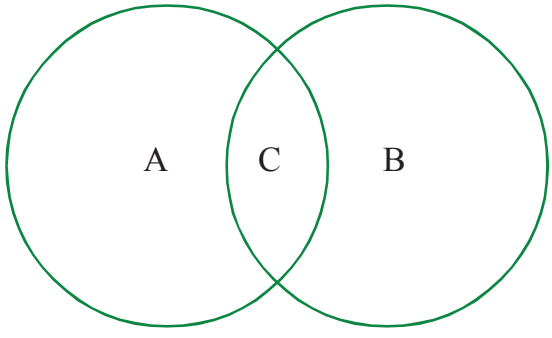
Key Points

- We are surrounded by a large variety of plants and animals. Such variety of plants and animals is a part of biodiversity.
- Plants and animals can be grouped on the basis of similarities and differences among them.
- Plants have similarities and differences based on features associated with roots, stems, leaves, flowers, and so on.
- The method of arranging things into groups based on their common features is called grouping.
- Plants can be grouped into herbs, shrubs, and trees based on their heights, types of stem, and branching patterns.
- Plants can also be grouped as dicotyledons (dicots) and monocotyledons (monocots) based on the number of cotyledons in their seeds.
- Monocots generally exhibit parallel venation in their leaves and possess fibrous roots while dicots typically exhibit reticulate venation in their leaves and possess taproots.
- Animals have different types of movement that can be a basis for their grouping.

- Biodiversity of different regions varies because of distinct environmental conditions.
- The special features that enable plants and animals to survive in a particular region are called adaptations.
- The place where plants and animals live is their habitat.
- Based on their habitats, animals and plants can be grouped as terrestrial and aquatic.
- Due to damage of their habitats, plants and animals lose their homes, food and other resources resulting in the loss of biodiversity.
- We must protect biodiversity to ensure that our planet is full of life, helping plants and animals to survive and thrive.

Let us enhance our learning

1. Which combination of features is correctly matched with a dicot plant?
   a) Parallel venation – fibrous root – one cotyledon
   b) reticulate venation – tap root – two cotyledons
   c) Parallel venation – tap root – two cotyledons
   d) reticulate venation – fibrous root – one cotyledon
2. Names of some animals are given below. Group them based on their habitats. Write the names of aquatic animals in the area marked 'A' and terrestrial animals in the area marked 'B'. Enter the names of animals living in both habitats in part 'C'.
   Horse, Dolphin, Frog, Sheep, Crocodile, Squirrel, Whale, Earthworm, Pigeon, Tortoise



3. Apply stem type and branching pattern to classify these plant into appropriate groups: rose, mango, wheat, coconut.

4. Based on the information in the table, find out examples of these plants for each group.

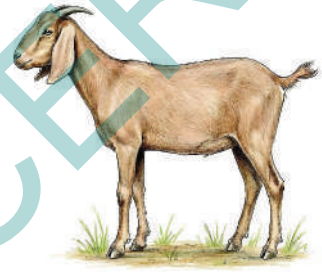
Group	Type of seed	Type of root	Examples
A	Dicot	Taproot	
B	Monocot	Fibrous roots	

(a) What other similarities do plants of group A have?

(b) What other similarities do plants of group B have?

5. Look at the image of a mountain goat and a goat found in the plains. Point out the similarities and differences between them. What are the reasons for these differences?

(a) Mountain Goat



(b) Goat found in the plains

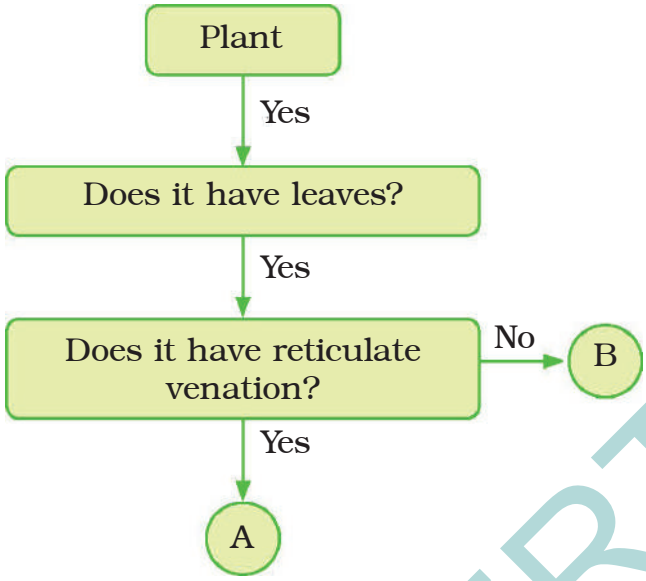
6. Here are two types of seeds. What differences do you find? 3Among the roots and leaf venation of their plants?

(a) Wheat

(b) Kidney beans

7. Manu's mother maintains a kitchen garden. One day, she was digging out radish from the soil. She told Manu that radish is a kind of root. Examine a radish and write what type of root it is. What type of venation would you observe in the leaves of radish plant?

8. Analyse the flowchart. What can be examples of 'A' and 'B'?



9. Observe the labelled part of a duck in the picture given below. What differences do you observe in the feet of the duck compared to the other birds? Which activity would the duck be able to perform using this part?

(a) Duck

(b) Pigeon

10. Assertion (A): Plants with reticulate venation usually have a tap root system.
Reason (R): Such plants generally have two cotyledons.
Choose the correct option:
a) Both A and R are true, and R is the correct explanation of A
b) Both A and R are true, but R is not the correct explanation of A
c) A is true, but R is false
d) A is false, but R is true

11. A plant with parallel venation and fibrous roots was placed in dicots. Evaluate this classification and state whether it is correct or not .

12. As the population grows and people want more comfortable lives, forests are being cut down to meet various needs. How can this affect our surroundings? How do you think we can address this challenge?
13. Raj argues with his friend Sanjay that "*udhal* (hibiscus) plant is a shrub". What questions can Sanjay ask for calrification ?
14. Group the following animals into two groups based on any feature other than those discussed in the chapter.
cow, cockroach, pigeon, bat, tortoise, whale, fish, grasshopper, lizard.

Learning further

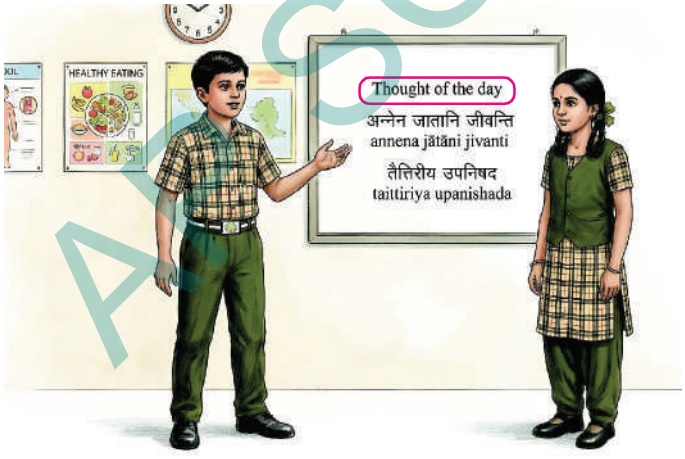
- Read about one Indian scientist or a wildlife biologist who is working towards protection of India's biodiversity. Prepare a brief report.
- Explore the contributions of Divya Mudappa, Usha Lachungpa, Ghazala Shahabuddin, Nandini Velho, Vidya Athreya, Uma Ramakrishnan and Divya Karnad towards biodiversity in India. Prepare a report of the work done by any three of them.
- Label the plants in your school with their local names with the help of your teacher or the gardener. List them in your notebook.
- With the help of your teacher, plan a field visit or a nature walk. Record your observations. Prepare a class biodiversity register by consolidating the observations and notes of all the students taken during the field visit or nature walk.
- Find out about 'Project Tiger' and other similar projects initiated in India to protect our biodiversity. Prepare a presentation for your class.
- Divide your class into groups of six students each. Initiate a discussion in the class on how you can protect biodiversity around you. Prepare a group-wise report that includes suggestions given by members of each group.
- Interact with elders in your family or neighbourhood to find out various plants and animals that they see now but were not seen earlier and vice-versa. Collect pictures of these plants and animals and paste them in a scrapbook. Find out more about them from your teacher.

3 Mindful Eating

Learners will be able to...

K5Y3Q1

- Give examples to different food sources for carbohydrates, proteins and fats.(CG-4)
- Explain different traditional foods in different states of India.(CG-4)
- Conduct experiments to analyses different food components in given food items.(CG-4)
- Give suggestions to avoid diseases like scurvy and goiter.(CG-7)
- Compare traditional and modern cooking practices.(CG-4)
- Understand the importance of balanced diet.(CG-4)



Subhash and Surichi read thought of the day on the school notice board every day. Today's thought "annena jtni jevanthi", makes them curious. Surichi tells Subhash that is a Sanskrit saying which means 'food gives life to living beings'

Let us try to understand the significance of this saying.

- What do you understand by the above picture?
- What kind of food do you think is good food for health?
- What is mindful eating?

Let us try to learn...

3.1 What Do We Eat?

Activity 3.1: Let us record

All of us eat food every day. Food is an essential component of our daily life. List the food items you have consumed over the week in Table 3.1.

Table 3.1: Food items consumed over a week

Day	*Food Item*		
	Break Fast	*Lunch*	*Dinner*
Monday			
Tuesday			
Wednesday			
Thursday			
Friday			
Saturday			
Sunday			

What observations can you make about your food from the data collected in Table 3.1? Do you eat the same kind of food in every meal or do your choices vary? **Compare** your list with those prepared by your friends. Find similarities and differences in the food consumed by you and your friends. What did you find? Record your findings in your notebook.

You may have noticed that there is a variety in the food eaten by you and your friends.

Do you think that such diversity in food exists in all states of our country?

3.1.1 Food in different regions

Activity 3.2: Let us explore

- Find out the types of food traditionally consumed and the crops grown in various states of India. You may refer to books in your library, search the internet, and interact with your friends, family and neighbours to collect information.
- In Table 3.2, add more states and fill the collected data.
  A few examples are already given.

Table 3.2: Some traditional food items in various states of India

State	Locally grown crop	Traditional food item eaten	Beverages
Punjab	Maize, wheat, chickpea, pulses	Makkidi roti, sarsonda saag, chhole bhature, parantha, halwa, kheer	Lassi, chhach (buttermilk), milk, tea
Andhra Pradesh	Rice, Ragi, Black gram, Red gram, other pulses	Rice, Payasam, Pulihora, Sambhar, Pickles, Idly, Dosa	Buttermilk, Coconut water, Milk
Karnataka	Rice,Finger millet, urad, coconut	Idli, dosa, sambhar, coconut chutney, ragi mudde, palya, rasam,rice	Buttermilk, coffee, Tea
Manipur	Rice, bamboo, soyabean	Rice, eromba (chutney), utti (yellow peas, bamboo shoots and green onion curry) singju, kangsoi	Black Tea
Any other			

Why do we see diversity in traditional food consumed in various states of our country?

Analyse the data collected by you in Table 3.2. Are there food items that are common across states? Make a list of those food items. You may find that some food items are common in many states while some are eaten only in a particular state.

What relation do you find between the traditional food items and the locally grown crops? You must have observed that the traditional food of any state is usually based on the crops grown in that state. India is an agricultural country with diverse soil and climate types. Various crops are grown in its different regions depending on the soil types and climatic conditions.

In various regions of India, the choice of food may vary according to the **cultivation** of food crops in that particular region, taste preferences, culture, and traditions.

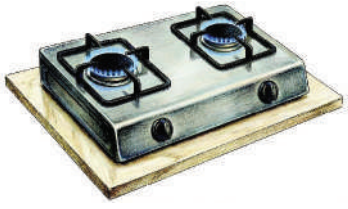
3.1.2 How have cooking practices changed over time?

You have learnt that food habits vary across states. Our food choices as well as practices of food preparation may differ from one another. Have our food habits and cooking practices changed over time?

Activity 3.3: Let us interact and find out

- Prepare a list of questions for gathering information from elderly people about their food habits and cooking practices. Following are some of the sample questions—
  - What kind of food do you still eat and what is new?
  - What are the changes in cooking practices over time?
  - What has caused these changes?
- Conduct interviews with some elderly people based on the questions prepared.

(a) Traditional stove



(b) Modern gas stove

(c) Stone grinder

(d) Electrical grinder

Fig. 3.1: Change in cooking tools over time

What are your findings from the interviews you conducted? Cooking practices, also called **culinary practices**, have changed over time. There is a significant difference between traditional and modern culinary practices. Earlier, most cooking was done using a *chulha* (Fig. 3.1a). Nowadays, most of us cook using a modern gas stove (Fig. 3.1b). Earlier, most grinding was done manually using a *sil-batta* (Fig. 3.1c). These days, we use an electrical grinder for ease of grinding (Fig. 3.1d). Find out what were the other ways of cooking and grinding. Why have these culinary practices changed over time? These changes may be due to factors such as technological development, improved transportation and better communication.

3.2 What are the Components of Food?

Subhash and Surichi visit the 'Traditional Food Festival' organised in their school. The theme of the festival is 'Eat Healthy, Live Healthy'.

The festival features various stalls displaying different kinds of traditional dishes. Dr Poshita, a nutritional expert, explains to students that ? Health is the Ultimate Wealth?

Let us understand what Dr Poshita means by this statement.

Have you ever missed a meal? How do you feel when you miss a meal?

We feel tired and less energetic when we do not eat for some time. Why do you think a marathon runner drinks glucose water during and after a race?

Glucose provides instant energy. Glucose is an example of a carbohydrate. **Carbohydrates** are one of the primary sources of energy in our diet. Cereals like wheat, rice, and maize, vegetables like potato and sweet potato, and fruits like banana, pineapple, and mango are some sources of carbohydrates (Fig. 3.2).

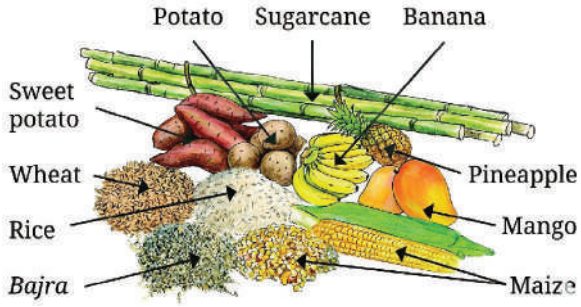
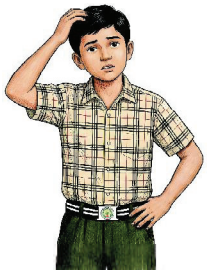


Fig. 3.2 Some sources of carbohydrates

Do you know that common sugar is also a type of carbohydrate?

Why do you think we prefer to have *laddoos* as a part of our traditional diet in winters?

Besan or wheat flour (*aata*) and ghee are among the main ingredients of laddoos along with *goond* (edible gum), nuts, and seeds. Ghee and various kinds of oils are grouped under another kind of food component, which is called **fat**.



Yes, my grandma told me that laddoos rich in ghee and nuts provide energy to keep us warm.

Sources of fats can be from plants or animals (Fig. 3.3). Nuts, such as groundnuts, walnuts, coconuts, and almonds, and seeds, such as pumpkin seeds and sunflower seeds, are some sources of fat. Fat is a source of stored energy.

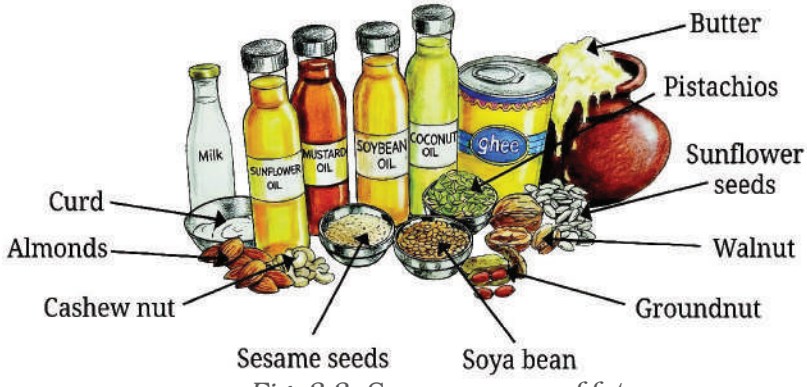


Fig. 3.3: Some sources of fats

Carbohydrates and fats provide us energy for performing various activities. Therefore, they are called **energy-giving foods.** Identify more food items that are rich sources of carbohydrates and fats .

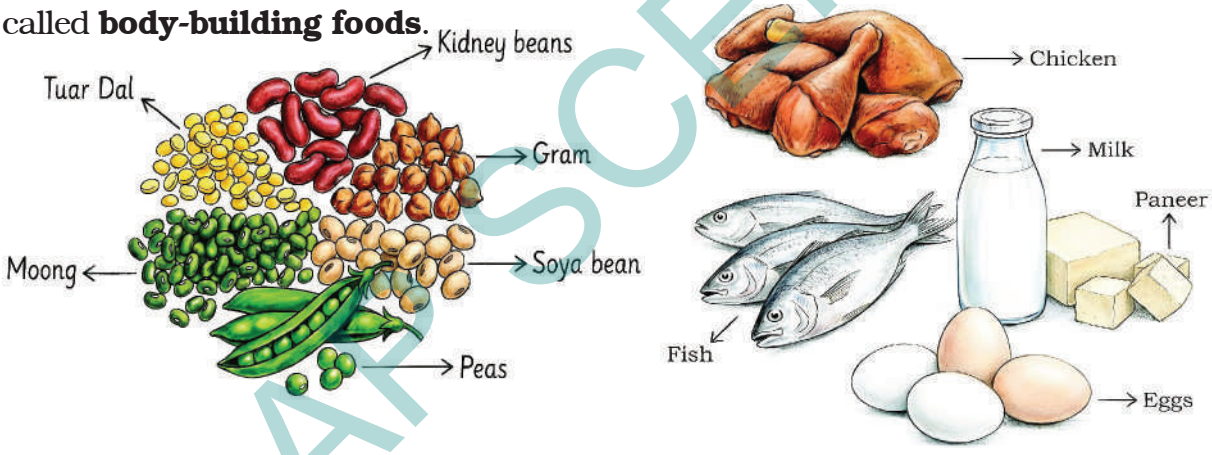
Polar bears accumulate a lot of fat under their skin. This fat serves as an energy source. It supports them during their months- long winter sleep (hibernation), enabling them to survive without eating.

Polar bear

More to know!

Proteins are also an important part of our food. Milk products and pulses are good sources of protein. Sportspersons need proteins in larger quantities to build their muscles. People get proteins from plants as well as animals.

Some excellent plant sources of protein are pulses, beans, peas and nuts (Fig. 3.4a). Animal sources of protein are milk, paneer, egg, fish and meat (Fig. 3.4b). Protein-rich foods help in growth and repair of our body. These are, therefore, called **body-building foods**.



(a) Plant sources

(b) Animal sources

Fig. 3.4: Some sources of proteins

The right amount of protein must be included in the diet of growing children for their proper growth and development. Which of these food components are part of your daily diet?

More to know!

Have you ever seen mushrooms? They grow mostly in dark and moist places. Edible mushrooms are good sources of protein.

Why do you think we are advised to include servings of fruits, vegetables and other plant-based foods in our daily diet? Let us understand the importance of some other **food components** by reading the following two cases—

Case 1

In earlier times, during long voyages, sailors often suffered from bleeding and swollen gums. During a voyage in 1746, Scottish physician James Lind observed that sailors who consumed lemons and oranges recovered from these symptoms. Bleeding and swollen gums are symptoms of a disease called **scurvy**.

What do you **interpret** by reading Case 1? What cures scurvy? Lemons and oranges help in curing scurvy. Scurvy is caused due to deficiency of Vitamin C. **Vitamin C** present in citrus fruits like lemons and oranges helps in curing this disease.

Case 2

In the 1960s, Indian scientists found that among the human population in the Himalayan region and the Northern plains of India, symptoms of swelling at the front of the neck were prevalent. As per norms of the Government of India, an effort was made to supplement common salt with iodine for preparing **iodised salt**. Consumption of iodised salt visibly reduced the above symptoms. These symptoms were due to a deficiency of iodine in the soil of this region resulting in a lack of iodine in the local food and water supply. Swelling at the front of the neck is a symptom of a disease called **goitre**.

What do you **infer** from Case 2?

You may have learnt about iodised salt through newspapers, advertisements or by reading about it on a salt packet. What does it mean? Iodised salt is simply common salt mixed with required quantities of salts of iodine.

Salt farming is a traditional practice of a tribal community named *Agariyas*. They practice salt farming in the Little Rann of Kutch and other parts of Gujarat. For eight months, they live in the extreme heat of the desert and work very hard to get salt from seawater.

More to know!

How would you find out more about other food components that protect our body from various diseases?

Activity 3.4: Let us conduct a survey

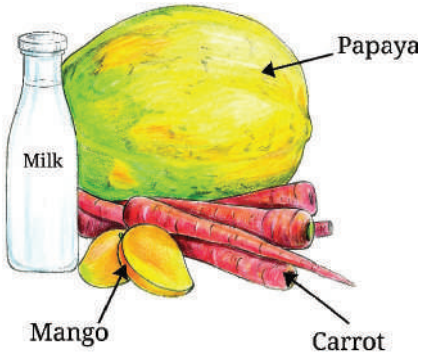
- Study the chart given in Fig. 3.5 to explore the functions and sources of various food components. Find out more sources of vitamins and minerals. Also, understand the symptoms of the diseases caused by the lack of these food components.
- Visit your neighbourhood, interact with people and find out if any individual shows the symptoms listed on the chart (an investigatory project of this kind can be taken by the students under the guidance of a teacher).
- Correlate these symptoms with their diet and identify the deficiency disease(s) or disorder(s).
- Suggest the possible cause(s) for the symptoms observed and changes required in the diet for improvement.
- Suggest them to visit a doctor for further advice.

Food component (Vitamin/ Mineral)	Functions	Some sources	Deficiency disease/ disorder	Symptoms
Vitamin A	Keeps eyes and skin healthy	Papaya, carrot, mango, milk	Loss of vision	Poor vision, loss of vision in darkness (night blindness), sometimes complete loss of vision
Vitamin B1	Keeps heart healthy and supports body to perform various functions	Legumes, nuts, whole grains, seeds, milk products	Beriberi	Swelling, tingling or burning sensation in feet and hands, trouble in breathing
Vitamin C	Helps body to fight diseases	*Amla*, guava, green chilli, orange, lemon	Scurvy	Bleeding gums, slow healing of wounds

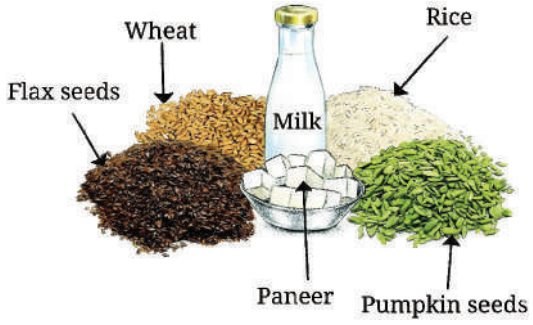
Food component (Vitamin/ Mineral)	Functions	Some sources	Deficiency disease/ disorder	Symptoms
Vitamin D	Helps body absorb calcium for bone and teeth health	Exposure to sunlight, milk, butter, fish, eggs	Rickets	Soft and bent bones
Calcium	Keeps bones and teeth healthy	Milk/soya milk, curd, cheese, paneer	Bone and tooth	Weak bones, tooth decay
Iodine	Helps to perform physical and mental activities	Seaweed, water chestnut (*singhada*), iodised salt	Goitre	Swelling at the front of the neck
Iron	Important component of blood	Green leafy vegetables, beetroot, pomegranate	Anaemia	Weakness, shortness of breath

Fig. 3.5: Chart of vitamins and minerals, their functions, some sources, related deficiency disease(s)/disorder(s) and symptoms

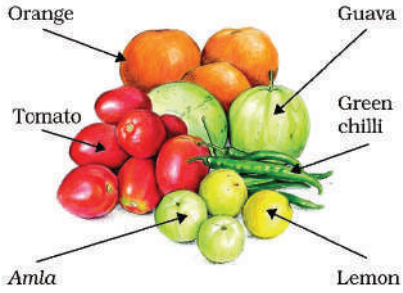
From Fig. 3.5, you have learnt that **vitamins** (A, B1, C and D) and **minerals** (calcium, iodine, and iron) are two groups of food components that protect our body from various diseases. But, how can we overcome vitamin and mineral **deficiency diseases** or disorders?



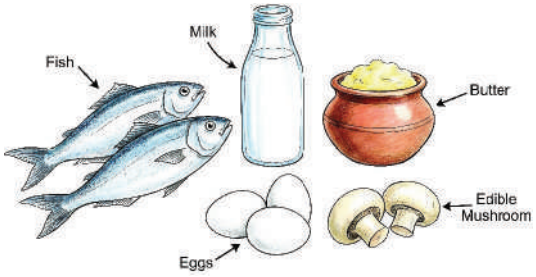
(a) Some sources of Vitamin A



(b) Some sources of Vitamin B1



(c) Some sources of Vitamin C



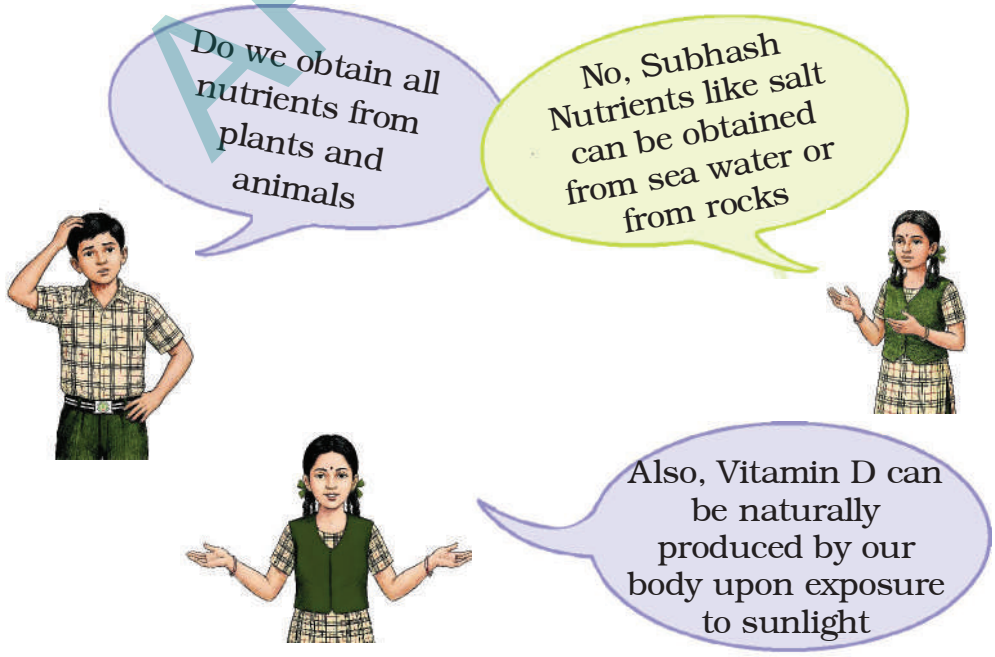
(d) Some sources of Vitamin D

Fig. 3.6: Some sources of different vitamins

Food components that provide energy, support growth, help repair and protect our body from diseases, and maintain various bodily functions are called **nutrients**. The major nutrients in our food include carbohydrates, proteins, fats, vitamins and minerals.

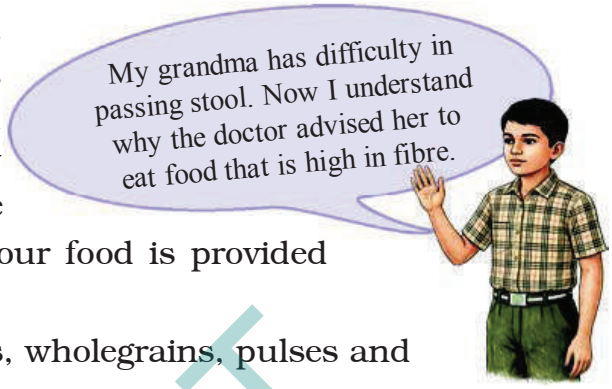
Vitamins and minerals are also called **protective nutrients.** These nutrients protect our body from diseases and keep us healthy. Your parents may have advised you to havemilk, green vegetables, fruits and wholegrains regularly. These food items are some sources of vitamins (Fig. 3.6) and minerals. Although vitamins and minerals are required in small amounts, they are essential to keep our body healthy.

What differences do you observe in raw and cooked vegetables? Have you ever noticed that vegetables sometimes lose their bright colour, or become softer and less crisp when cooked? Some nutrients like vitamin C and others are lost during cooking due to high heat. Would it not be wise to include fruits and uncooked vegetables into our diet? Washing cut or peeled vegetables and fruits may also result in the loss of some vitamins. However, it is highly recommended that all fruits and vegetables be thoroughly washed before consumption.



Fruits and vegetables are rich in dietary fibres. Let us see how dietary fibres are beneficial for us.

In addition to the essential nutrients, our body needs dietary fibres and water. Dietary fibres, also known as **roughage**, do not provide any nutrients to our body. However, they are an essential component of our food. They help our body get rid of undigested food and ensure smooth passage of stools. Roughage in our food is provided mainly by suitable plant products.



Green leafy vegetables, fresh fruits, wholegrains, pulses and nuts are good sources of roughage.

Eating food that is locally grown and plant based, to the extent possible, is not only healthy for the body but is also good for our environment and our planet.

Water is also an essential part of our diet. It helps the body absorb nutrients from food. It removes waste from the body through sweat and urine. We should drink sufficient water regularly to keep ourselves healthy.

What are the food sources that provide water to our body? List a few of them. ?

Know a scientist

Coluthur Gopalan (1918–2019) initiated nutrition research in India. He analysed more than 500 Indian foods for their nutritional value and recommended an appropriate diet in the Indian context. He led surveys on the nutritional status of the Indian population, identifying widespread deficiencies in protein, energy, and other food components. This led to the implementation of the Mid Day Meal Programme in 2002, now a 'PM POSHAN' initiative, to provide balanced food in the government-run and government-aided schools of our country. This scheme has played a role in improving the health and nutrition of millions of children nationwide.

3.3 How to Test Different Components of Food?

Let us find out which nutrients are present in various food items.

Some nutrients like **starch** (a type of carbohydrate), fat and protein can be detected using fairly simple tests, while others can be detected only in a well-equipped laboratory. Let us explore how we can detect the presence of starch, fat and protein in some food items.

3.3.1 Test for starch

Activity 3.5: Let us investigate

- Take a small quantity of the food items such as a slice of potato, cucumber, bread, some boiled rice, boiled gram, crushed peanuts, oil, butter and crushed coconut. You can take other food items too for testing.

Fig. 3.7: Testing for the presence of starch in various food items

- Place a small piece of each item on a separate dish.
- With the help of a dropper, put 2–3 drops of diluted iodine solution on each food item (Fig. 3.7).
- Observe if there are any changes in the colour of the food items. Have they turned blue-black? Record your observations in Table 3.3.

A blue-black colour indicates the presence of starch.

3.3.2 Test for fats

Activity 3.6: Let us investigate

- Take a small part of the food items that you tested for the presence of starch in Activity 3.5.
- Place each food item on a separate piece of paper.
- Wrap the paper around the food and press it. Be careful not to tear the paper.
- If a food item contains a little water, allow the paper to dry.

Does the paper develop an oily patch? What do you think is the reason for this patch? If oil or butter is present in the food item, it leaves an oily patch on the paper. Now, hold the paper against light. Can you see the light faintly shining through this patch? An oily patch on the paper shows that the food item contains fat. Which of these items contain fats? Record your observations in Table 3.3.

3.3.3 Test for proteins

Activity 3.7: Let us investigate

This activity may be demonstrated by the teacher.

- Take the food items tested in previous activities.
- Make a paste or powder of the food item using pestle and mortar (Fig. 3.8).
- Put about half teaspoon of each food item in a separate clean test tube.

Precautions

- These chemicals are harmful and need to be handled with care. Do not touch any of these chemicals unless asked to do so.
- If any chemical gets spilled on your body, immediately wash the affected area with water.
- Do not put any of these chemicals into your mouth, or try to smell them.

- Add 2–3 teaspoons of water to each test tube and shake them well.
- Add two drops of copper sulphate solution to each test tube using a dropper.
- Now, take another dropper and add 10 drops of caustic soda solution to each tube (Fig. 3.8).
- Shake well and leave the test tubes undisturbed for a few minutes.

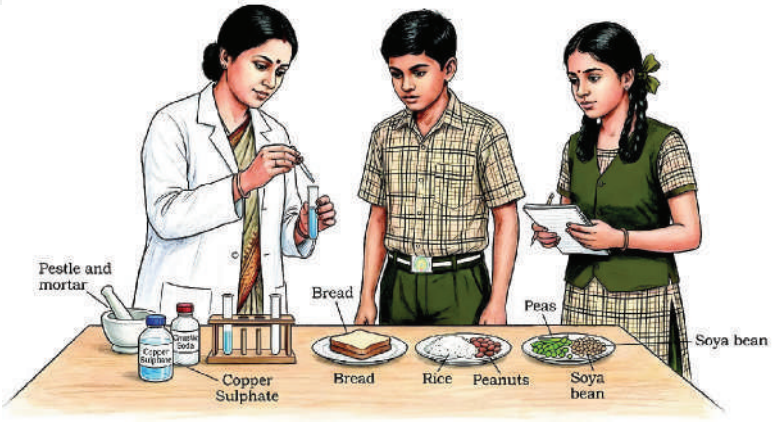


Fig. 3.8: Testing for the presence of protein in various food items

What did you observe? Did the content of some test tubes turn violet? This violet colour indicates the presence of proteins in the food item. Write your observations in Table 3.3.

What conclusions can you draw from Table 3.3? Which food items show the presence of more than one nutrient? Which food items show the presence of both proteins and fats? Peanuts show the presence of both proteins and fats. This indicates that any food which we eat may contain multiple nutrients. Is there a food item that lacks any of these nutrients? Which of these foods do you consume daily? Try to find out other foods that are good sources of starch, fats, and proteins.

Table 3.3: Exploring nutrients present in various food items

Name of the food item	Colour of the food item for starch test		Oily patch for fat test		Colour of the food item for protein test		Starch present (Yes/ No)	Fat present (Yes/ No)	Protein present (Yes/ No)
	Before iodine test	After iodine test	Predic-tion (Yes/No)	Observa-tion (Yes/No)	Before protein test	After protein test			
Potato.									
Cucumber									
Boiled rice									
Boiled gram									
Peanuts									
Bread/ Chapati									
Butter									
Coconut									
Any other									

3.4 Balanced Diet

Are nutritional requirements the same for everyone? Do you and your grandparents need the same type or the same amount of nutrients? Requirements of the type and amount of nutrients in a diet may vary according to age, gender, physical activity, health status, lifestyle, and so on.

Activity 3.8: Let us find out

You have listed food consumed by you during the week in Activity 3.1. Check whether your food contains all the nutrients and other essential components necessary for growth and development. If not, check which nutrients or other food components need to be added.

A diet that has all essential nutrients, roughage, and water in the right amount for proper growth and development of the body is known as a **balanced diet**. What changes would you make in your diet to make it a balanced diet?

Activity 3.9: Let us compare

Read the nutritional information given below for a packet of potato wafers and a packet of roasted *chana* shown here.

Based on the nutritional information on the food packets given above,

(a) Potato wafers

(b) Roasted chana

Nutritional Information (per 100 g)	
Energy	536 kcal (kilocalories)
Fats	35.0 g
Carbohydrates	53.0 g
Proteins	7.0 g
Dietary Fibre	4.8 g

Nutritional Information (per 100 g)	
Energy	355 kcal (kilocalories)
Fats	6.26 g
Carbohydrates	58.58 g
Proteins	18.64 g
Dietary Fibre	16.8 g

which food would you choose? Why?

Some foods have high calories due to high sugar and fat content. Moreover, they contain very low amounts of proteins, minerals, vitamins, and dietary fibres. These foods are called junk foods. These foods include potato wafers, candy bars and carbonated drinks. Consuming these foods frequently is not good as these are not healthy for our body. They make a person obese. Such a person may suffer from several health problems. You should always remember

Dr Poshita's statement that 'Health is the Ultimate Wealth.'
We should take care of our body to stay healthy. Eating a balanced diet and avoiding junk food contribute towards a healthy body. Good health is essential for leading a happy life.
Which of the two foods you studied in Activity 3.9 could be labelled as junk food?

Packaged food items must have information about the nutrients on their cover. The information should list the amount of each nutrient. Sometimes, more nutrients are added to the food during processing (fortification) to improve its nutritional quality. Iodised salt and some baby foods are examples of fortified foods. The Food Safety and Standard Authority of India (FSSAI) is a government agency that regulates food quality in India.

fssai

More to know!

3.5 Millets: Nutrition-rich Cereals

You may have heard of *jowar*, *bajra*, *ragi*, and *sanwa* (Fig. 3.9). These are native crops of India. These can be easily cultivated in different climatic conditions. These highly nutritious grains are also called **millets**. Have you ever had food items made from these millets?

Jowar *Sanwa*

Fig.3.9 Millets

Millets are small-sized grains and have been an integral part of the Indian diet for centuries. They have regained popularity due to their numerous health benefits. They are good sources of vitamins, minerals like iron and calcium, and dietary fibres as well. That is the reason they are also called nutri-cereals. They contribute significantly to a balanced diet required for the normal functioning of our body.

3.6 Food Miles: From Farm to Our Plate

How does food reach from a farm to our plate? What are the steps involved in this process? Who are the people involved in this process? Do you know how much time and effort is required to get the wheat flour once seed grains germinate in the farm? Let us look at Fig. 3.10 to understand the entire process of making the chapati that we eat.

Fig. 3.10: From farm to plate

The entire distance travelled by a bag of wheat or any other food item, from the producer to the consumer, is known as its **food miles**. Reducing food miles is important because it helps to cut down the cost and pollution during its transport; it helps support local farmers; and it also keeps our food fresh and healthy.

Many people waste food, leaving it unconsumed on their plates. One must remember the time and effort put by our farmers and other community members in getting the food from the farm to our plate. We must take only as much food as we can consume. It would reduce food wastage. Try to find the timeline for the various processes involved in getting the food from farm to plate (Fig. 3.10).

How would eating local food help reduce food miles?

3.7 FOOD PRESERVATION

The discussion about food will be incomplete unless we talk about food preservation. How do farmers protect rice from pests and store it after it is harvested? How is rice stored in your home? Why does curry get spoiled when kept out for a couple of days but pickle stays fresh for so long? It is only because of preservation. For preserving certain food-items, they are salted and dried. In certain areas dried fish is commonly used. Vegetables and meat are dried and also pickled.

For preserving food we use different types of preservatives. But some food items which are available in the market have harmful preservatives. So we must be aware of the ingredients of packed food. When you purchase any food item in the market, don't forget to read about its ingredients and manufacturing date. Now a days the artificial food colours, flavours and chemical preservatives damages our health and causes so many diseases. Eating out-dated food material may damage your health.

Eat healthy, share and respect food. Support local producers

Carbohydrate	Millets
Culinary practices	Minerals
Deficiency diseases	Nutrients
Fats	Proteins
Food components	Rickets
Food miles	Roughage
Iodized salt	Scurvy
	Vitamins

Summary

Key Points

- People across India eat diverse types of food, containing various food components.
- Choice of food may vary according to the cultivation of food crops in a region, taste preferences, culture and traditions, and so on.
- Culinary practices have changed over time. There is a significant difference between traditional and modern methods of cooking food.
- Food provides us energy, support growth, repairs our bodies and protects us from diseases.
- The major nutrients in our food are carbohydrates, fats, proteins, vitamins, and minerals. In addition, food also contains dietary fibres and water.
- Carbohydrates and fats are primary energy sources, while proteins are body-building nutrients.
- Vitamins and minerals strengthen our body, protect us from infections, and keep us healthy.
- A balanced diet provides all the essential nutrients in the right quantities, along with adequate roughage and water.
- Deficiency of one or more nutrients in our diet for a long time can lead to deficiency diseases and disorders.
- Junk foods are unhealthy as they contain high levels of sugar and fats but little protein, minerals, vitamins, and dietary fibres.
- Millets are known as nutri-cereals as they provide most of the nutrients required for the normal functioning of our bodies. They can be easily cultivated in different climatic conditions.
- Eating food that is locally grown and plant-based, to the extent possible, is not only healthy for our bodies but is also good for our environment and our planet.
- The distance travelled by a food item, from the place of its production to the consumer, is called food miles. We must aim to minimise food miles.
- We should never waste food and only take as much as we can consume.
- For preserving certain food-items, they are salted and dried and also pickled.

Let us enhance our learning

1. Pick the odd one out and give reasons:
   (i) *Jowar*, *Bajra*, Ragi, Chana
   (ii) Kidney beans, Green gram, Soya bean, Rice
2. Discuss traditional versus modern culinary practices in India.
3. A teacher says that good food may act as medicine. Ravi is curious about this statement and has some questions for his teacher. List at least two questions that he can ask.
4. Not all delicious foods are necessarily healthy, while not all nutritious foods are always enjoyable. Share your thoughts along with a few examples.
5. Medu does not eat vegetables but enjoys biscuits, noodles and white bread. He often has stomach ache and constipation. What changes should he make in his diet to get rid of these problems? Explain your answer.
6. Kranti had trouble seeing things in dim light. The doctor tested her eyesight and prescribed a particular vitamin supplement. He also advised her to include a few food items in her diet.
   (i) Which deficiency disease is she suffering from?
   (ii) Which food component may be lacking in her diet?
   (iii) Suggest some food items that she should include in her diet to overcome this problem (any four).
7. You are provided the following:
   (i) Canned fruit juice (ii) Fresh fruit juice
   (iii) Fresh fruit
   Which one would you prefer and why?
8. Sekhar got a fracture in his leg. His doctor aligned the bones and put on a plaster. The doctor also gave him calcium tablets. On the second visit, the doctor gave him Vitamin D syrup along with calcium tablets. Refer to Fig. 3.5 and answer the following questions:
   (i) Why did the doctor give calcium tablets to Sekhar?
   (ii) On the second visit, why did the doctor give Vitamin D syrup along with calcium tablets?
   (iii) What question arises in your mind about the choices made by the doctor in giving the medicines?
9. Sugar is an example of carbohydrates. Sugar is tested with iodine solution but it does not change to blue-black colour. What can be a possible reason?
10. What do you think of Ramu's statement, "All starches are carbohydrates but not all carbohydrates are starches." Describe the design of an activity to test your answer.

11. While using iodine in the laboratory, a few drops of iodine fell on Mishti's socks and a few fell on her teacher's saree. The drops of iodine on the saree turned blue-black while the colour on the socks did not change. What can be a possible reason?
12. Why are millets considered a healthy choice of food? Can eating just millets suffice for the nutritional requirements of the body? Discuss.
13. You are given a sample of a solution. How would you check the possibility of it being an iodine solution?

Learning further

- Help your mother in unpacking the packets of various food items after shopping for grocery next time. Read the nutritional information of at least three fortified food items and analyse those.
- The Apatani tribe of Arunachal Pradesh produces a salt called *tapyo* to fulfil their dietary requirements. Collect more information from the internet about their salt making process and the need to make their own salt. Collect pictures and paste them on a chart paper. Also, write a paragraph about the process of making this salt and its usefulness.
- Vegetables or fruits that grow naturally in the forest or nearby fields without being cultivated by farmers are considered wild varieties. Traditionally, many tribal groups in India depend on these wild varieties, which form a part of their food. Read about *ranbhajis* from Maharashtra and edible mushrooms from Himachal Pradesh. Are you aware of any such wild varieties of food from your region? Discuss in class.
- List junk foods you eat frequently. Ask your friends also to make such lists. On the basis of these lists, write a letter to your principal requesting to ban certain junk foods inside the school campus. Suggest some healthy options.
- Find out the variation in nutritional requirements of different individuals based on age, physical activity and health conditions. Record your observations. Discuss and analyse.
- Prepare a diet chart to provide a balanced diet to a twelve-year-old child. The diet chart should include food items that are not expensive and are commonly available in your area.

4 Exploring Magnets

Learners will be able to...

X2B2D9

- Classify materials as magnetic or non-magnetic through simple experiments.(CG - 1)
- Explain how a magnet shows directions by aligning north-south. (CG - 2)
- Infer that the earth behaves like a giant magnet. (CG - 2)
- Make and test a simple magnetic compass. (CG - 2)
- Use magnets creatively to design simple activities or toys. (CG - 7)

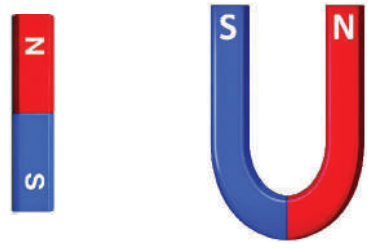
Hasini lives in a coastal town of andhra Pradesh and is very interested in writing short stories. Her grandmother loves listening to her stories, so Hasini was writing a new story to share with her grandmother on her 60th birthday.

The story was based on a ship carrying rice and chillies from Andhra Pradesh for trade in the olden days. Hasini was aware that in those days, the sailors used stars to find directions at night. But in her story, a situation arose whereinthe sailors got caught in a storm with an overcast sky and stars were not visible. Harini could not take her story forward as she could not think of a way for sailors to find directions. She searched for information on the internet and her school library. She learnt that the sailors used a device, known as a magnetic compass, for finding directions.

Hasini had seen pencil boxes and purses which had magnets to keep them closed. A writing board in her school also had a duster with a magnet. But she had never looked at those carefully. She now became curious to learn more about magnets and magnetic compasses.

Fig. 4.1: Some common items that have magnets attached to them

The magnets used by sailors in the olden days were based on naturally occurring magnets, known as lodestones which were discovered in ancient times. Later on, people found out that magnets could also be made from pieces of iron. Nowadays, we have magnets made of different materials. The magnets that you find in your school laboratory and those used in pencil boxes, stickers, toys are all artificial magnets (Fig. 4.1). The magnets can be of various shapes, some of which are shown in Fig. 4.2.



Bar magnet *U-shaped magnet* *Ring magnet*

Do magnets stick to objects made of certain materials only?

Fig. 4.2: Magnets of different shapes

About 2500 years ago, there was a place called Magnesia in Greece and there lived a shepherd named Magnus. One day, he was resting, keeping his iron- tipped staff on a rock. After resting when he tried to pick up his staff from the rock, the shepherd had a strange experience. Later, scientists discovered the real reason behind this. Such rocks would not only attract the shepherd's staff but also all other magnetic substances. In memory of the shepherd, these rocks later were called magnets. There are mountains having such rocks with magnetic power in many places on Earth. These rocks known as Lodestones, are natural magnets.

4.1 Magnetic and Non-magnetic Materials

Activity 4.1: Let us explore

- Collect a few objects made of different materials and also a magnet.
- **Predict** which of the objects will stick to the magnet. Write your prediction in Table 4.1.
- Now hold a magnet in your hand and bring it near the objects one by one (Fig. 4.3). **Observe** which of the objects stick to the magnet.

Fig. 4.3: Identifying the materials attracted by a magnet

❖ **Record** your observations in Table 4.1.

Table 4.1: Identifying the materials attracted by a magnet

Name of the object	Material which the object is made of (plastic/wood/glass/ iron/any other)	Attracted by the magnet (Yes/No)	
		Prediction	Observation
Pencil	Wood		
Eraser	Rubber		

Was your prediction correct for all objects? Which materials stuck to the magnet? What conclusion can you draw?

Through this activity, we found out that some of the objects were attracted to the magnet and stuck to it, while others were not. The materials which are attracted towards a magnet are called **magnetic materials**. The metal iron is a magnetic material. Nickel and cobalt are other metals that are also magnetic. Some of their combinations with other metals are also attracted towards magnets. The materials which are not attracted towards a magnet are called **non-magnetic materials**.

Do all parts of a magnet attract magnetic materials equally? ?

Which materials listed in Table 4.1 were found to be non-magnetic?

4.2 Poles of Magnet

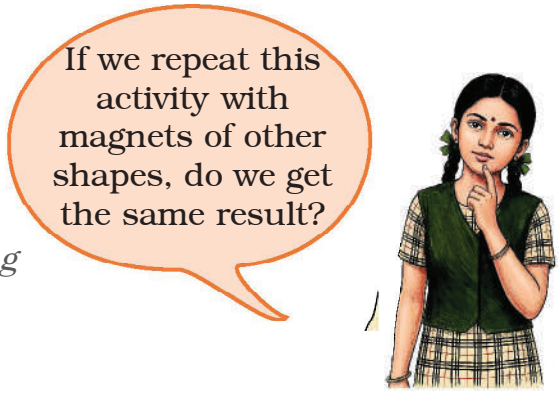
Activity 4.2: Let us investigate

- Spread some iron filings (very small pieces of iron) on a sheet of paper.
- Place a bar magnet over them. Tap the paper and observe carefully what happens to the iron filings.

Do you observe anything special about the way they stick to the magnet? Do the iron filings stick all over the magnet uniformly? Or do the iron filings stick more at some places?

We find that maximum iron filings stick near the ends of the bar magnet, as shown in Fig. 4.4, while a very few iron filings stick at the remaining part of the magnet.

Fig. 4.4: Iron filings sticking to a bar magnet



These ends of the magnet are called the poles of the magnet—the North pole and the South pole. Most of the iron filings stick to the poles of a magnet of any shape.

It is not possible to obtain a magnet with a single pole. If a magnet is broken into smaller pieces, North and South poles always exist in pairs even in the smallest piece of the magnet. A single North pole or a South pole cannot exist.

Can we find a magnet with a single pole? ?

4.3 Finding Directions

Activity 4.3: Let us experiment

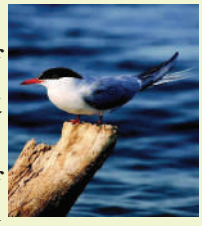
- Suspend a bar magnet with a thread tied to the middle of the magnet as shown in Fig. 4.5. You may need to adjust the position of the string till the magnet is balanced horizontally.
- Now rotate the magnet gently in the horizontal direction and let it come to rest.
- Mark the position corresponding to the ends of the magnet on the ground (or on a piece of paper stuck to the ground). Join these two points on the ground with a line. This line indicates the direction along which the magnet comes to rest.
- Now again rotate the magnet by giving a gentle push at its one end and wait till it comes to rest. Does the magnet rest along the same line?

Fig. 4.5: A freely suspended bar magnet

What direction does this line indicate along which the magnet rests? How can we find it out?

If we have noticed the direction where the Sun rises or sets, we have an approximate idea of where East or West is. Hence, we can locate the direction along which the magnet rests.

Do You knows?



The main reason for Earth's magnetism is the movement of molten iron and nickel in its massive core. This movement generates electric currents,creating a magnetic field.

* The 'Arctic Tern' bird has a complete understanding of geomagnetism, and uses it as a compass to navigate. It migrates approximately 44,000km from the Arctic to the Antarctic each year, demonstration its reliance on geomagnetism.

A freely suspended magnet comes to rest along the north-south direction. The end of the magnet that points towards north direction is called the North-seeking pole or the **North pole of the magnet**. The other end that points towards the South direction is called the South-seeking pole or the **South pole of the magnet**. A freely suspended magnet rests along the north-south direction because our Earth itself behaves like a giant magnet.

Repeat this activity with a small iron bar in place of the bar magnet. What do you observe? Does it always rest along north-south direction? It does not. It can rest along any direction. This implies that only magnets rest along north-south direction. This activity provides us with a way to test whether a piece of metal is a magnet or not.

The property of a freely suspended magnet to always rest along the north-south direction is used to find directions. Based on this, a small device called a magnetic compass was developed in olden days for finding directions. It has a magnet in the shape of a needle which can rotate freely (Fig. 4.6). The needle of a magnetic compass indicates the north-south direction.

Fig. 4.6: A magnetic compass

The compass is kept at the place where we wish to know the directions. After some time, the needle comes to rest in the north-south direction. The compass box is then gently rotated until the north and south marked on the dial are aligned with the needle. Now all directions at that place are as indicated on the dial.

More to know!

A magnetic compass is usually a small circular box with a transparent cover on it, as shown in Fig. 4.6. The magnet, in the shape of a needle, is mounted on a pin standing on the bottom of the box. This needle is balanced on the pin in such a manner that it can move around this point easily, that is, it can rotate freely. The end of the needle which rests in the North directionis usually painted red. Below the needle, there is a dial with directions marked on it.

How can we make our own magnetic compass?

Activity 4.4: Let us construct

- Collect a few materials like a cork piece, iron sewing needle, a permanent bar magnet, a glass bowl, and water.
- Place the iron sewing needle on a wooden table. Then keep any one pole of the magnet at one end of the needle. Move the magnet over the needle along its length as shown in Fig. 4.7(a). When it reaches the other end of the needle, lift it up.

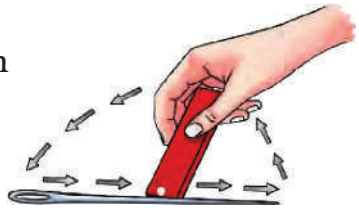


Fig. 4.7(a): Making an iron needle a magnet

- Bring the same pole of the magnet you started with to the same end of the sewing needle from which you began, and repeat the previous step. Repeat this process at least 30 to 40 times.
- Bring some iron filings or steel pins near the needle. If the pins or iron filings get attracted to the needle, then that means that the needle has become a magnet.
- Pass this needle through the cork horizontally. Float the cork in a glass bowl filled with water, such that the needle always remains above the level of water as shown in Fig. 4.7(b).

Fig. 4.7(b): A compass needle in a bowl of water

- When the needle comes to rest, your magnetic compass is ready for use. Note the direction in which either side of the needle points.
- Rotate the cork gently and wait till it stops rotating. Repeat this a few more times. Do the ends of the needle always point in the same direction?

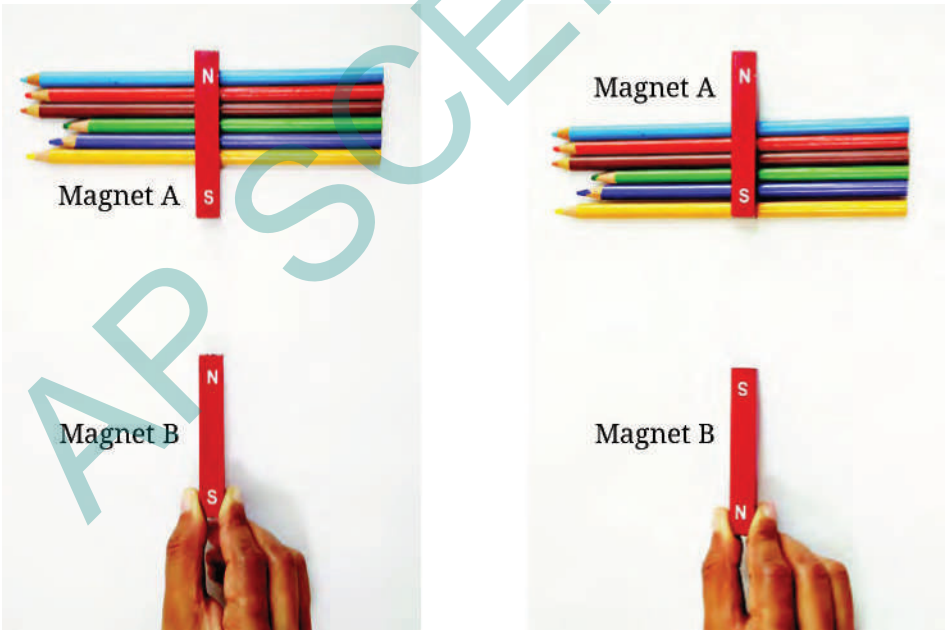
Do you know?

Much before the widespread use of the modern magnetic compass (Fig. 4.6), a device similar to the compass needle made by you (Fig. 4.7(b)) was used by Indians for navigation at sea. It consisted of a magnetised fish-shaped iron piece, kept in a vessel of oil. It was called *matsya-yantra*

4.4 Attraction and Repulsion between Magnets

Activity 4.5: Let us experiment

- Take a pair of bar magnets on which North and South poles have been marked. Mark the two bar magnets as A and B.
- Place the longer side of magnet A over 5–6 round shaped pencils as shown in Fig. 4.8(a).
- Now bring one end of magnet B near the end of magnet A placed on the pencils. Make sure that the two magnets do not touch each other. Observe what happens.
- Next, bring the other end of magnet B near the same end of magnet A (Fig. 4.8(b)). Does the magnet A on the pencils begin to move? Does it always move in the direction of the approaching magnet? What do these observations suggest?



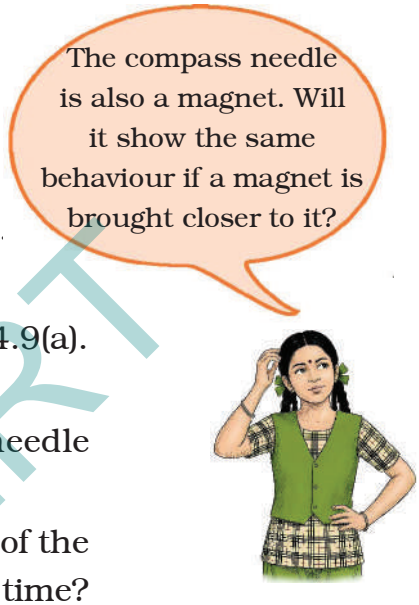
(a) (b)

Fig. 4.8: Interaction between two bar magnets

You will see that unlike poles of two magnets, that is, the North pole of one magnet and the South pole of another magnet, attract each other. The like poles, that is, either the North poles or the South poles of both magnets, repel each other.

- Repeat the activity by using an iron bar in place of one of the magnets. What do you observe this time?
  You will find that both the ends of the iron bar will be attracted by both the North and South poles of the magnet. From this activity, we find that a magnet can be identified by its property of repulsion.

Activity 4.6: Let us experiment



- Take a magnetic compass and a bar magnet.
- Place the magnetic compass over a horizontal surface and wait for its needle to come to rest.
- Now slowly bring North pole of the bar magnet pole of the compass needle as shown in Fig. 4.9(a). Observe the compass needle carefully. What do you observe? Does the needle deflect? If yes, in which direction?
- Now repeat the above step with the South pole of the bar magnet. Do you observe any difference this time?

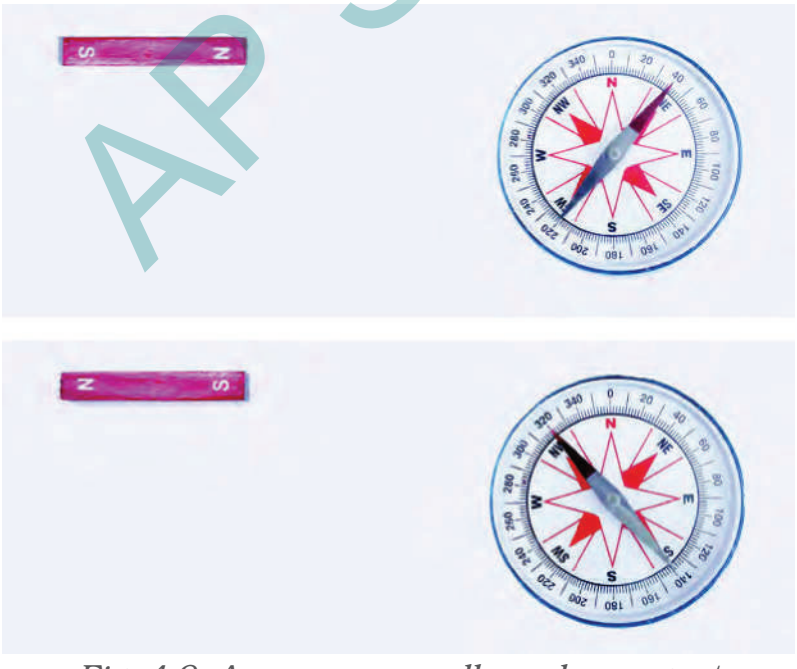
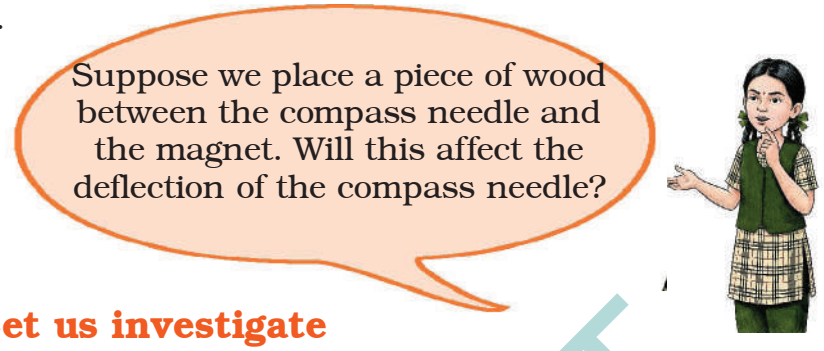


Fig. 4.9: A compass needle and a magnet

When the North pole of a magnet is brought closer to the North pole of the compass needle, it moves away as shown in Fig. 4.9(a). When the South pole of the magnet is brought closer to the North pole of the compass needle, it moves closer (Fig.



Activity 4.7: Let us investigate

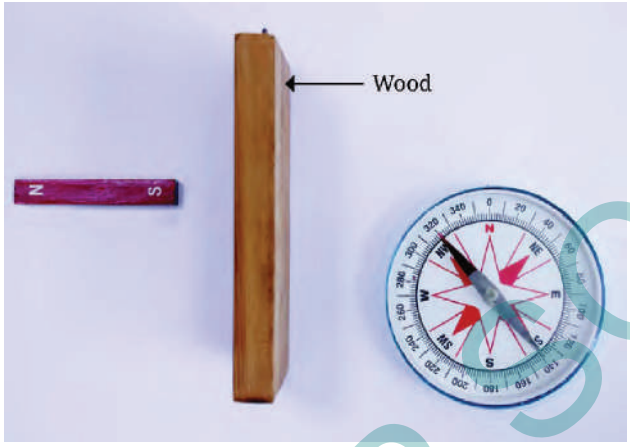


Fig. 4.10: Compass needle and a magnet with a piece of wood in between

- Repeat the first or second part of Activity 4.6.
- Without disturbing the bar magnet and magnetic compass, place a piece of wood between them, perpendicular to the table as shown in Fig. 4.10.

  Observe the compass needle carefully.
- Is there any effect on the deflection of compass needle due to the piece of wood? Record your observation in Table 4.2.
- Repeat the process by replacing the piece of wood with a cardboard sheet, thin plastic sheet, and a thin glass sheet.

Table 4.2: Observing the effect of magnet through non-magnetic materials

S. no.	Material placed between the magnet and the compass needle	Observations
1.	Wood	
2.	Cardboard	
3.	Plastic	
4.	Glass	

You would observe that there is no appreciable change in the deflection of the needle when a sheet of any of the above material is placed between the magnet and the compass needle. Therefore, we can **conclude** that the magnetic effect can act through non-magnetic materials.

4.5 Fun with Magnets

After learning about magnets, Hasini was excited and decided to set up some fun activities using magnets at her school fair. You may try making these yourself and may also think of some more fun ideas. Can we make a garland? (Fig. 4.11)

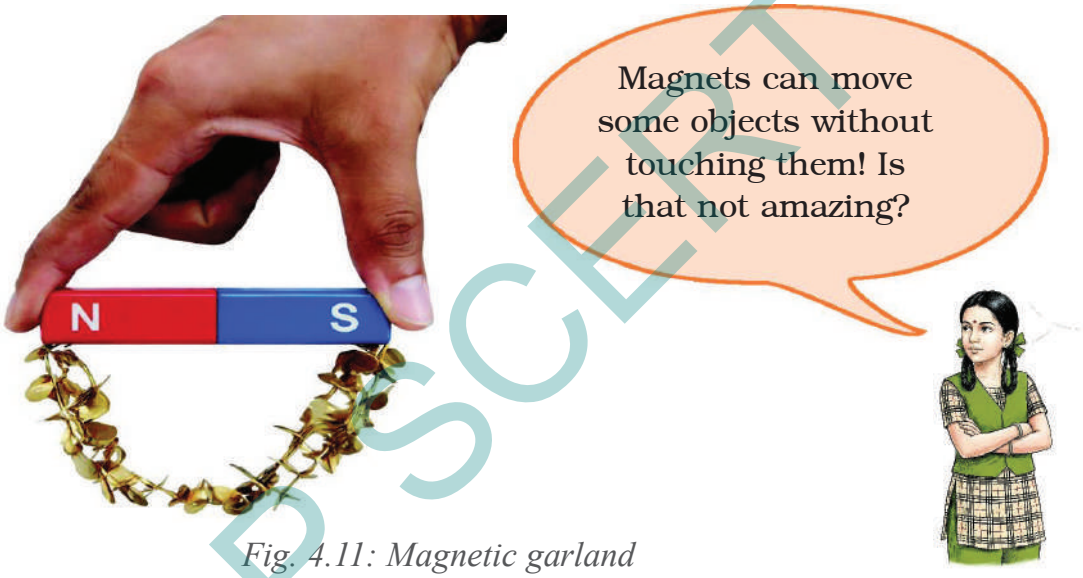


Fig. 4.11: Magnetic garland

Can we take the steel balls out of the maze by moving a magnet below the cardboard tray? (Fig. 4.12)

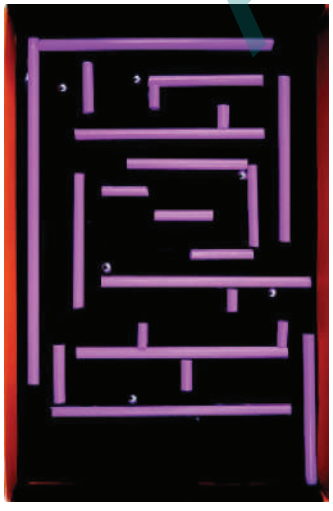


Fig. 4.12: Steel balls in a maze

Can we pick out a steel paper clip fallen in water using a magnet, without getting our fingers or the magnet wet?
(Fig. 4.13)

Fig. 4.13: Steel paperclip in water

Will the two cars speed towards each other or run away from each other when brought closer? (Fig. 4.14)

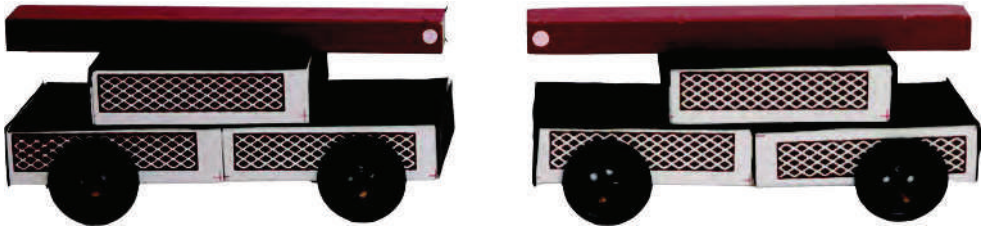


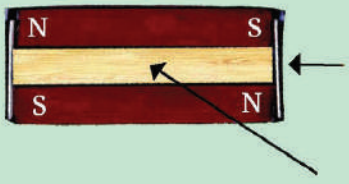
Fig. 4.14: Two matchbox-magnet cars with like poles of the magnets facing each other

More to know!

In some magnets, the North and South poles are marked as N and S. In some other magnets, the North pole is indicated by a white dot. Sometimes, the North pole of a magnet is painted red and South pole is painted blue.

How to keep the magnets safe?

Magnet says,
"Store me properly. Keep me in pairs with unlike poles on the same side. Keep a piece of wood in between. Place two pieces of soft iron across the ends."



More to know!

"Do not heat me or drop me or hammer me.
Do not keep me near mobile phones or remote controls."

Caution
Have fun, but treat magnets with care.

Keywords

Attraction	Magnetic Pole
Bar magnet	Freely Suspended Magnet
Magnetic compass	Experiment
Magnetic materials	Attraction
Non-magnetic materials	Like Poles
North pole of a magnet	Unlike Poles
Repulsion	Iron fillings

Summary

Key Points

- A magnet has two poles—the North pole and the South pole.
- The poles of a magnet always exist in pairs. A single North pole or a single South pole cannot exist.
- Magnetic materials are the materials that are attracted towards a magnet.
- Non-magnetic materials are the materials that are not attracted towards a magnet.
- A freely suspended magnet rests along the north-south direction.
- The needle of a magnetic compass indicates the north-south direction.
- When two magnets are brought close to each other, like poles (North-North, South-South) repel each other while unlike poles (North-South) attract each other.

Let us enhance our learning

1. Fill in the blanks
   (i) Unlike poles of two magnets _____each other, whereas like poles _____each other.
   (ii) The materials that are attracted towards a magnet are called _____.
   (iii) The needle of a magnetic compass rests along the direction._____.
   (iv) A magnet always has_____poles.

2. State whether the following statements are True (T) or False (F).
   (i) A magnet can be broken into pieces to obtain a single pole. [ ]
   (ii) Similar poles of a magnet repel each other. [ ]
   (iii) Iron filings mostly stick in the middle of a bar magnet when it is brought near them. [ ]
   (iv) A freely suspended bar magnet always aligns with the north-south direction. [ ]

3. Column I shows different positions in which one pole of a magnet is placed near that of the other. Column II indicates the resulting interaction between them for different situations. Fill in the blanks.

Column I	Column II
N – N	----------
S – N	----------
---------- -S	Repulsion

4. Deepak performed an experiment in which he took a bar magnet and rolled it over a heap of steel U-clips (Fig. 4.15).
   According to you, which of the options given in Table 4.3 is likely to be his observation?

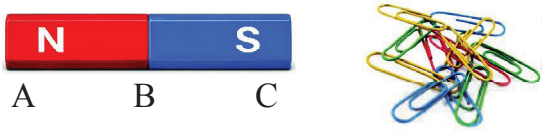


Fig. 4.15: Bar magnet and heap of steel U-clips

Table 4.3: Number of pins attracted by the magnet at its various positions

	Position A	Position B	Position C
(i)	10	2	10
(ii)	10	10	2
(iii)	2	10	10
(iv)	10	10	10

5. Hasini bought three identical metal bars from the market. Out of these bars, two were magnets and one was just a piece of iron. How will she identify which two amongst the three could be magnets (without using any other material)?
6. You are given a magnet which does not have the poles marked. How can you find its poles with the help of another magnet which has its poles marked?
7. A bar magnet has no markings to indicate its poles. How would you find out near which end its North pole is located without using another magnet?
8. If the earth is itself a magnet, can you guess the poles of earth's magnet by looking at the direction of the magnetic compass?
9. While a mechanic was repairing a gadget using a screw driver, the steel screws kept falling down. Suggest a way to solve the problem of the mechanic on the basis of what you have learnt in this chapter.
10. Two ring magnets X and Y are arranged as shown in Fig. 4.16. It is observed that the magnet X does not move down further. What could be the possible reason? Suggest a way to bring the magnet X in contact with magnet Y, without pushing either of the magnets.

Fig. 4.16: Two ring magnets

11. Three magnets are arranged on a table in the form of the shape shown in Fig. 4.17. What is the polarity, N or S, at the ends 1, 2, 3, 4 and 6 of the magnets? Polarity of one end (5) is given for you.

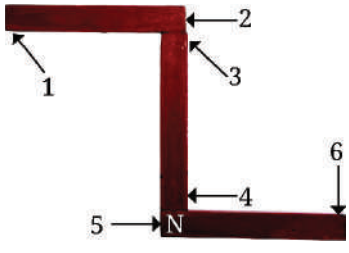
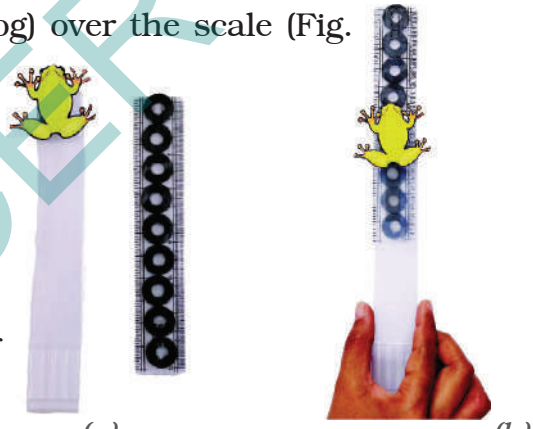


Fig. 4.17: Three bar magnets

Learning further

- Using 3–4 different magnets, try to lift steel pins or U-clips and check which magnet picks up the largest number of pins. Discuss with your friends why different magnets might have picked up different numbers of pins.
- Make a toy 'Hopping Frog' as a combined class activity with the help of your teacher. For constructing the toy, fix ring magnets in an alternate North-South fashion along the length of a scale using glue (Fig. 4.18(a)). Paint a frog on paper, cut along the outline and glue a ring magnet at its base. Take a transparent, flexible plastic strip (Fig. 4.18(a)) of a smaller size and glue it to the ring magnet which is attached to the frog.

  When you slide the plastic strip (with frog) over the scale (Fig. 4.18(b)), you can observe the frog hopping.
- Find out about the Maglev Train and try to make its model.
- Try to find out why there is a need to make magnets of different shapes.
- Collect information related to the use of magnets in the field of medicine.

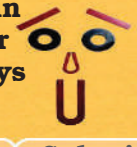


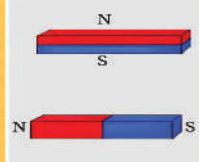
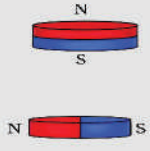
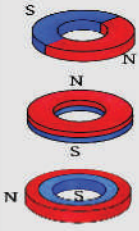
(a) (b)

Fig. 4.18: My hopping frog

More to know!

Magnet says "Humans have made me in different shapes and sizes as per their requirements. However, my poles always occur in pairs, no matter my shape".



Bar Magnet	Disc	Cylindrical Magnet	Ring Magnet	Spherical Magnet
				

5 Measurement of Length and Motion

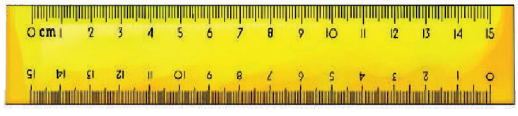
The learner will be able to...

- Measures length accurately using correct tools and techniques. (CG-1)
- Identifis and explain motion using reference points over time. (CG-2,)
- Classify types of motion using real-life examples. (CG-2,)
- Explain distance as the length of the path travelled. (CG-2,)
- Differentiate between uniform and non-uniform motion. (CG-2,)

Z7G3N6

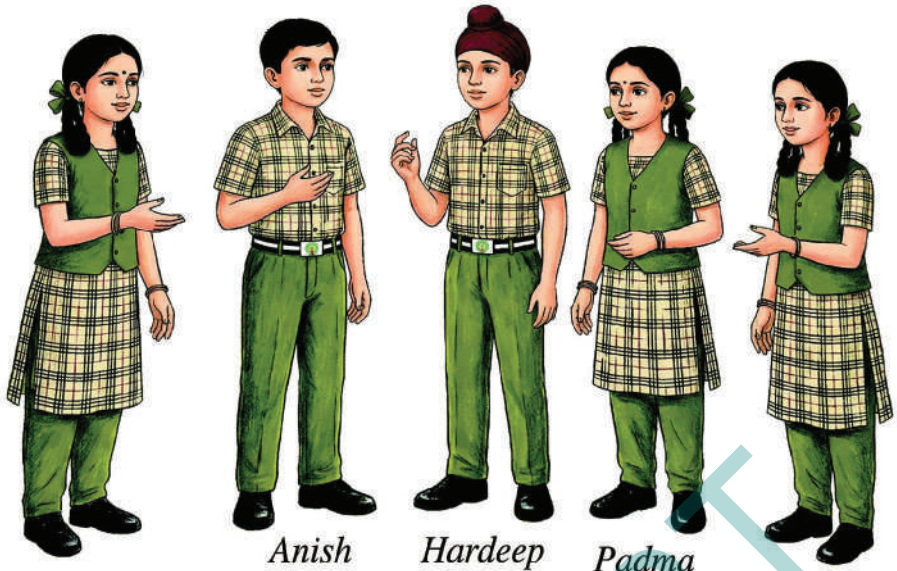
Deepa, a curious eleven-year old girl, lives in the state of Andhrapradesh. The new school year has started. Deepa needs a new uniform since she has grown taller. Her mother takes her to a cloth shop. She asks for a two-metre cloth piece. The shopkeeper measures the cloth using a metal measuring rod.

Then, the tailor takes her measurements using a flexible measuring tape. Her mother instructs the tailor to increase the length of her uniform by Bettha (four fingers width).



Are the tape and rod similar to the scale that the elder sister has in her geometry box? What did mother mean by Bettha?

Deepa shares her experience with her school friends Anish, Hardeep, Padma, Tasneem and this leads to a discussion among st them.



5.1 How do we Measure?

Hardeep says, "I have seen my grandmother measuring cloth by the length of her arm."

"Have you ever seen how a farmer measures length to divide his field into beds? He walks and counts the number of his strides," says Padma.

"Oh, not just the length of the strides—sometimes they also use the length of their feet to measure," adds Anish.

Deepa says excitedly, "Measuring length using body parts must be so much fun! Let us also measure something using a body part."

"What should we measure? Okay, let us measure the length of the table in our classroom," says Tasneem.

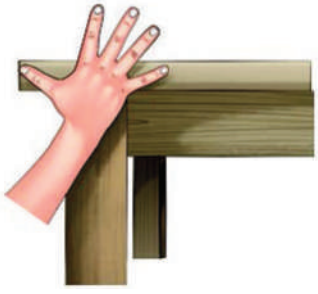


Fig. 5.1: Use of handspan for measuring

Padma adds, "And which body part should we use to measure it?"

Deepa says, "Let us use our handspan. I will show you how to use it. I have seen my mother using it. She calls it *balisht.*" [Jaana]

Hardeep adds, "Okay. Let us also note down our measurements."

Table 5.1: Measuring the length of the table

Name of the Student	Number of Handspans
Anish	Slightly more than 13
Padma	13
Tasneem	Slightly less than 13
Deepa	Between 13 and 14
Hardeep	14

Padma says, "Oh, the number of handspans is different for all of us. So, what can we say about the length of the table?"

"But why should the number be different?" Hardeep asked thoughtfully.

Tasneem says, "I can guess. Our handspans are of different sizes."

Anish gives an idea, "Let us check this."

So, all five of them put their handspans along each other and arrive at the conclusion that the lengths of their handspans are different.

Deepa says thoughtfully, "No wonder people use scales and measuring tapes."

Deepa and her friends compare the length of the table with the length of their handspans. The length of the table is expressed in terms of their handspans. Here, the handspan used for measurement is an example of a unit. And the length is expressed in two parts, a number and a unit. For example, if the length of the table is found to be 13 handspans, then 13 is the number and 'handspan' is the unit selected for the measurement.

However, handspans and other similar units, such as length of hand, foot, fist or fingers, differ from person to person. Thus, there is a need for such a unit for which measurements of the same length made by different people do not differ.

More to know!

India has a rich history of measurement systems dating back to ancient times. Angula (finger width), multiples of angula, dhanusa, and yojana are some of the units mentionein ancient Indian literature, and used in measuring artefacts, architecture, and town planning. The angula is still used by traditional craftspeople like carpenters and tailors. Several objects with ruled markings which could be scales have been excavated from sites of the Harappan Civilisation.

5.2 Standard Units

Several systems of units evolved with time in different parts of the world. However, when people started travelling from one place to another, it created a lot of confusion. In 1790, The French created a standard unit of measurement called the metric system. This led to the different countries coming together and adopting a set of standard units of measurement. The system of units now used is known as the 'International System of Units' or SI units.

[From French ; Systeme international d' units]

The **SI unit of length** is **metre**. Its symbol is **m**. A metre scale is shown in Fig. 5.2. One metre (m) is divided into 100 equal divisions. Each division is called a **centimetre** (**cm**). You may be familiar with a smaller part of the metre scale, typically 15 cm long, shown in Fig. 5.3.

Look carefully at the 15-cm scale. It has markings (in cm) from 0 to 15. The length of any section between two consecutive big marks, such as between 1 and 2 or between 5 and 6, is 1 cm. Observe that these sections of 1 cm length are further divided into 10 equal parts. The length of one of these smaller parts is called a **millimetre** (**mm**). 1 mm is the smallest value of length that you can measure using this scale. 1 mm is equal to one-tenth of a centimeter (1 mm = 0.1 cm).

Fig. 5.2: A metre scale

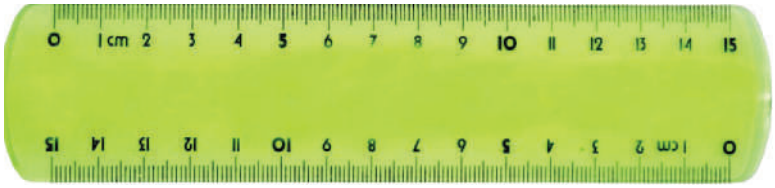


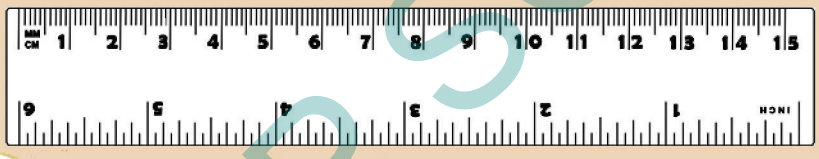
Fig. 5.3: A 15-cm scale

For measuring larger lengths, we use a larger unit called a **kilometre** (**km**) which is equal to 1000 metres. And for measuring smaller lengths, we use units such as centimetre or millimetre.

Would it be convenient to use the unit metre to measure larger lengths, such as the length of a railway track between two cities, or to measure smaller lengths, such as the thickness of a page of a book?

1 km = 1000 m | **1 m = 100 cm** | **1 cm = 10 mm**

In some scales, you might have noticed another scale marking. This scale marking is in inches, where 1 inch = 2.54 cm. In earlier days, units, such as inch and foot, were used to measure length. These units are still used by some people.



Do you know?

Suppose we all measure the length of the table again, but this time using a metre scale. Will our results still be different?

No, but we should first learn the correct way of using a scale to measure length.

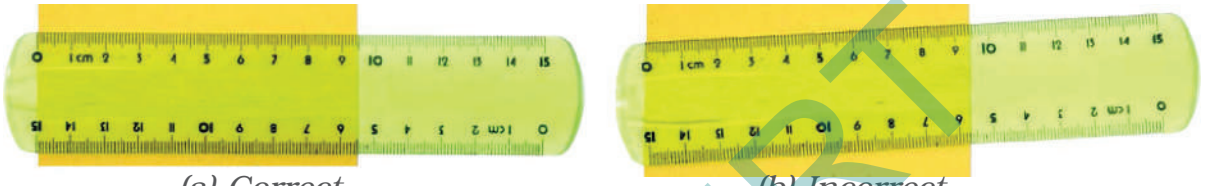
5.3 Correct Way of Measuring Length

For measuring any length, we need an appropriate scale. For example, if you want to measure the length of your pencil, you may use a 15-cm scale. Similarly, if the height of a room is to be measured, you may need a metre scale or a measuring tape. You cannot directly measure the girth of a tree or the size of your chest using a metre scale. For such measurements, flexible measuring tape, such as a tailor's tape is more suitable.

While measuring lengths, we need to take care of some points.

What is the correct way to place the scale?

Place the scale in contact with the object along its length as shown in Fig. 5.4.



(a) Correct (b) Incorrect

Fig. 5.4: Method of placing the scale

What is the correct position of the eye while reading the scale?

For example, if you are trying to measure the length of a pencil by aligning it with a scale, the position of your eye should be directly above the tip of the pencil (Fig. 5.5).

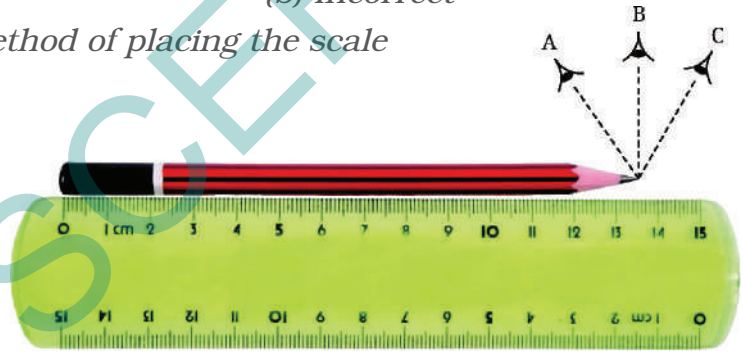


Fig. 5.5: Correct position of the eye is 'B'

How to measure the length if the ends of the scale are broken?

If the ends of the scale are broken or the zero marking is not clear, it can still be used for measurement. With such a scale, use any other full mark of the scale, say, 1.0 cm (Fig. 5.6). Then you must subtract the reading of this mark from the reading at the other end. For example, in Fig. 5.6, the reading at one end is 1.0 cm and at the other end, it is 10.4 cm. Therefore, the length of the object is 10.4 cm–1.0 cm = 9.4 cm.

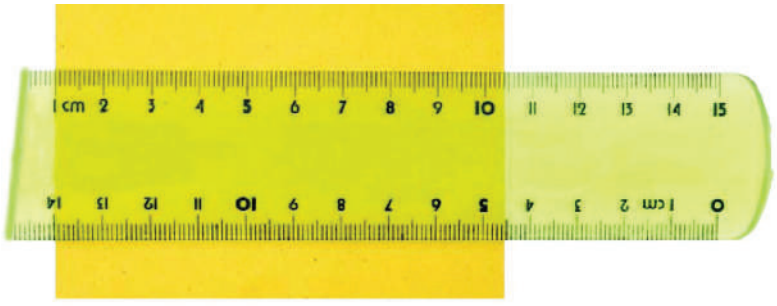


Fig. 5.6: Correct method of placing the scale with broken end

How do visually challenged students measure lengths? They use scales with raised markings that can be felt by touching them.

Do you know?

Activity 5.1: Let us measure

- Select some objects around you, such as a comb, a pen, a pencil, and an eraser to measure their lengths.
- Measure their lengths one by one using a metre scale and note down the measurements in Table 5.2.

Table 5.2: Measuring lengths

Object	Length of the object

While writing the length, do not forget to write the unit also. Thus, your result will consist of two parts—one part is a number and the other part is the unit of measurement.

Some of your friends in the class would have measured the length of the same objects. Compare the lengths measured by you with that of your friends. Are the measured lengths the same or slightly different? If not the same, discuss the possible reasons for the differences.

Why are some length measuring devices made up of flexible materials?

Units of length, such as kilometre, metre, centimetre and millimetre, begin with a lowercase letter, except at the beginning of a sentence. Their symbols km, m, cm and mm are also written in lowercase letters, and are never followed by 's' for the plural. Note that a full stop is not written after the symbol, except at the end of a sentence. While writing the length, always leave a space between the number and the unit.

Do you know?

5.4 Measuring the length of a curved line

Anish and his parents fixed electric string lights on the arches of the verandah of their house, as shown in Fig. 5.7, for a celebration at home. How would they have measured the required length of string lights?

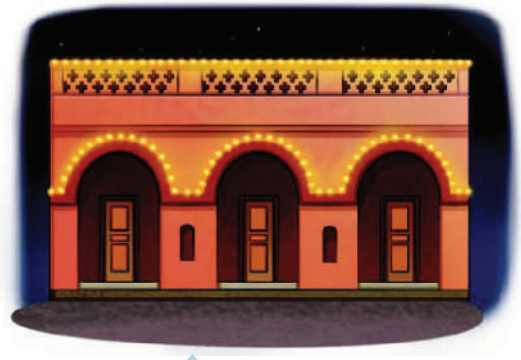


Fig. 5.7: House decorated with string lights

In the case of a curved line, measurements can be made with the help of a flexible measuring tape or by using a thread as shown in Fig. 5.8.

Fig. 5.8: Measuring the length of a curved line

The thread can then be straightened and its length can be measured using a metre scale.

5.5 Describing Position

One day the teacher informs her students that she has planned an educational visit to a nearby garden. She asks the students to reach there directly in the morning. Deepa and her friends start discussing whether the garden would be closer than their school or farther. Tasneem and Padma say that the garden would be closer, while Deepa and Anish feel that the school would be closer, Hardeep thinks that both would be almost at an equal **distance** (Fig. 5.9).

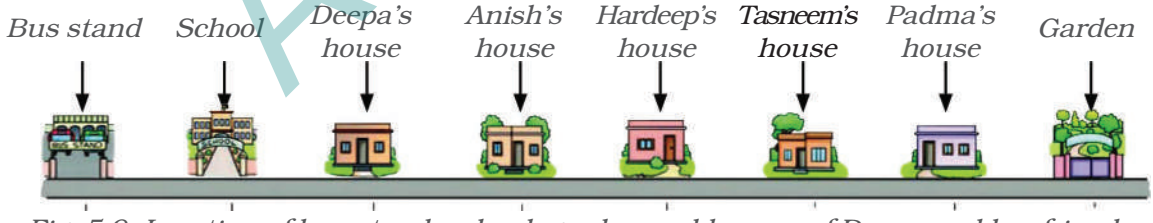


Fig. 5.9: Location of bus stand, school, garden and houses of Deepa and her friends

Who do you think is correct? All of them are correct (Fig. 5.9). Then, why are their observations different? They are locating the distances of the school and garden from their houses. If, instead, each of them had thought of distances from a same object or point, say, the bus stand, then their observations would have been the same.

When distance is stated with respect to a fixed object or point, then this point is called a **reference point.**

A few days later, Hardeep tells his friends excitedly, "Let us all go to the playground. The sports teacher wants us to help her to draw lines with *chuna* powder (limestone powder) for making the Kabaddi court for the sports day."

Padma: "We will need a longer measuring tape. Let us take it from the sports room." (Fig. 5.10)

Deepa: "Let us first decide the point on the ground from which we will measure the distances to start drawing the lines. Let us call this our reference point." (Fig. 5.11)

Fig. 5.10: A measuring tape

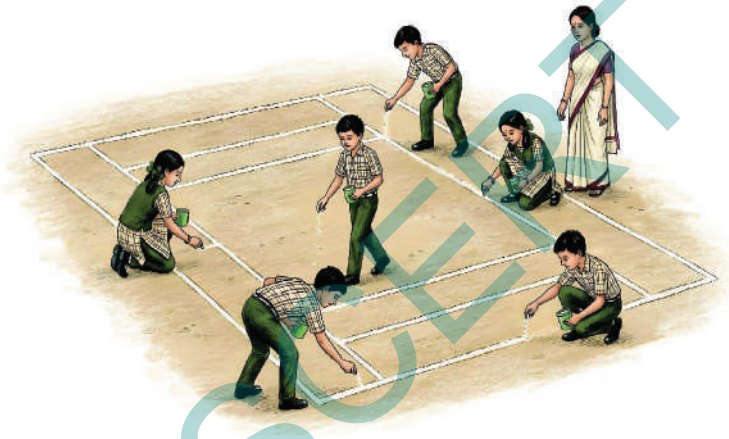


Fig. 5.11: Drawing lines for Kabaddi court

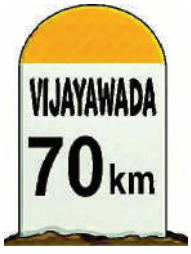


Fig. 5.12: A kilometre stone

After a few days, Padma was travelling by bus to visit her grandparents in Vijayawada, She was eager to reach Vijayawada and was reading the kilometre stones on the side of the road. On one of the kilometre stones, it was written Vijayawada 70km'(Fig.5.12).

Further on, the next kilometre stone read Vijayawada 60 km'. Each kilometre stone indicated that she was getting closer to her grandparents' house.

These kilometre stones indicated her distance from Vijayawada So, Vijayawada is the reference point in this situation.

What do such kilometre stones indicate? How could Padma conclude that she was getting closer to her destination?

Fig. 5.13: Positions of kilometre stones with respect to Vijayawada as a reference point

If the kilometre stone reads 'Vijayawada 70 km' as shown in Fig. 5.13, we can say that the position of Padma is 70 km from Vijayawada. When the kilometre stone reads 'Vijayawada 60 km', the position of Padma is 60 km from Vijayawada.

Does this mean that the position of Padma, with respect to the reference point, is changing with time? When does the position of an object change with respect to a reference point? Does it change when an object is moving?

5.6 Moving Things

Activity 5.2: Let us explore

- Look around and prepare a list of five objects that are in motion and five objects that are at rest.
- Record your observations in Table 5.3.
- Think about how you decided whether an object was in motion or at rest. Write your explanation (**justification**) in Table 5.3.

Table 5.3: Observing things around you

Objects in motion	Justification	Objects at rest	Justification
Cow grazing in the field		Tree	

Compare and analyse your justifications. How can one decide if an object is in motion or at rest?

An object is said to be in **motion** if its position changes with respect to the reference point with time. If an object is not changing its position with respect to the reference point with time, it is said to be at rest.

Deepa looked around her in the bus and noticed that all the passengers were seated. She looked around again after a minute and found them still occupying their seats. She wondered, 'Are they moving?' She concluded that the position of the passengers was not changing with time. Therefore, they were certainly at rest. However, when she looked outside, she felt they were in motion as their positions were changing with respect to things outside. The reference point is important in deciding whether an object is at rest or in motion.

If Deepa considered herself (or the bus) as the reference point, then the passengers were at rest. However, if she considered any object outside the bus (say a building) as the reference point, then the passengers (and the bus) were in motion.

More to know!

Think it over!

Suppose you are travelling on a ship which is moving at a constant speed along a straight line on a calm sea. Suppose there is no window on the ship. Is there any way that you can determine whether the ship is moving or is stationary?

5.7 Types of Motion

Activity 5.3: Let us explore

- Take an eraser and drop it from a certain height.
- Observe its motion.

Does it move along a straight line? When an orange drops from the tree, does it move in a straight line? Have you seen the Republic Day parade? Recall the march-past of students during the parade. Do they move on a straight-line path? When a heavy box is pushed, it may also move along a straight line (Fig. 5.14).

When an object moves along a straight line, its motion is called **linear motion**. **Identify** such linear motion in your surroundings.

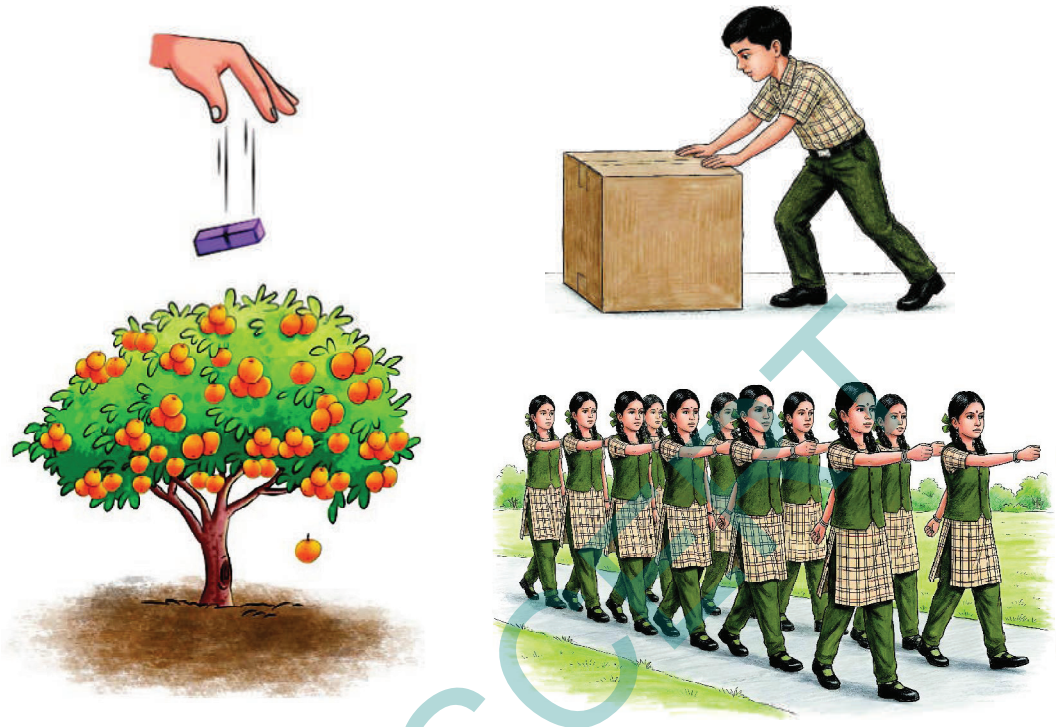


Fig. 5.14: Linear motion

But do things always move along a straight line? You might have enjoyed playing on swings and merry-go-rounds.
Are these types of motion also linear motion?

Activity 5.4: Let us investigate

- Tie an eraser (or a potato) to one end of a thread.
- Hold the other end of the thread with your hand and whirl it (Fig. 5.15).
- Observe its motion.

Is the motion of the eraser the same as that of a merry-go-round?

When an object moves along a circular path, its motion is called **circular motion.**

Fig. 5.15: Circular motion

Activity 5.5: Let us investigate

- Tie an eraser (or a potato) to one end of a thread.
- Hang the eraser by holding the other end of the thread (Fig. 5.16). Keep your hand steady.
- Using the other hand, take the eraser slightly to one side and then release (Fig. 5.16).

Does it start moving to and fro? Is its motion similar to the motion of a swing? When an object moves to and fro about some fixed position, its motion is called **oscillatory motion.**

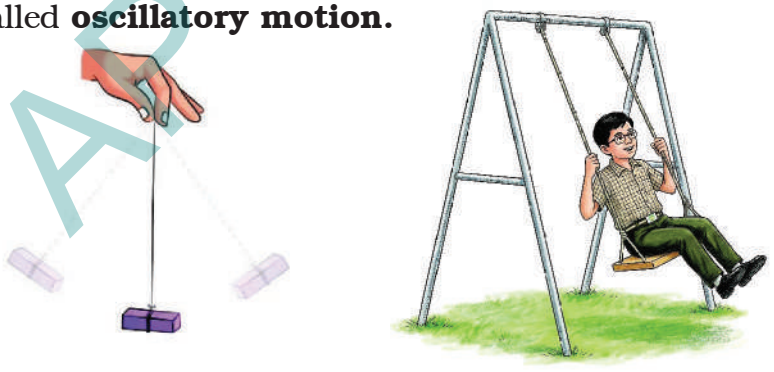


Fig. 5.16: Oscillatory motion

Activity 5.6: Let us investigate

- Take a thin metal strip of about 50 cm long.
- Hold its one end pressed to a table. You may use a few books or a brick to hold it (Fig. 5.17).

- Press the free end of the strip slightly and let it go.
- Observe the motion of this end of the strip.

  Does it move up and down? This is also an example of oscillatory motion.

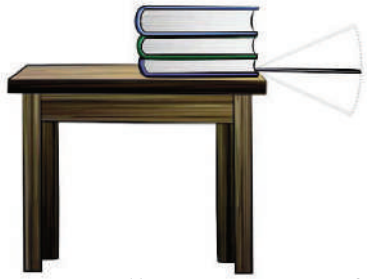


Fig. 5.17: Oscillatory motion of a metal strip

More to know!

If an object repeats its path after a fixed interval of time, its motion is said to be periodic. When an object is in circular motion, it moves along the circular path again and again. An object in oscillatory motion also repeats its motion while moving to and fro. Both circular and oscillatory motion are periodic in nature.

Activity 5.7: Let us identify

- Look at the picture of a children's park (Fig. 5.18) or visit a children's park.
- Observe different kinds of motions. **Classify** them as linear, circular or oscillatory motion.

  List them in Table 5.4. Give your justification for why you put each in a certain category.

Fig. 5.18: Types of motion observed in a children's park

Table 5.4: Types of Motion

Object	Linear motion	Circular motion	Oscillatory motion
Swing			Moving to and fro

Key Words

centimetre	measurement	motion
circular motion	metre	standard unit
distance	millimetre	measuring tape
kilometre	reference point	curved line
length	oscillatory motion	linear motion

Summary

Key Points

- The International System of Units (SI units) has been adopted by countries as standard units of measurement.
- The SI unit of length is metre. Its symbol is m.
- 1 km = 1000 m, 1 m = 100 cm, 1 cm = 10 mm.
- When distance is stated with respect to a fixed object or point, then this point is called a reference point.
- An object is said to be in motion if its position changes with respect to a reference point with time.
- When an object moves along a straight line, its motion is called linear motion.
- When an object moves along a circular path, its motion is called circular motion.
- When any object moves to and fro about any fixed position, its motion is called oscillatory motion.

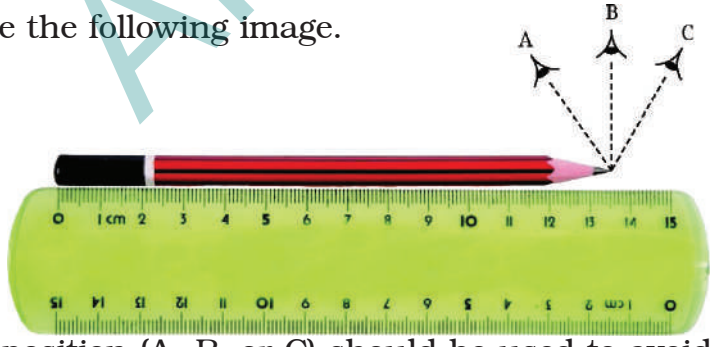
Let us enhance our learning

1. Fill in the blanks
   A) When an object moves along a straight line, its motion is called ..... motion.
   B) When an object moves along a circular path, its motion is called ..... motion.
   C) When any object moves to and fro about any fixed position, its motion is called ..... motion.
2. Which of the following is not a standard unit of measuring length?
   (i) millimetre (ii) centimetre
   (iii) kilometre (iv) handspan
3. Some lengths are given in Column I of Table 5.5. Some units are given in Column II. Match the lengths with the units suitable for measuring those lengths.

Table 5.5

Column I	Column II
Distance between Delhi and Lucknow	centimetre
Thickness of a coin	kilometre
Length of an eraser	metre
Length of school ground	millimetre

4. Observe the following image.



Which position (A, B, or C) should be used to avoid **parallax error** when measuring the pencil?

A) Position A, because it allows you to see the tip more clearly from the side.

B) Position B, because the line of sight is perpendicular to the scale.

C) Position C, because it compensates for the thickness of the pencil.

D) Any position, as long as the pencil is touching the ruler.

5. Give two examples each for linear, circular and oscillatory motion.
6. Suppose the distance between your school and home is 1.5 km. Express it in metres.
7. Take a tumbler or a bottle. Measure the length of the curved part of the base of glass or bottle and record it.
8. You are given a coin. Estimate how many coins are required to be placed one after the other lengthwise, without leaving any gap between them, to cover the whole length of the chosen side of a notebook. Verify your estimate by measuring the same side of the notebook and the size of the coin using a 15-cm scale.
9. A student observes the following situations:
   1. A child swinging back and forth on a swing.
   2. A car moving along a straight road.
   3. The hands of a wall clock.

   Identify the type of motion in each situation.

   A) Swing→Oscillatory, Car→Circular, Clock hands→Linear

   B) Swing→Oscillatory, Car→Linear, Clock hands→Circular

   C) Swing→Linear, Car→Oscillatory, Clock hands→Circular

   D) Swing→Circular, Car→Linear, Clock hands→Oscillatory
10. Observe different objects around you. It is easier to express the lengths of some objects in mm, some in cm and some in m. Make a list of three objects in each category and enter them in the Table 5.6.

Table 5.6: Sizes of objects around us

Size	Objects
mm	
cm	
m	

11. Search for the different scales or measuring tapes at your home and school. Find out the smallest value that can be measured using each of these scales. Record your observations in a tabular form.
12. A rollercoaster track is made in the shape shown in Fig. 5.19. A ball starts from point A and escapes through point F. Identify the types of motion of the ball on the rollercoaster and corresponding portions of the track.

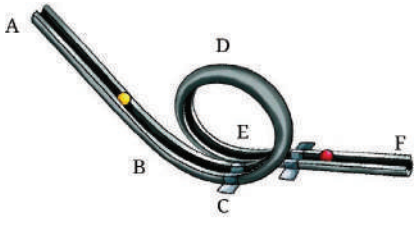


Fig. 5.19: Rollercoaster track

13. Tasneem wants to make a metre scale by herself. She considers the following materials for it—plywood, paper, cloth, stretchable rubber and steel. Which of these should she not use and why?

14. Read the following statements and mark True (T) or False (F) against each.
    (i) The motion of a car moving on a straight road is an example of linear motion. [ ]
    (ii) Any object which is changing its position with respect to a reference point with time is said to be in motion. [ ]
    (iii) 1 km = 100 cm [ ]

15. Think, design and develop a card game on conversion of units of length to play with your friends.

Learning further

- Can you find the thickness of a single page of your notebook or textbook using a scale? Think of a way and write it. Carry out the activity and report your result.
- Collect fallen leaves from the same tree. Identify the name of the tree whose leaves you have taken. Measure length and breadth of all these leaves using a 15-cm scale, as shown in Fig. 5.20. Record your observations in the Table 5.7.

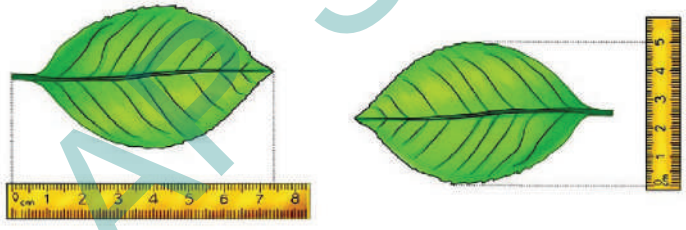


Fig. 5.20: Measuring a leaf

Table 5.7: Length and breadth of leaves

S. no.	Name of tree	Length of leaf	Breadth of leaf
1.			

- Discuss why the leaves of the same tree vary in length and breadth.
- Discuss with elders in your community what units were used for measurement of length in the olden days. Also, using the internet, try to find out about the length scales found in excavations of archaeological sites in India.
- Create a maze using lines of 1 cm, 2 cm and their combination. Part of it has been made for you in Fig. 5.21. Now use your imagination and expand it to a size as big as you want.

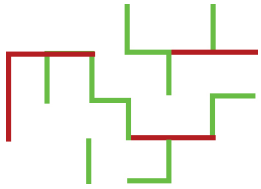


Fig. 5.21: A maze

- How tall am I? Stand along a wall and with the help of an adult, mark your height (Fig. 5.22). Repeat it every three months to maintain a height record for yourself and your siblings.

Fig. 5.22: Measuring height

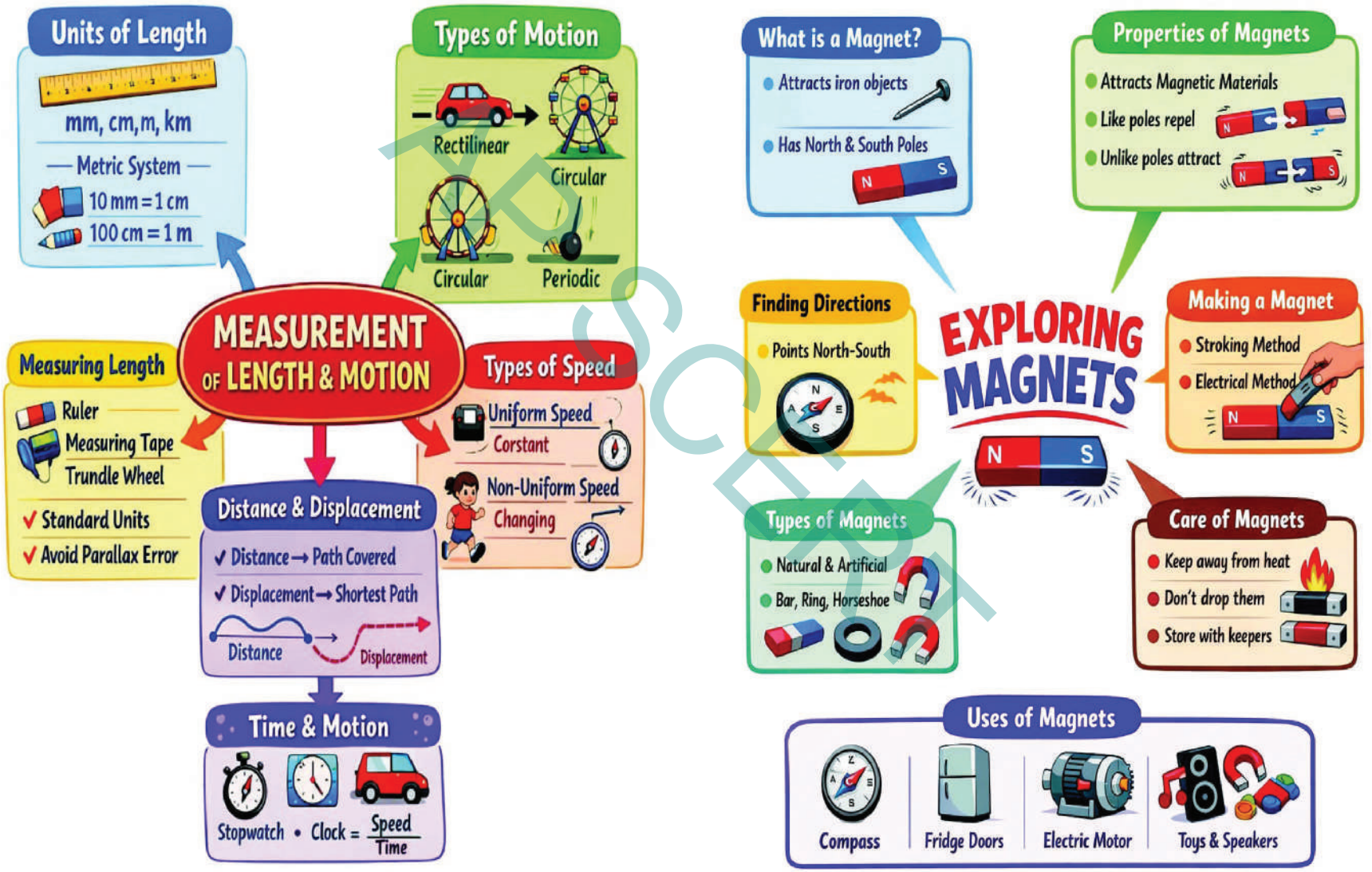
- Let us design a fun method for measuring the distance between two places by using a bicycle. Attach a flexible metal strip to the spoke of the front wheel in such a manner that it hits the frame of the bicycle holding the wheel, every time it crosses it and produces a sound (Fig. 5.23).

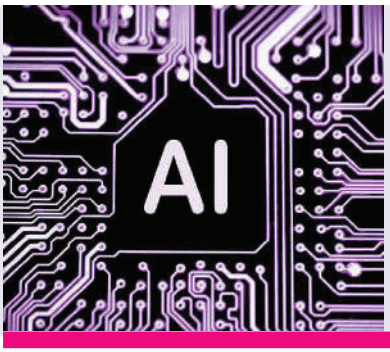
Now ride the bicycle slowly and count the number of times in which sound occurred. The number will give you the number of turns of your wheel made. Now measure the length of the outer boundary of the wheel using a string as done in Fig. 5.8. Multiply this length by the number of turns of the wheel. This is the distance you travelled.

Fig. 5.23: Measuring distance

Such methods are actually used to measure the distance for road running races. Try to find out about a 'Jones Counter' which is attached to a bicycle wheel and is used for measuring distances.

Concept Maps



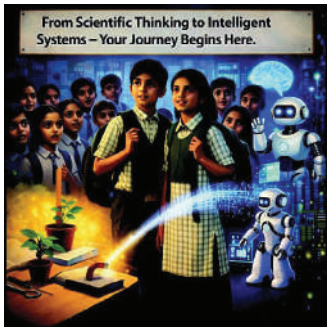


Integrating Artificial Intelligence(AI)

Learners will be able to...

W7I8C9

1. Understand and use correctly the AI terms Artificial Intelligence, sensor, input, output, digital data, and algorithm while explaining scientific examples from the textbook.
2. Explain how sensors collect input (light, heat, motion, magnetic signals) and how this information is converted into digital data for processing in intelligent systems.
3. Describe the process of data processing and pattern recognition by connecting biological classification and material grouping to machine learning systems.
4. Differentiate between human observation and digital detection, and relate measurement in science to data collection in AI systems.



We often notice how our phone suggests videos we may like, how maps show the fastest route, or how a camera recognises a face. These are not magic. They are examples of artificial intelligence. You may feel that AI is something very new, but you already use similar skills in your science class. When you carefully observe a plant, measure its height, compare objects, or group animals based on their features, you are thinking scientifically. AI also works in a similar way. It collects information, looks for patterns, and gives results.

In this chapter, you will learn how your scientific thinking connects with modern technology. You will understand what artificial intelligence means, how machines collect and process information, and how observation, measurement, and classification become digital data and intelligent decisions.

Disclaimer: "The use of AI tools by students must be strictly under the direct guidance and supervision of teachers and parents / guardians".

Foundations of AI in Science Learning.

The chapters in this semester help develop important scientific skills such as **observation, measurement, classification,** and **experimentation.** These same skills are also used in **Artificial Intelligence (AI).**

Artificial Intelligence helps machines study information, find patterns, and give simple results. AI systems use sensors to collect information such as light, heat, motion, and magnetic signals. This information is changed into **digital data** so that computers can understand and use it. By learning these lessons, basic AI words can also be understood, and the link between Science and modern technology becomes clear.

What is Science? Is it only the study of plants, food, magnets, motion, and materials? Science is not just about studying things. It also includes careful observation, correct measurement, proper classification, comparison, and finding patterns in daily life.

Artificial Intelligence (AI) is the ability of machines to do tasks such as observing, analysing, sorting, and making simple decisions. Through sensors, machines detect light, heat, movement, and magnetic signals. This collected information is converted into digital data, studied through data processing, and then shown as an output.

Guidance: - This section should be introduced through guided discussion rather than direct explanation. Encourage learners to respond to the reflective questions using examples from classroom activities and daily life. Allow students to first recognise scientific skills such as observation, measurement, comparison, and classification before introducing the idea of Artificial Intelligence.

Example 1: Observation and Measurement

When a plant bends towards sunlight, we watch it carefully to understand the change. This careful watching is called **observation**. When the height of the plant is measured with a ruler and written in centimeters, it is called **measurement**. **Observation** tells what is seen. **Measurement** gives the exact number.

Now think about a digital thermometer. It does not "feel" temperature like humans. It uses a sensor to detect heat and changes it into numbers. A digital camera does not "see" like the human eye. It detects light and converts it into **digital signals**.

In this way, the difference between **observation** and **measurement** helps in understanding how machines take **digital input** and give results.

Thinking with AI :	If a digital thermometer does not "feel" heat like humans, how does it detect temperature and convert it into numbers? Explain the steps from heat detection to number display. Scan the QR code for more information.
Key Words:	**Sensor** – A device that detects physical changes such as heat, light, or motion. **Digital Input** – Information given to a machine for processing. **Digital Signals** – Information changed into electronic form **Output** – The result shown by a machine after processing the input.

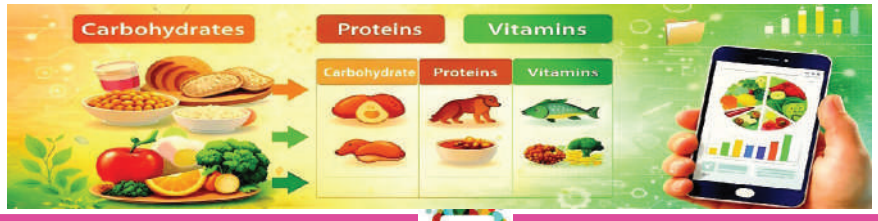
Example 2: Classification Systems

Living organisms are grouped based on common characteristics. This method of grouping is called classification. The same idea is used in Artificial Intelligence (AI) to organise information. When pictures of animals are shown to a computer, it studies features such as shape, colour, and size. If these features match the stored patterns, the computer places the image into the correct group. This method is called Pattern Recognition.

Computers do not learn by themselves. People first give many labelled examples. This collection of labelled examples is called a dataset. The computer studies this dataset through Machine Learning so that it can give more correct answers. In this way, scientific classification helps in understanding how intelligent systems organise digital data.

Thinking with AI :	When animals are grouped based on features, humans observe, compare and use stored examples to classify an animal image?
Key Words:	**Dataset** – A collection of labelled examples used to train a computer. **Pattern Recognition** – Identifying repeated features or similarities in data. **Machine Learning** – A method by which computers improve performance by studying data. **Classification** – Grouping items based on common characteristics.

Example 3: Sorting Food by Nutrients

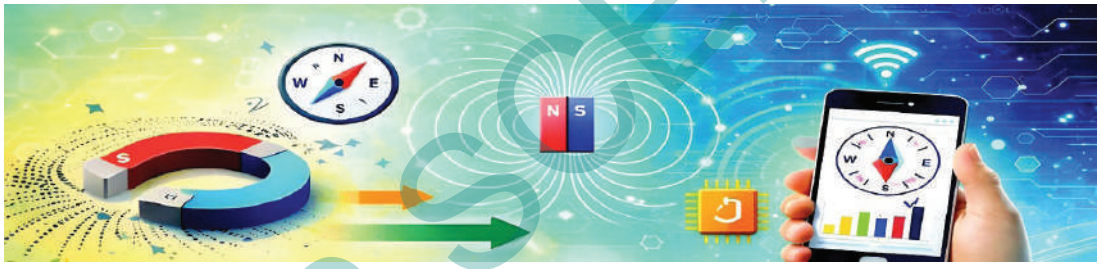


Food items are grouped into categories such as energy-giving foods, body-building foods, and protective foods. This grouping helps in better classification of nutrients. Nutrients are arranged in tables so that their functions can be compared easily. In digital systems, information is also arranged in tables. Nutrition applications study the information and compare nutrient values before giving suggestions. This process is called data processing.

In this way, the scientific skill of organising information into groups helps in understanding digital data processing and comparison in computers.

Thinking with AI :	If a nutrition application suggests a balanced diet, what kind of information must it analyse before giving suggestions? Explain how data is compared before producing an output.
Key Words:	**Data Processing** – Organising and analysing information to produce useful results. **Algorithm** – A set of step-by-step instructions used to solve a problem. **Digital Data** – Information converted into numerical form for computer use.

Example 4: Magnetic Detection

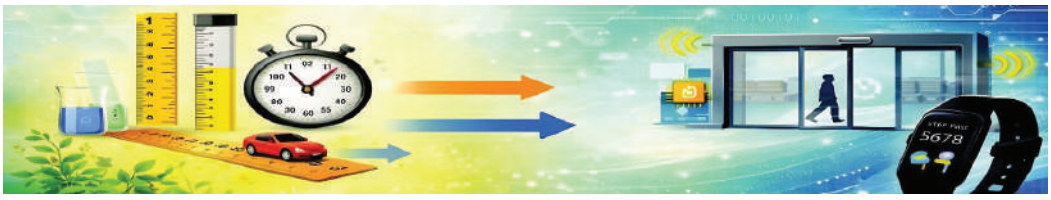


When a magnet is placed near iron nails, it pulls them towards itself. This is called attraction. The magnetic field cannot be seen with our eyes, but its effect can be observed. A smartphone has a magnetic sensor that detects the Earth's magnetic field. It uses this information to show direction in a compass application. Machines can detect invisible digital signals and change them into useful information.

By studying magnetic poles and magnetic fields, it becomes easier to understand how a sensor can detect forces that humans cannot directly see or feel.

Thinking with AI :	A magnet attracts iron nails even though the magnetic field cannot be seen. How does a smartphone detect Earth's magnetic field and display direction? Explain the steps involved. Scan the QR code for more information.
Key Words:	**Magnetic Sensor** – A device that detects magnetic fields. **Signal Detection** – Identifying physical changes such as magnetic force. **Digital Signal** – Physical information converted into electronic form.

Example 5: Measurement of Length and Motion



Length is measured using standard units such as centimetre and metre. Motion is studied by observing how the position of an object changes with time. In measurement, accuracy and careful measurement are important to get correct results. Automatic doors detect motion using sensors. Fitness bands measure steps in digital form. These devices change movement into numerical data.

The ideas of units, accuracy, and measurement error are important in scientific experiments as well as in digital systems.

Thinking with AI :	When an automatic door opens after detecting movement, what steps occur between motion detection and the door opening? Describe the process from sensing to action.
Key Words:	**Unit** – A standard quantity used to measure something, such as metre or centimetre. **Measurement Error** – The small difference between the measured value and the actual value. **Digital Systems** – Electronic systems that work using digital data.

Guidance: - While guiding each example, first complete the related textbook concept through activity or demonstration. Ensure that students clearly understand the scientific idea (such as observation, classification, magnetic force, motion, or material properties) before linking it to AI-based applications. Demonstrations using simple classroom materials should precede any discussion about digital devices. Encourage students to explain similarities between human scientific processes and machine-based detection in their own words. The connection to AI should be brief, concept-based, and strictly aligned with the syllabus content.

Exploring with AI

Understanding AI in Science Learning

Artificial Intelligence enables computers to analyse information, recognise patterns, and provide explanations in simple language. However, AI does not replace teachers, experiments, or textbooks. The textbook remains the primary and reliable source of scientific knowledge. AI servers only a supportive learning assistant.

Accessing AI for Science Learning

AI tools may be accessed through school computer laboratories under teacher guidance or through digital devices at home under parental supervision. AI must always be used responsibly and strictly for educational purposes.

Safe and Responsible Use of AI

While using AI tools, personal information such as name, address, school

details, or passwords must never be shared. AI responses must not be copied directly without understanding. All information generated by AI must be verified with the Science textbook. AI must not be used during examinations.

Responsible use of AI strengthens discipline, honesty, and scientific thinking.

The tasks given below are designed to strengthen scientific thinking through guided use of Artificial Intelligence tools. These tasks must be performed only under the supervision of a teacher in school or with the guidance of parents at home. AI tools are to be used strictly for educational purposes. These result of AI can be used in the tool1 and tool3 of assessment book given, All responses generated by AI must be verified with the Science textbook before final understanding or submission.

Writing Effective Prompts in Science

A prompt is the instruction or question given to an AI tool.

A good Science prompt should include:

- Class level (Class 6)
- Chapter name
- Clear concept
- Request for step-by-step explanation if needed

Note:- Clear prompts lead to clear scientific explanations.

Example Prompt: "I am a Class 6 student. Please explain how evaporation happens in simple language with one real-life example."

Types of Prompts in Science Learning

To obtain clear and meaningful responses from an AI tool, prompts should be written according to the purpose of learning. In Science, prompts may be framed in three main ways:

1. **Concept Understanding Prompt:** This type of prompt is used to understand a scientific concept clearly in simple language.
   Example: "I am a Class 6 student. Please explain how evaporation happens in simple language with one real-life example." This type of prompt helps in building basic conceptual clarity.
2. **Comparison or Analytical Prompt:** This type of prompt is used to compare two ideas or analyse differences and similarities.
   Example: "I am a Class 6 student. Please explain the difference between human observation and digital detection with two suitable examples." This type of prompt helps in developing reasoning and analytical thinking.
3. **Application or Activity-Based Prompt:** This type of prompt is used to apply scientific knowledge in an activity or real-life situation.
   Example: "I am a Class 6 student. Help me design a simple experiment to test plant growth and explain how digital measurement can be used to record the results." This type of prompt encourages practical application and creative thinking.

Can AI Make Mistakes?

AI systems are powerful, but they are not always perfect. AI cannot think or feel like humans. It depends completely on the data provided to it. If the dataset is incomplete or incorrect, the AI system may produce wrong output. Sometimes AI may generate information that sounds correct but is inaccurate. This is why AI-generated responses must always be verified.

Myths and Truths about AI	
Myth	**Truth**
AI can replace teachers and textbooks.	AI supports learning, but teachers guide understanding and textbooks remain the primary source of knowledge.
AI predictions are always accurate	AI predictions are based on available data and probabilities, so they may not always be exact.

Do You Know?

Artificial Intelligence can study satellite images to understand changes on Earth, such as the growth of cities, forests, and rivers. For more information ask AI about this topic.

Guidance: Before allowing any AI-based activity, instruct learners to read the relevant textbook section thoroughly. Demonstrate how to frame clear, subject-specific prompts including class level, chapter name, and concept. Monitor student interactions with AI tools and ensure that responses are verified with textbook content. Reinforce that AI-generated answers must not be copied without understanding. Promote responsible digital behaviour and academic honesty. AI should be used only to deepen conceptual clarity and not to complete work mechanically.

Chapter-wise AI-Supported Exploration

Tasks for Students to Explore with AI (Science – Semester 1)

Chapter	Foundational Level	Analytical Level	Creative Level
Chapter 1: The wonderful World of Science	• Define observation and measurement. • List tools used in experiments.	• Compare observation and interference. • Identify variables in a simple experiment.	• Design a simple experiment to test plant growth. • Compare human observation and digital detection.
Chapter 2 : Diversity in the Living World	• List characteristics of living organisms. • Classify animals based on habitat.	• Compare vertebrates using reasoning or measurement. • Prepare a . classification chart	• Compare biological classification with computer-based classification • Design a grouping system using observable features.

Chapter 3 : Mindful Eating – A Path to a Healthy Body	• List major nutrients. • Identify deficiency diseases.	• Analyse a balanced diet chart. • Categorise foods by nutrient content.	• Design a weekly balanced diet plan. • Compare human dietary choices with digital nutrition analysis.
Chapter 4 : Exploring Magnets	• Identify magnetic and non-magnetic materials • Label parts of a magnet.	• Explain magnetic field. • Investigate Earth as a magnet	• Explore magnetic sensors in devices. • Compare human detection and sensor detection.
Chapter 5 : Measurement of Length and Motion	• List standard units of length. • Identify types of motion.	• Convert units of measurement. • Calculate simple speed.	• Compare manual measurement and digital measurement. • Investigate motion sensors in daily life.

Students may undertake small community-oriented projects under teacher or parental guidance to apply scientific learning in practical situations. Activities such as maintaining simple observation records, classifying household materials, preparing balanced diet charts, or studying motion in daily life strengthen understanding and social responsibility.

Guidance: During the concluding discussion, guide learners to reflect on how the first five chapters collectively develop core scientific abilities. Help them articulate how observation, measurement, classification, and comparison are essential both in science learning and in intelligent systems. Encourage small, supervised community-based activities that apply textbook knowledge in real-life situations. Reinforce disciplined thinking, ethical technology use, and careful verification of information. The focus should remain on strengthening scientific understanding while responsibly exploring technological applications.

Conclusion: The first five chapters of this semester develop the core scientific skills of observation, measurement, classification, comparison, and experimentation. These same skills form the foundation of intelligent systems. Scientific thinking prepares learners to understand how machines observe, measure, and respond to the world. With careful study, responsible use of technology, and disciplined inquiry, scientific knowledge becomes meaningful and beneficial to society.

Mind Map