Government of Karnataka

Curiosity

Textbook of Science for Grade 6

6

SIXTH STANDARD

Part - 1

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राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

Karnataka Textbook Society (R.)
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FOREWORD

The National Education Policy 2020, envisages a system of education in the country that is rooted in Indian ethos and its civilisational accomplishments in all domains of human endeavour and knowledge while at the same time preparing the students to constructively engage with the prospects and challenges of the twenty-first century. The basis for this aspirational vision has been well laid out by the National Curriculum Framework for School Education (NCF-SE) 2023 across curricular areas at all stages. Having nurtured the students' inherent abilities touching upon all the five planes of human existence, the *pañchakośhas*, in the Foundational and the Preparatory Stages have paved the way for the progression of their learning further at the Middle Stage. Thus, the Middle Stage acts as a bridge between the Preparatory and the Secondary Stages, spanning three years from Grades 6 to 8.

This framework, at the Middle Stage, aims to equip students with the skills that are needed to grow, as they advance in their lives. It endeavours to enhance their analytical, descriptive, and narrative capabilities, and to prepare them for the challenges and opportunities that await them. A diverse curriculum, covering nine subjects ranging from three languages—including at least two languages native to India—to Science, Mathematics, Social Sciences, Art Education, Physical Education and Well-being, and Vocational Education promotes their holistic development.

Such a transformative learning culture requires certain essential conditions. One of them is to have appropriate textbooks in different curricular areas as these textbooks will play a central role in mediating between content and pedagogy—a role that will strike a judicious balance between direct instruction and opportunities for exploration and inquiry. Among the other conditions, classroom arrangement and teacher preparation are crucial to establish conceptual connections both within and across curricular areas.

The National Council of Educational Research and Training, on its part, is committed to providing students with such high-quality textbooks. Various Curricular Area Groups, which have been constituted for this purpose, comprising notable subject-experts, pedagogues, and practising teachers as their members, have made

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all possible efforts to develop such textbooks. *Curiosity*, Textbook of Science for Grade 6, is one of these. It has been developed in consonance with the recommendations of NEP 2020 and the NCF-SE 2023 to take students on a journey of experiential learning by citing examples from the world of the learners. The content stimulates curiosity, a sense of exploration, questioning, and critical thinking. The content seamlessly weaves together concepts from physics, chemistry, biology, and earth science, along with cross-cutting themes like environmental education, value education, inclusive education, and Indian Knowledge Systems (IKS). The textbook aims to engage learners through an integrated approach by including multiple activities and thoughtful use of technology. The textbook offers ample opportunities for reflection and group discussions.

To encourage creativity and innovation, it is feasible to regard students as active participants in the learning process, rather than mere recipients of a predetermined set of knowledge. This can only be achieved if the necessary number of hours are dedicated to science teaching–learning annually as outlined in NCF-SE 2023. The pedagogical approach of the textbook also considers how important it is for students to think critically, reason well and make decisions. It also provides students with numerous opportunities to learn from each other, making the learning experience more engaging for both teachers and students.

However, in addition to this textbook, students at this stage should also be encouraged to explore various other learning resources. School libraries play a crucial role in making such resources available. Besides, the role of parents and teachers will also be invaluable in guiding and encouraging students to do so.

With this, I express my gratitude to all those who have been involved in the development of this textbook and hope that it will meet the expectations of all stakeholders. At the same time, I also invite suggestions and feedback from all its users for further improvement in the coming years.

Dinesh Prasad Saklani
Director
National Council of Educational
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New Delhi
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About the Book

Curiosity, Textbook of Science for Grade 6 learners has been crafted in alignment with the recommendations of the National Education Policy (NEP) 2020 and the National Curriculum Framework for School Education (NCF-SE) 2023. The policy advocates a radical shift from a content-based education to a competency-based education, particularly in the realm of science. Therefore, the formulation of curricular goals for Science, subsequent competencies and learning outcomes are tailored towards competency-based learning. These curricular goals encompass various scientific concepts, including matter, the physical and living world, health, hygiene, and the exploration of the interface between science, society and technology. Additionally, the goals focus on the nature of science, its processes, historical and contemporary aspects of the development of science and science communication. While these goals are explicitly articulated, they are interdependent and collectively contribute to a better understanding of the world around us. Accordingly, the chapters of this textbook are structured around creative activities, reflective questions, processes and illustrations. The integration of the concepts from biology, chemistry, physics and earth science, and cross-cutting themes, such as value education, inclusive education, Indian Knowledge Systems (IKS) and environmental education have been interwoven in the content. Thus, the textbook aims to provide experience-based learning, rather than simply reading and memorising the concepts.

In the Middle Stage, science teaching–learning adopts an integrated approach. This integrated approach develops fundamental capacities across biology, chemistry, physics and earth science. The use of an integrated approach helps the learners to appreciate the interrelations between subjects and make sense of their observations and experiences.

Curiosity, Textbook of Science for Grade 6, comprises twelve chapters. As the name of the textbook suggests, there are numerous opportunities for the learners to explore the world of science and its nature. Through the chapters, learners will embark on a journey that will connect them to the world around and spark curiosity for further exploration. The hands-on activities embedded within each chapter engages the learners and provide them an opportunity to reflect on learning. These activities are inclusive in nature. Some activities require both the teacher and learners to prepare in advance.

Chapter 1, titled 'The Wonderful World of Science', provides a holistic view of the new topic of Science introduced in the Middle Stage. It showcases, through examples, the essence of Science—a way of thinking, observing, and finding out by doing, and by asking questions. This chapter

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weaves together the concepts covered in the rest of the book, and aims to excite the readers as they start their adventures into the world of science. There are no assessment exercises in this chapter and is designed to be **non-evaluative**. Also, every chapter in the book begins with an introduction that makes the learners curious and tries to show different ways with which the goals of the curriculum can be achieved effectively. The chapters begin with the stories related to real-life situations, these are meant to capture learners' interest and connect them with what is already known. The various activities given are based on scientific processes, designed to provide hands and minds-on experiences. Following each activity, there are questions to help learners understand and assess how well they have grasped the information. Questions are significant in the learning process. They help learners to explore and reinforce their understanding. One will also find many thought-provoking questions designed to encourage deep thinking, self-awareness and critical analysis. These questions prompt learners to ponder and delve deeper into their thoughts.

In order to sustain the interest of the readers, some of the challenging ideas, additional information, poems, stories, strange facts and other interesting materials are also presented as add on **non-evaluative** content in the boxes labelled 'Do you know?', 'More to know!', 'Think it over!' and 'More to do!'. The thrill of scientific inquiry comes from pursuing the unknown, giving learners the opportunity to think and explore beyond the syllabus. Some chapters also include a section called 'Know a scientist', which presents the contributions of Indian scientists related to that concept. All these box items, including brief biographies of scientists, are **non-evaluative**. The important ideas and steps in understanding a given concept of science are included as 'Keywords' at the end of each chapter. These 'Keywords' will help learners to acknowledge various ideas and encourage them to think more deeply about the content. The keywords related to scientific processes depict the steps or procedure involved in the scientific activities. These words guide learners on how scientific knowledge is generated, tested and applied. 'Summary' offers an overview of the chapter's main points, reinforcing the key ideas discussed. It serves to outline the content presented in the chapter. A **non-evaluative** interesting element that has been incorporated in some of the chapters is the introduction of certain verses from various Indian texts to promote rootedness in the learners as envisaged in NEP 2020.

The primary aim of *Curiosity* is to prepare the children for becoming the responsible members of the society, and therefore efforts have been made to raise awareness about various issues, such as gender, region, environment, health and hygiene, water scarcity and energy conservation. Activities given in the book endeavour to promote peer-learning and group activities.

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The assessment exercises, 'Let us enhance our learning', play a vital role in the learning process. They help to reinforce the understanding and identify areas for improvement, making them essential components of effective teaching and learning. Assessment consists of various exercises, from pictorial questions to creating puzzles and multiple-choice questions, to create a challenging and interesting experience for the learners. These questions also facilitate the evaluation of various competencies expected to be developed through a particular chapter. Peer and group activities to explore answers to the questions are also encouraged.

A significant feature of the book is what we termed as 'Learning further'. In this section, some projects and activities are designed to increase learners' interaction with experts, teachers, parents and the wider community. Learners are encouraged to gather diverse information and draw their own conclusions.

The textbook is just one way to learn. Learners should enhance their knowledge by exploring and observing their surroundings. Information and Communication Technology (ICT) can also be a valuable tool for learners' learning and development, when used appropriately. Learners can explore ICT with the help of Quick Response (QR) codes provided in the textbook. QR codes make the reading experiences more interactive and enjoyable. These QR codes that have additional resources can be accessed by the learners at their own convenience and pace. These additional resources include videos, puzzles, games, quizzes, audio, documentaries and additional content on some topics.

At the end of this book, learners will find a page titled 'It is not the end, my friend!'. This includes words of encouragement, motivating learners to continue their educational journey and ignite their curiosity for further learning. It is meant to be **non-evaluative**.

May the journey of every learner be filled with joy and continue the curiosity in the higher grades as well!

We express our gratitude to all the members of the textbook development committee for their contributions in shaping this textbook. We look forward to the feedback of the readers.

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ಮುನ್ನುಡಿ

2025–26 ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ರಾಜ್ಯದ ಎಲ್ಲಾ 6ನೇ ತರಗತಿ ವಿದ್ಯಾರ್ಥಿಗಳ ಕಲಿಕೆಗಾಗಿ ಲಭ್ಯವಾಗುತ್ತಿರುವ 'ಕುತೂಹಲ' ವಿಜ್ಞಾನ ಪಠ್ಯಪುಸ್ತಕವನ್ನು ಎನ್.ಸಿ.ಆರ್.ಟಿ ಯು 2020 ರ ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿ ಹಾಗೂ 2023 ರ ರಾಷ್ಟ್ರೀಯ ಪಠ್ಯಕ್ರಮ ಚೌಕಟ್ಟು (ಶಾಲಾ ಶಿಕ್ಷಣ)ಗಳ ಆಶಯಗಳನ್ನು ಒಳಗೊಂಡು ರಚಿಸಿದೆ. ವಿದ್ಯಾರ್ಥಿಗಳ ಅಂತರ್ಗತ ಸಾಮರ್ಥ್ಯಗಳ ಅಭಿವೃದ್ಧಿಯೊಂದಿಗೆ ಅವರ ವಿಶ್ಲೇಷಣಾತ್ಮಕ, ವಿವರಣಾತ್ಮಕ, ಪ್ರಾಯೋಗಿಕ, ಅನ್ವೇಷಣಾತ್ಮಕ ಮತ್ತು ನಿರೂಪಣಾತ್ಮಕ ಸಾಮರ್ಥ್ಯಗಳನ್ನು ಪೋಷಿಸಬೇಕಿದೆ. ಈ ಹಿನ್ನೆಲೆಯಲ್ಲಿ 'ಕುತೂಹಲ' ವಿಜ್ಞಾನ ಪಠ್ಯಪುಸ್ತಕ ಮಹತ್ತರವಾದ ಪಾತ್ರವನ್ನು ವಹಿಸುತ್ತದೆ ಎಂದರೆ ತಪ್ಪಾಗಲಾರದು.

ಪಠ್ಯಾಧರಿತ ಶಿಕ್ಷಣದಿಂದ ಸಾಮರ್ಥ್ಯಾಧರಿತ ಶಿಕ್ಷಣಕ್ಕೆ ಬದಲಾಗುತ್ತಿರುವ ಈ ಸನ್ನಿವೇಶಕ್ಕೆ ಪೂರಕವಾಗಿ, ಶೈಕ್ಷಣಿಕ ಗುರಿಗಳ ಸಾಧನೆಗೆ ಮತ್ತು ಸಾಮರ್ಥ್ಯಗಳು, ಕಲಿಕಾ ಫಲಗಳನ್ನು ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಧಿಸಲು 'ಕುತೂಹಲ' ಪಠ್ಯಪುಸ್ತಕ ಸಹಾಯಕವಾಗಿದೆ. ಶೈಕ್ಷಣಿಕ ಗುರಿಗಳನ್ನು ಸಾಧಿಸಲು ಅನುಕೂಲವಾಗುವಂತೆ ಹಲವು ವೈಜ್ಞಾನಿಕ ಪರಿಕಲ್ಪನೆಗಳು, ಭೌತಿಕ ಮತ್ತು ಜೀವಜಗತ್ತು, ಆರೋಗ್ಯ, ಸ್ವಚ್ಛತೆ, ತಂತ್ರಜ್ಞಾನ ಮುಂತಾದ ವಿಷಯಗಳನ್ನು ಇದು ಒಳಗೊಂಡಿದೆ. ವಿದ್ಯಾರ್ಥಿಗಳ ಕುತೂಹಲ ಮತ್ತು ಸೃಜನಾತ್ಮಕ ಸಾಮರ್ಥ್ಯಗಳನ್ನು ಅಭಿವೃದ್ಧಿ ಪಡಿಸಲು ಅನುಕೂಲವಾಗುವಂತೆ ಅಳವಡಿಸಿಕೊಂಡಿರುವ ಸೃಜನಾತ್ಮಕ ಚಟುವಟಿಕೆಗಳು, ಪ್ರತಿಫಲನಾತ್ಮಕ ಪ್ರಶ್ನೆಗಳು, ಪಠ್ಯಗಳಲ್ಲಿ ಬಳಸಿಕೊಂಡಿರುವ ನಿರೂಪಣೆ ಮತ್ತು ಉದಾಹರಣೆಗಳು ಅರ್ಥಗರ್ಭಿತವಾಗಿವೆ. ಜೀವಶಾಸ್ತ್ರ, ಭೌತಶಾಸ್ತ್ರ, ರಸಾಯನಶಾಸ್ತ್ರ ಮತ್ತು ಭೂ ವಿಜ್ಞಾನದ ಪರಿಕಲ್ಪನೆಗಳ ಜೊತೆಗೆ ಭಾರತೀಯ ಜ್ಞಾನ ವ್ಯವಸ್ಥೆ, ಮೌಲ್ಯ ಶಿಕ್ಷಣ, ಪರಿಸರ ವಿಷಯಗಳನ್ನು ಸಮನ್ವಯ ಮಾಡಿಕೊಂಡಿರುವುದರಿಂದಾಗಿ ಸಮಗ್ರ ಶಿಕ್ಷಣಕ್ಕೆ ಮತ್ತು ಸಂಯೋಜಿತ ವಿಧಾನಕ್ಕೆ ಈ ಪುಸ್ತಕ ಮಾದರಿಯಾಗಿ ನಿಲ್ಲಬಲ್ಲದು.

ಕಲಿಕಾರ್ಥಿಗಳು ತಮ್ಮ ಅನುಭವಗಳು ಮತ್ತು ತಮ್ಮ ಸುತ್ತಲಿನ ಪರಿಸರವನ್ನು ವೀಕ್ಷಣೆ ಮಾಡುತ್ತಾ ಕಲಿಯಲು ಸಾಧ್ಯವಾಗುಂತೆ ಅನುಭಾತ್ಮಕ ಕಲಿಕೆಗೆ ಹೆಚ್ಚಿನ ಆದ್ಯತೆ ನೀಡರುವುದರಿಂದ ಪರಿಕಲ್ಪನೆಗಳನ್ನು ಕಂಠಪಾಠ ಮಾಡಿ ಕಲಿಯುವ ಅವಕಾಶವನ್ನು ತಡೆಯುತ್ತದೆ. ಅಲ್ಲದೆ ಮಕ್ಕಳನ್ನು ಸಮಾಜದ ಜವಾಬ್ದಾರಿಯುತ ವ್ಯಕ್ತಿಯನ್ನಾಗಿ ಮಾಡಲು ಲಿಂಗ, ಪರಿಸರ, ಆರೋಗ್ಯ, ಸ್ವಚ್ಛತೆ, ನೀರಿನ ಕೊರತೆ, ಶಕ್ತಿಯ ಉಳಿತಾಯ ಮುಂತಾದ ಸವಾಲಿನ ವಿಷಯಗಳ ಬಗ್ಗೆ ಅವರಲ್ಲಿ ಅರಿವನ್ನು ಮುಡಿಸುತ್ತದೆ. ಅದಕ್ಕಾಗಿ ಸಹಪಾಠಿಗಳೊಂದಿಗೆ ಹಾಗೂ ಗುಂಪಿನಲ್ಲಿ ಹೆಚ್ಚು ಕಲಿಯಲು ಅವಕಾಶ ಇರುವ ಚಟುವಟಿಕೆಗಳನ್ನು ವ್ಯಾಪಕವಾಗಿ ಅಳವಡಿಸಲಾಗಿದೆ. ಕಲಿಕಾರ್ಥಿಗಳಲ್ಲಿ ಹೆಚ್ಚು ಆಸಕ್ತಿ ಹಾಗೂ ನಾವೀನ್ಯ ಆಲೋಚನೆಗಳನ್ನು ಬೆಳೆಸಲು ಪೂರಕವಾಗುವಂತೆ 'ನಿಮಗಿದು ತಿಳಿದಿದೆಯೇ?' 'ಹೆಚ್ಚು ತಿಳಿಯಿರಿ', 'ಇದರ ಬಗ್ಗೆ ಆಲೋಚಿಸಿರಿ' ಎಂಬ ಭಾಗಗಳನ್ನು ಪಠ್ಯಪುಸ್ತಕದಲ್ಲಿ ಅಳವಡಿಸಲಾಗಿದೆ. 'ಹೆಚ್ಚುವರಿಯಾಗಿ ಕಲಿಯಿರಿ' ಎಂಬ ಭಾಗಗಳಿಂದ ಕಲಿಕಾರ್ಥಿಗಳು ಯೋಜನೆಗಳು ಮತ್ತು ಚಟುವಟಿಕೆಗಳಲ್ಲಿ ಸಕ್ರಿಯವಾಗಿ ಪಾಲ್ಗೊಳ್ಳಲು ಸಹಕಾರಿಯಾಗಿದೆ. ತನ್ನ ಸುತ್ತಲಿನ ಪ್ರಪಂಚವನ್ನು ವೀಕ್ಷಣೆ ಮಾಡಿ ಕಲಿಯಲು ಅವಕಾಶ ನೀಡಿರುವಂತೆ ಮಾಹಿತಿ ಮತ್ತು ತಂತ್ರಜ್ಞಾನದ ಮೂಲಕವೂ ಕಲಿಯಲು ಅವಕಾಶವನ್ನು ಮಾಡಿಕೊಡಲಾಗಿದೆ. ಅಗತ್ಯವಿರುವೆಡೆ ನೀಡಿರುವ ಕ್ಯೂಆರ್ ಸಂಕೇತಗಳನ್ನು ಬಳಸಿ ಸಂತಸದಾಯಕ ಕಲಿಕೆಯಲ್ಲಿ ಕಲಿಕಾರ್ಥಿಗಳು ತೊಡಗಿಸಿಕೊಳ್ಳಬಹುದಾಗಿದೆ.

ವೈವಿಧ್ಯಮಯವಾದ ಮೌಲ್ಯಾಂಕನಕ್ಕೆ ಈ ಪಠ್ಯಪುಸ್ತಕ ಅವಕಾಶ ನೀಡಿದೆ. ನೀಡಿರುವ ಚಿತ್ರ ಸಹಿತ ಪ್ರಶ್ನೆಗಳು, ಒಗಟುಗಳು ಮತ್ತು ಬಹು ಆಯ್ಕೆಯ ಪ್ರಶ್ನೆಗಳು ಕಲಿಕಾರ್ಥಿಗಳಲ್ಲಿ ಆಸಕ್ತಿ ಮತ್ತು ಸವಾಲುಗಳನ್ನು ಸೃಜಿಸುತ್ತವೆ. ಅಲ್ಲದೆ ಕಲಿಕಾರ್ಥಿಗಳ ಸಾಮರ್ಥ್ಯಗಳನ್ನು ಹೊಮ್ಮಿಸಲು ಅವಕಾಶವನ್ನು ನೀಡುತ್ತವೆ. ತಮ್ಮ ಸಹಪಾಠಿಗಳ ಸಹಯೋಗ ಮತ್ತು ಗುಂಪಿನ ಮೂಲಕವು ಉತ್ತರವನ್ನು ಕಂಡುಕೊಳ್ಳಲು ಮುಕ್ತತೆ ನೀಡಲಾಗಿದೆ.

ಇಷ್ಟೆಲ್ಲ ವಿಶೇಷ ಗುಣಲಕ್ಷಣಗಳನ್ನು ಹೊಂದಿರುವ 'ಕುತೂಹಲ' ಪಠ್ಯಪುಸ್ತಕವನ್ನು ತರಗತಿ ಪ್ರಕ್ರಿಯೆಯಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಲು ಸುಗಮಕಾರರು ತಮ್ಮ ತರಗತಿಯನ್ನು ಅದಕ್ಕೆ ಪೂರಕವಾಗುವಂತೆ ವ್ಯವಸ್ಥೆಗೊಳಿಸಿಕೊಳ್ಳುವುದು ಹಾಗೂ ಪೂರ್ವಭಾವಿ ಸಿದ್ಧತೆಯೊಂದಿಗೆ ತರಗತಿ ನಿರ್ವಹಣೆ ಮಾಡುವುದು ತುಂಬಾ ಅಗತ್ಯವೆನಿಸುತ್ತದೆ. ಪರಿಕಲ್ಪನೆಗಳ ವಿವರಣೆಗಷ್ಟೆ ಅವಕಾಶ ಇರದೆ ಪ್ರಯೋಗ, ಅನ್ವೇಷಣೆ, ಚರ್ಚೆ, ಯೋಜಿತ ಕಾರ್ಯಗಳು, ಸಂವಾದ, ಆಟ, ಪರಸ್ಪರ ತೊಡಗಿಸಿಕೊಳ್ಳುವಿಕೆ ಹಾಗೂ ತಾರ್ಕಿಕವಾಗಿ ಆಲೋಚಿಸಲು ಸಾಧ್ಯವಾಗುವಂತಹ ಗುಂಪು ಚಟುವಟಿಕೆಗಳು ಒಳಗೊಂಡ ಸುಗಮಗಾರಿಕೆಯನ್ನು ಈ ಪಠ್ಯಪುಸ್ತಕ ನಿರೀಕ್ಷೆ ಮಾಡುತ್ತದೆ. ಈ ನಿರೀಕ್ಷೆಯನ್ನು ನಮ್ಮ ಸುಗಮಕಾರರು ಹುಸಿ ಮಾಡುವುದಿಲ್ಲ ಎಂಬ ನಂಬಿಕೆ ರಾಜ್ಯ ಶಿಕ್ಷಣ ಇಲಾಖೆಯದ್ದಾಗಿದೆ.

ಎನ್.ಸಿ.ಆರ್.ಟಿ ಪ್ರಕಟಿಸಿರುವ ಈ ಪಠ್ಯಪುಸ್ತಕವನ್ನು ಕರ್ನಾಟಕ ರಾಜ್ಯದ ವಿದ್ಯಾರ್ಥಿಗಳು ರಾಷ್ಟ್ರಮಟ್ಟದ ಎಲ್ಲಾ ಅವಕಾಶಗಳನ್ನು ತನ್ನದಾಗಿಸಿಕೊಳ್ಳಬೇಕು ಎಂಬ ಆಶಯದೊಂದಿಗೆ 2025–26 ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅಳವಡಿಸಿಕೊಳ್ಳಲು ಅನುಮತಿ ನೀಡಿದ ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ಶಿಕ್ಷಣ ಇಲಾಖೆಯ ಎಲ್ಲಾ ಹಂತದ ಅಧಿಕಾರಿಗಳಿಗೆ ಹಾಗೂ ಪಠ್ಯಪುಸ್ತಕ ಬಳಕೆಗೆ ಅವಕಾಶ ನೀಡಿದ ಎನ್.ಸಿ.ಆರ್.ಟಿ ಯ ಎಲ್ಲಾ ಹಂತದ ಅಧಿಕಾರಿಗಳಿಗೆ ಹಾಗೂ ಪ್ರಕಾಶನ ವಿಭಾಗಕ್ಕೆ ಹೃತ್ಪೂರ್ವಕ ಧನ್ಯವಾದಗಳು.

ಶ್ರೀ ಎಂ. ¦. aiÁzÃUËq
ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು
ಕರ್ನಾಟಕ ಪಠ್ಯಪುಸ್ತಕ ಸಂಘ (ರಿ.)
ಬೆಂಗಳೂರು.

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CONTENTS

Foreword *iii*

About the Book *v*

Chapter 1
The Wonderful World of Science **1**

Chapter 2
Diversity in the Living World **9**

Chapter 3
Mindful Eating: A Path to a Healthy Body **35**

Chapter 4
Exploring Magnets **61**

Chapter 5
Measurement of Length and Motion **79**

Chapter 6
Materials Around Us **101**

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Chapter 1

The Wonderful World of Science

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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!

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', which is where the title of this book comes from.

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

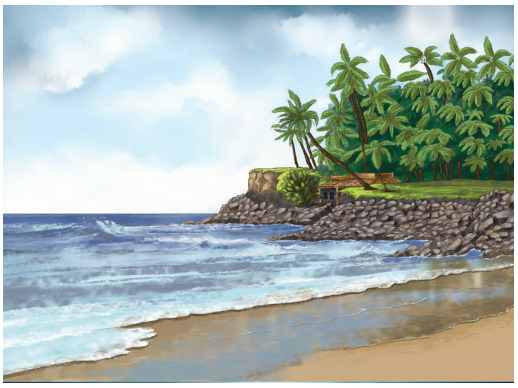


A mountainous region

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A Desert



A Coast

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.



An underwater view of an Ocean



A Galaxy

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

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

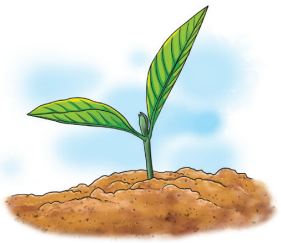
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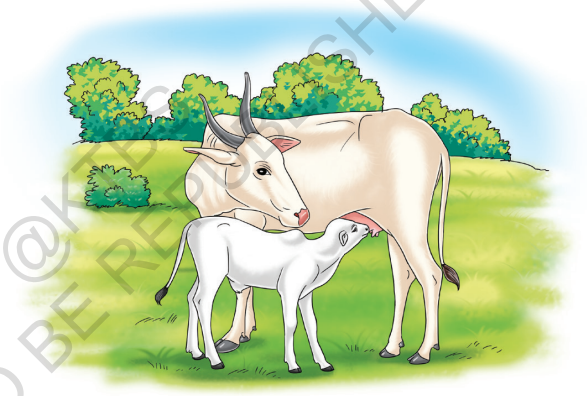
daily lives. And guess what happens as we discover more and more? We start realising that these ideas are all connected.

What will we explore with the help of this book? ?

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?

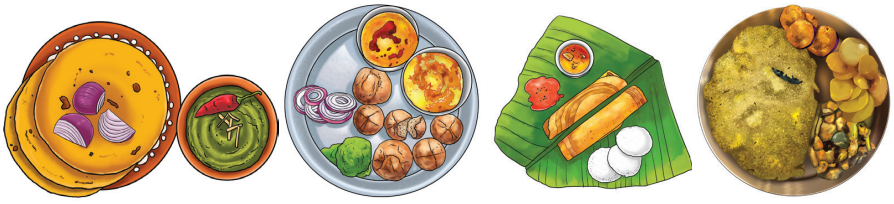






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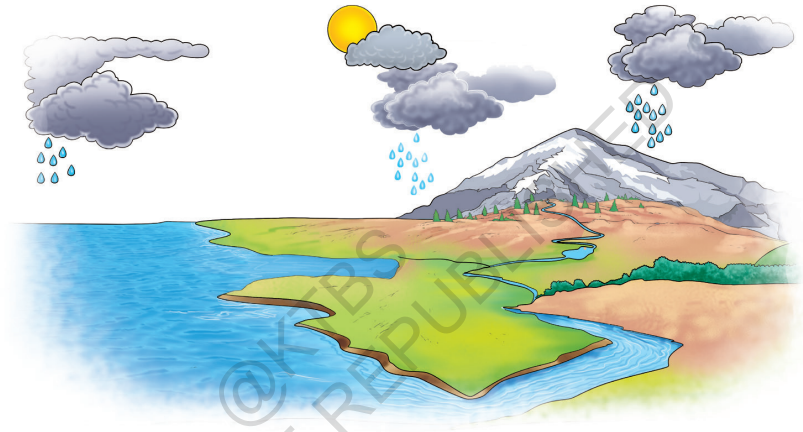
Of course, to grow, we need food to eat, and especially in a large and diverse country like India, food is so fascinating. Across the country, we have different cuisines with their many tasty dishes. What are they made of? How do we find out?



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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!



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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?



Chapter 1.indd 4 10/18/2024 9:49:27 AM

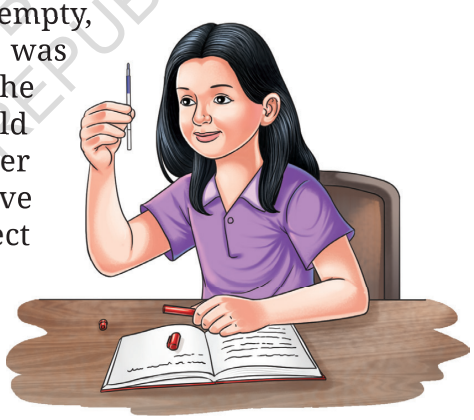
We will have an almost unending list of questions about everything on Earth as we further explore this book. But why limit our questions to the Earth alone? We can ask questions on things beyond—the Sun, the Moon, and the millions of stars that shine in the sky!

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.**

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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?

Chapter 1.indd 5 10/18/2024 9:49:27 AM

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!

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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

Chapter 1.indd 6 10/18/2024 9:49:28 AM

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.

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

Chapter 1.indd 7 10/18/2024 9:49:28 AM



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!!

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Chapter 1.indd 8 10/18/2024 9:49:29 AM

Chapter 2

Diversity in the Living World

“ छायामन्यस्य कुर्वन्ति तिष्ठन्ति स्वयमातपे ।
फलान्यपि परार्थाय वृक्षाः सत्पुरुषा इव ॥

(सुभाषित)

Trees stand in the Sun and give shade to others. Their fruits are also for others. Likewise, good people bear all hardships and bring welfare to others. They give to others whatever they have earned.

(Wise saying) ”

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It is a pleasant morning after yesterday’s refreshing rain. Dr Raghu and Maniram *chacha* (uncle) have been invited to the school by the science teacher, Madam Sulekha, to

facilitate an exciting nature walk. Dr Raghu is a scientist at the nearby Research Laboratory and Maniram *chacha* is an elderly person from a nearby community. Maniram *chacha* 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 Raghu 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 Raghu advises the students to notice the variety of smells in the park and emphasises respecting all living creatures and observing them without disturbing. Maniram *chacha* 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 Raghu and Maniram *chacha*.



The students can hear the chirping of birds. Dr Raghu informs them that each bird has a unique chirp. This is an example of diversity in nature. Dr Raghu requests Maniram *chacha* to mimic calls of some birds. Maniram *chacha* 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.

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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.

Chapter 2.indd 10 10/4/2024 3:17:55 PM

- 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.



(a) Grass *(b) Tulsi (Holy Basil)* *(c) Hibiscus (Gudhal)*

Fig. 2.1: Examples of different features of some plants

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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				

Chapter 2.indd 11 10/4/2024 3:18:06 PM

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				

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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.

Chapter 2.indd 12 10/4/2024 3:18:06 PM

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?



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- 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.

Chapter 2.indd 13 10/4/2024 3:18:07 PM

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? This shows that 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).

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Chapter 2.indd 14 10/4/2024 3:18:07 PM



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 are 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 2.3 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.

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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.

Chapter 2.indd 15 10/4/2024 3:18:07 PM

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

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(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, a mango tree (Fig. 2.3a).



(b) Shrub



(c) Herb

Fig. 2.3: Types of plants

Chapter 2.indd 16 10/4/2024 3:19:51 PM

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).

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**. Some plants creep along the ground and are called **creepers**.

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. 2.4a and Fig. 2.4b?



(a) Hibiscus leaf with reticulate venation

(b) Banana leaf with parallel venation

(c) 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).

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Chapter 2.indd 17 10/4/2024 3:19:52 PM

Do you think that plants can be grouped on the basis of venation present in their leaves?

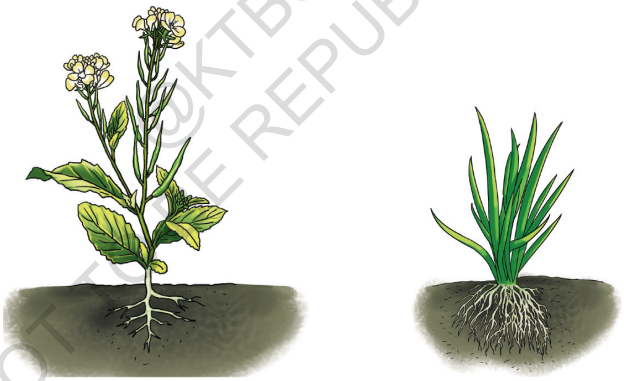
Now, let us try to **explore** roots of the plants. Do all plants have roots? Are these roots similar?

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. 2.5a and Fig. 2.5b?

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(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. 2.5a. 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. 2.5b 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?

Chapter 2.indd 18 10/4/2024 3:19:55 PM

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.	Lemongrass	Parallel	Fibrous
2.			
3.			
4.			
5.			

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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.

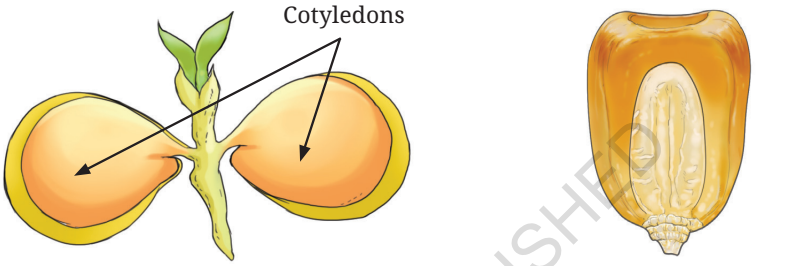
Chickpea (*chana*) is another example of a plant with taproots and reticulate venation in leaves. Wheat is an example of a plant with fibrous roots and parallel venation in its leaves.

Chapter 2.indd 19 10/4/2024 3:19:55 PM

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.

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Chapter 2.indd 20 10/4/2024 3:19:55 PM

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?

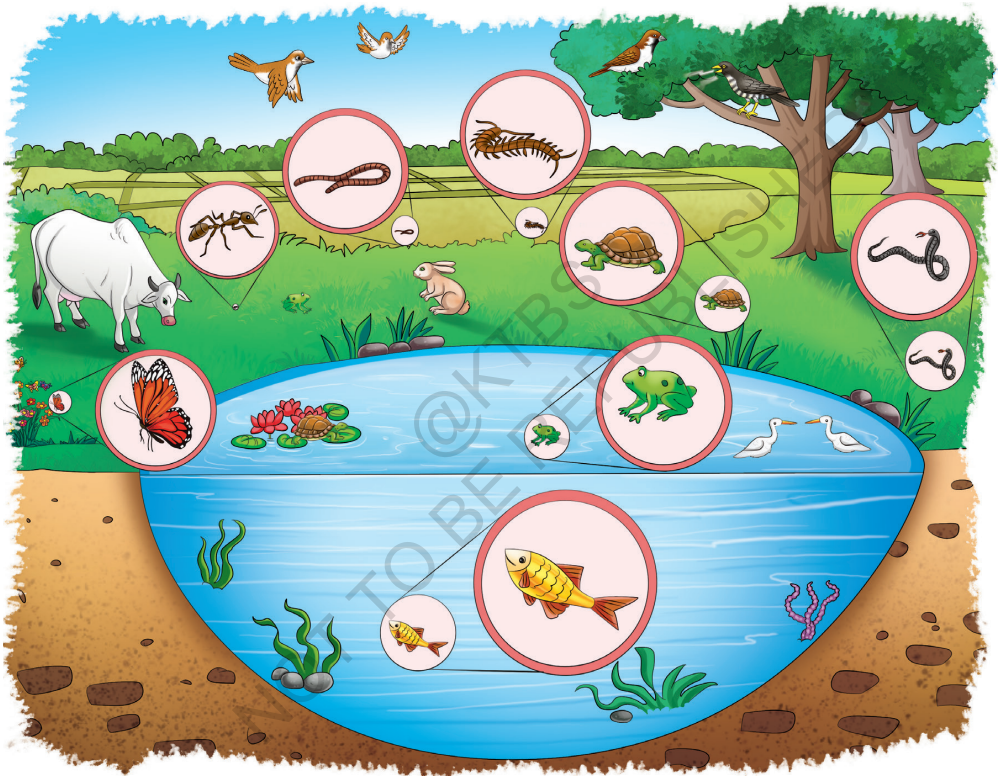


Fig. 2.7: Diversity in animals

- 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.

Chapter 2.indd 21 10/4/2024 3:19:56 PM

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.

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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.

Chapter 2.indd 22 10/21/2024 9:59:16 AM

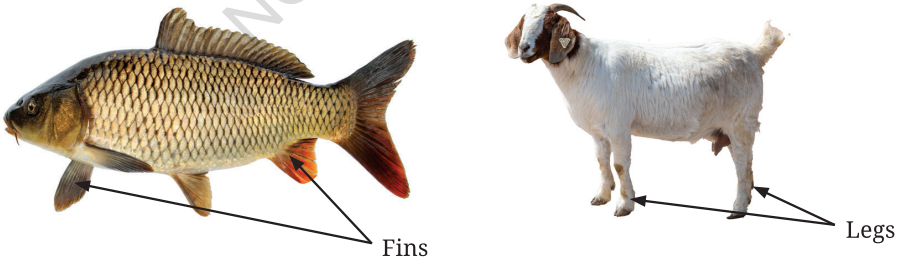
Success Story—Save Silent Valley Movement

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. Fishes live 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

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Chapter 2.indd 23 10/21/2024 9:59:39 AM

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	Deodar tree	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). These trees are conical in shape and have flexible and sloping branches.

Notice that these two types of plants found in different regions are different



Fig. 2.10: A deodar tree in the mountains

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Chapter 2.indd 24 10/21/2024 9:59:42 AM

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.

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?

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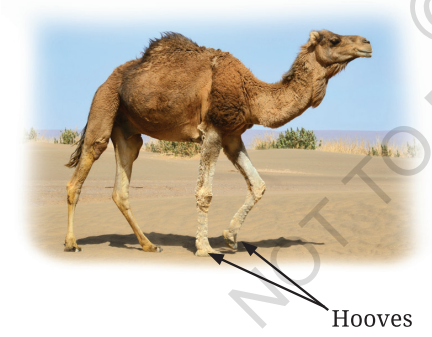


Fig. 2.11: A camel living in the hot desert of Rajasthan

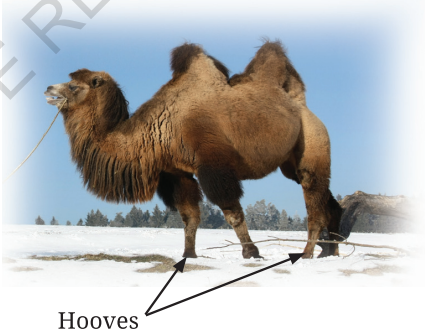


Fig. 2.12: A camel living in the cold desert of Ladakh

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 cold desert are comparatively shorter than those found in a hot desert. These short legs allow them to walk easily in mountainous regions.

Chapter 2.indd 25 10/21/2024 9:59:45 AM

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.



(a) Rhododendron in Nilgiris



(b) Rhododendron in Sikkim

Fig. 2.13: Different features of rhododendrons in two different regions

Maya talks about seeing plants with beautiful bright flowers, **rhododendrons**, in the Shola forests of Nilgiris (Fig. 2.13a). 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. 2.13b). So, even plants such as rhododendrons may exhibit different features in different regions to survive the conditions of those regions.

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.

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Chapter 2.indd 26 10/21/2024 9:59:47 AM

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.

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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.



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.

Chapter 2.indd 27 10/21/2024 9:59:50 AM

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**.

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.

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Do you know?

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 and Maharashtra.



Bengal Tiger



Cheetah



Great Indian Bustard

Chapter 2.indd 28 10/21/2024 10:00:13 AM

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.



Sacred grove from the Western Ghats

More to know!

Find out about the sacred groves in your region.

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

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Keywords

Adaptation
Amphibians
Aquatic
Biodiversity
Cotyledon
Dicot plants
Fibrous root
Habitat
Herbs
Monocot plants
Parallel venation
Reticulate venation
Sacred groves
Shrubs
Taproot
Terrestrial
Tree
Venation
Analyse
Compare
Create
Explore
Group
Observe
Record
Relate

Chapter 2.indd 29 10/21/2024 10:00:37 AM

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.

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Chapter 2.indd 30 10/21/2024 10:00:39 AM

Let us enhance our learning

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



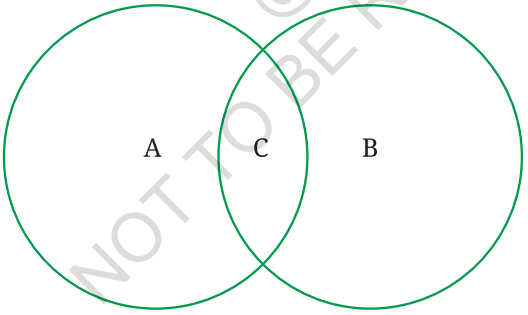
(a) Wheat



(b) Kidney beans

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. 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?

4. 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?

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Chapter 2.indd 31 10/4/2024 3:22:42 PM



(a) Mountain Goat

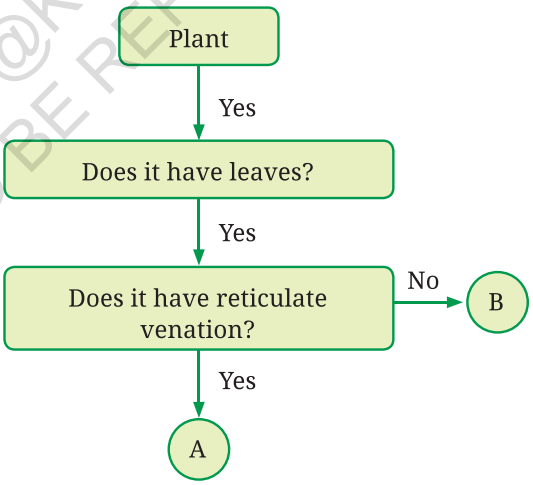


(b) Goat found in the plains

5. 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.

6. 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?

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



8. Raj argues with his friend Sanjay that "*Gudhal* (hibiscus) plant is a shrub." What questions can Sanjay ask for clarification?

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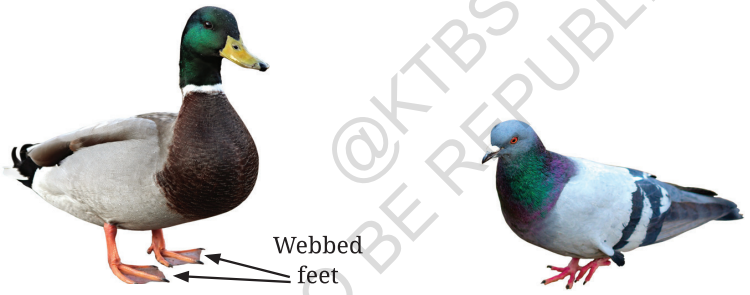
9. Based on the information in the table, find out examples of these plants for each group.

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?

10. 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*

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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.

Chapter 2.indd 33 11/4/2024 12:03:29 PM

- 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.

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Chapter 2.indd 34 10/4/2024 3:22:52 PM

Chapter 3

Mindful Eating: A Path to a Healthy Body

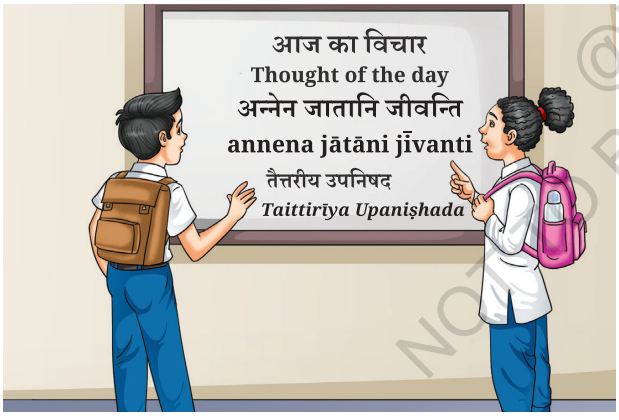
कोऽरुक्? कोऽरुक्? कोऽरुक्?
हितभुक् मितभुक् ऋतुभुक्

(सुभाषित)

Who is healthy? Who is healthy? Who is healthy? One who eats food that is wholesome, in moderate quantities, and appropriate for the season, time, and place.

(*Wise saying*)

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Medu and Mishti read 'thought of the day' on the school noticeboard every day. Today's thought, *'annena jātāni jīvanti'*, makes them curious. Mishti tells Medu that it is a Sanskrit saying which means 'food gives life to living beings.'

Let us try to understand the significance of this saying.

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.

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Table 3.1: Food items consumed over a week

Day	Food items
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	
Sunday	

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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.

Chapter 3.indd 36 10/4/2024 3:16:48 PM

- 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 crops	Traditional food items eaten	Beverages
Punjab	Maize, wheat, chickpea, pulses	*Makki di roti*, *sarson da saag*, *chhole bhature*, *parantha*, halwa, *kheer*	Lassi, *chhach* (buttermilk), milk, tea
Karnataka	Rice, ragi, *urad*, coconut	Idli, dosa, sambhar, coconut chutney, ragi *mudde*, *palya*, rasam, rice	Buttermilk, coffee, tea
Manipur	Rice, bamboo, soya bean	Rice, *eromba* (chutney), *utti* (yellow peas and green onion curry) *singju*, *kangsoi*	Black Tea
Any other			

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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.

Chapter 3.indd 37 10/4/2024 3:16:48 PM

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.

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(a) Chulha (Traditional stove)



(b) Modern gas stove



(c) Sil-batta (Stone grinder)



(d) Electrical grinder

Fig. 3.1: Change in cooking tools over time

Chapter 3.indd 38 10/4/2024 3:17:01 PM

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?

Medu and Mishti 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'.

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Chapter 3.indd 39 10/4/2024 3:17:16 PM



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?

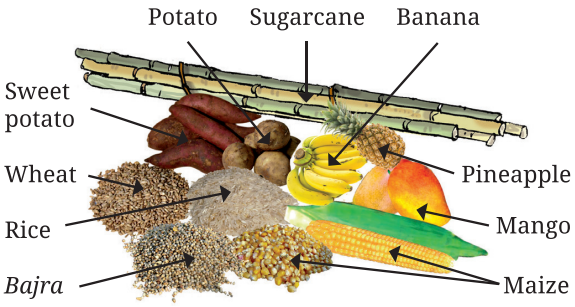


Fig. 3.2: Some sources of carbohydrates

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).

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.

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Chapter 3.indd 40 10/4/2024 3:17:26 PM

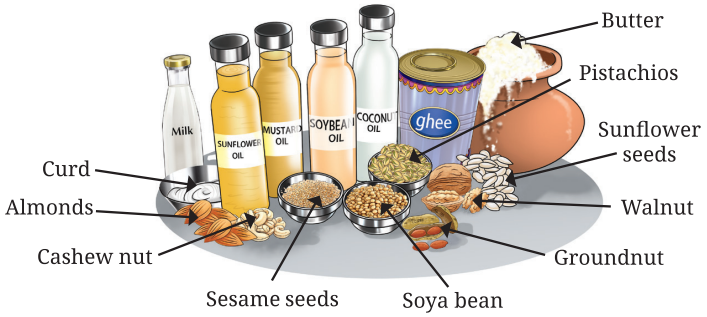


Fig. 3.3: Some sources of fats

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 .



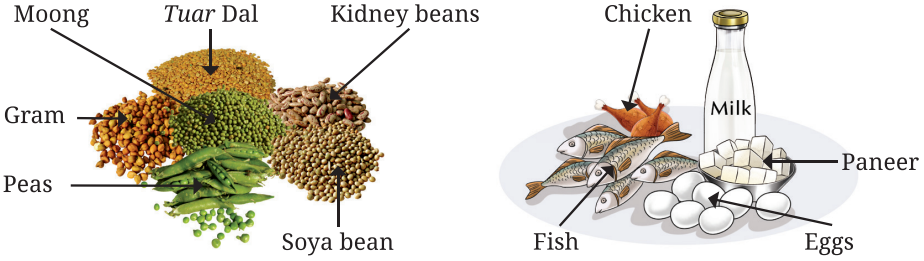
Polar bear

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.

More to know!

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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

Chapter 3.indd 41 10/4/2024 3:18:02 PM

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.



Mushroom

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**.

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Chapter 3.indd 42 10/4/2024 3:19:26 PM

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.

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Chapter 3.indd 43 10/4/2024 3:19:49 PM

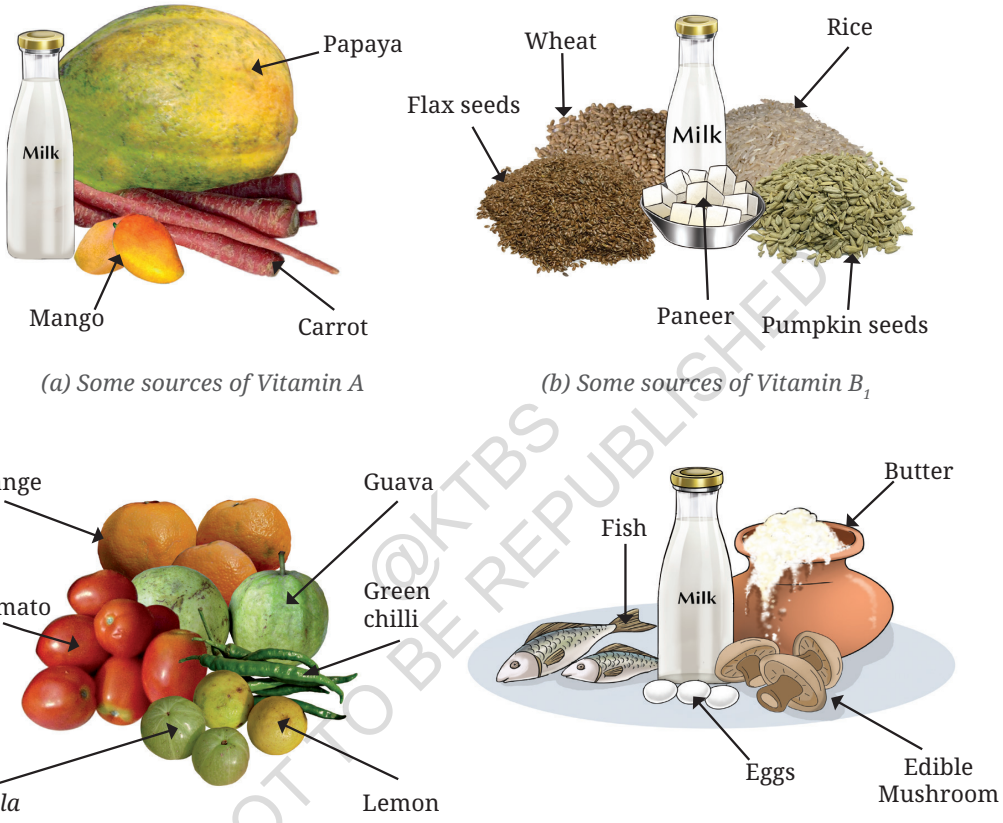
Food component (Vitamin/ Mineral)	Functions	Some sources	Deficiency disease/ disorder	Symptoms
Vitamin A	Keeps eyes and skin healthy	Papaya, carrot, mango, milk	Loss of vision	Poor vision, loss of vision in darkness (night blindness), sometimes complete loss of vision
Vitamin B_1	Keeps heart healthy 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
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 decay	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

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

Chapter 3.indd 44 10/4/2024 3:19:49 PM

From Fig. 3.5, you have learnt that **vitamins** (A, B_1, 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 B_1

(c) Some sources of Vitamin C

(d) Some sources of Vitamin D

Fig. 3.6: Some sources of different vitamins

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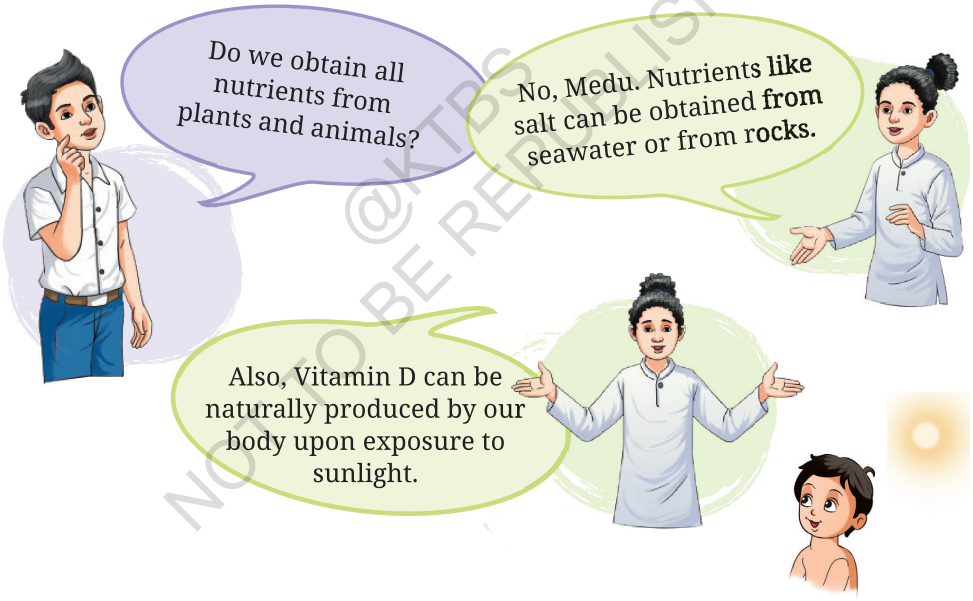
Food components that provide energy, support growth, help repair and protect our body from diseases, and maintain various bodily functions are called **nutrients**. The major nutrients in our food include carbohydrates, proteins, fats, vitamins and minerals.

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 have

Chapter 3.indd 45 10/4/2024 3:19:54 PM

milk, 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.



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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.

Chapter 3.indd 46 10/4/2024 3:19:56 PM

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. ?

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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.

Chapter 3.indd 47 10/4/2024 3:20:01 PM

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.

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Chapter 3.indd 48 10/4/2024 3:20:27 PM

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.

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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.

Chapter 3.indd 49 10/4/2024 3:20:29 PM

- 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.

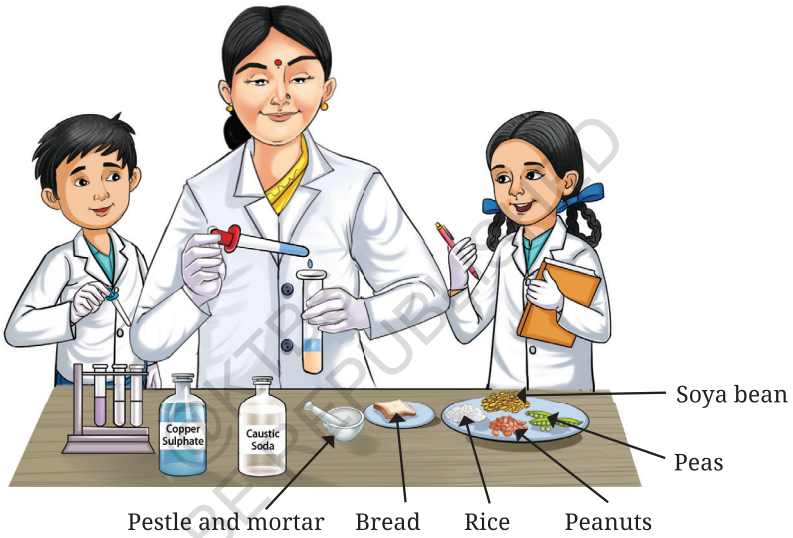


Fig. 3.8: Testing for the presence of protein in various food items

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.

Chapter 3.indd 50 10/4/2024 3:20:30 PM

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									

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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?

Chapter 3.indd 51 10/4/2024 3:20:31 PM

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.



(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

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

Chapter 3.indd 52 10/4/2024 3:20:38 PM

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 (Fig. 3.9). 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?



Fig. 3.9: Sanwa (Barnyard millet)

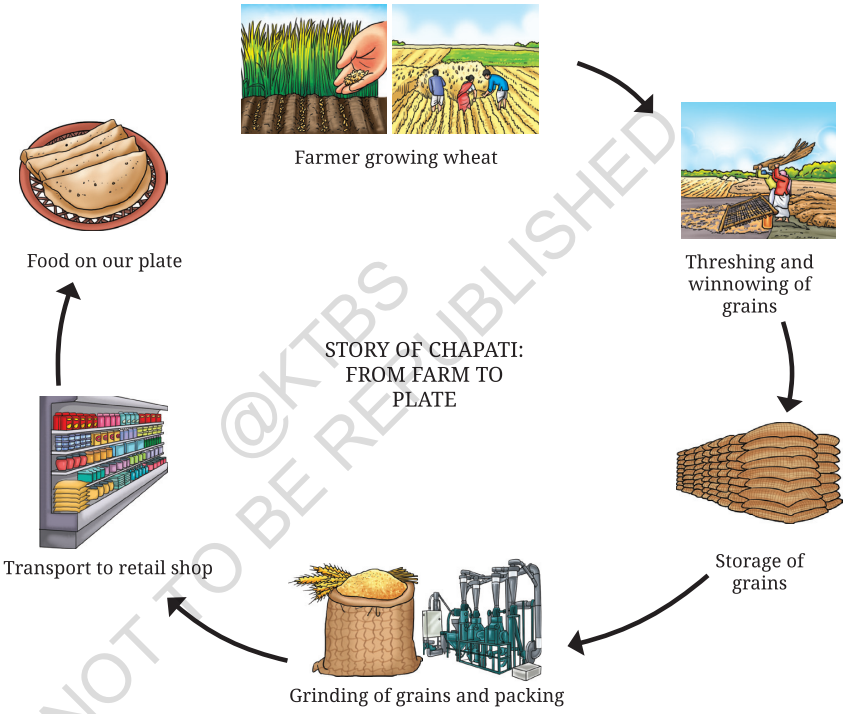
Millets are small-sized grains and have been an integral part of the Indian diet for centuries. They have regained popularity due to their numerous health benefits. They are good sources of vitamins, minerals like iron and calcium, and dietary fibres as well. That is the reason they are also called nutri-cereals.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

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Chapter 3.indd 53 10/4/2024 3:20:58 PM

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.



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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.

Chapter 3.indd 54 10/4/2024 3:21:27 PM

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?

Eat healthy, share, and respect food. Support local producers!

Keywords

Carbohydrate	Millets	Analyse
Culinary practices	Minerals	Compare
Deficiency diseases	Nutrients	Infer
Fats	Proteins	Interpret
Food components	Rickets	Investigate
Food miles	Roughage	Observe
Iodized salt	Scurvy	Prediction
	Vitamins	Survey

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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.

Chapter 3.indd 55 10/4/2024 3:21:46 PM

- 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.

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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

Chapter 3.indd 56 10/7/2024 9:52:32 AM

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. Reshma 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. Gourav 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 Gourav?

   (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?

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Chapter 3.indd 57 10/4/2024 3:21:53 PM

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 Raman'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?

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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.

Chapter 3.indd 58 10/4/2024 3:22:16 PM

- 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.

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Chapter 3.indd 59 10/4/2024 3:22:16 PM

Notes

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Chapter 4

Exploring Magnets



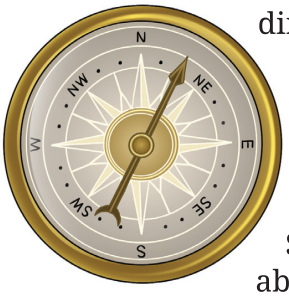
Reshma lives in a coastal town of Kerala and is very fond of writing short stories. Her grandmother loves listening to her stories, so Reshma was writing a new story to share with her grandmother on her 60th birthday.

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The story was based on a ship carrying spices from Kerala for trade in the olden days. Reshma was aware that in those days, the sailors used stars to find directions at night. But in her story, a situation arose wherein the sailors got caught in a storm with an overcast sky and stars were not visible. Reshma 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 travellers used a device, known as a magnetic compass, for finding directions.



Reshma 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.

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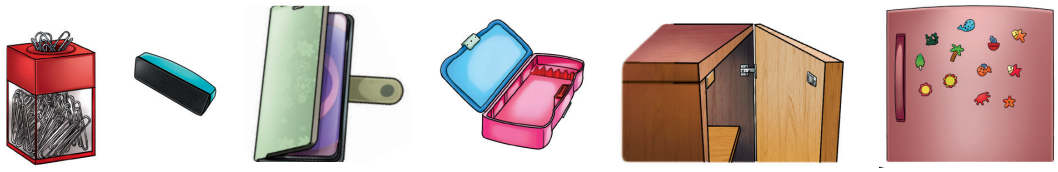


Fig. 4.1: Some common items that have magnets attached to them

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*

Fig. 4.2: Magnets of different shapes

Do magnets stick to objects made of certain materials only?

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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.

Chapter 4.indd 62 10/4/2024 3:16:52 PM



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		

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Chapter 4.indd 63 10/4/2024 3:19:31 PM

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?

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4.2 Poles of Magnet

Activity 4.2: Let us investigate

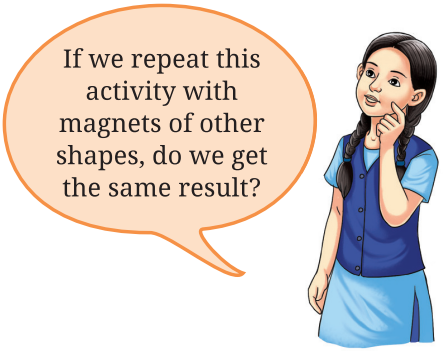
- Spread some iron filings (very small pieces of iron) on a sheet of paper.
- Place a bar magnet over them. Tap the paper and observe carefully what happens to the iron filings.

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



Chapter 4.indd 64 10/4/2024 3:19:54 PM

These ends of the magnet are called the two 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?

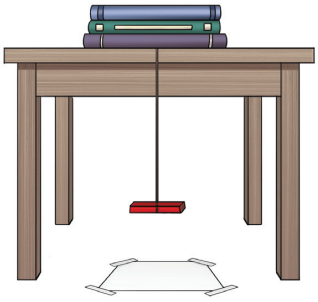


Fig. 4.5: A freely suspended bar magnet

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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.

Chapter 4.indd 65 10/4/2024 3:19:56 PM

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.

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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 direction is usually painted red. Below the needle, there is a dial with directions marked on it.



Chapter 4.indd 66 10/4/2024 3:20:26 PM

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. 4.7a. When it reaches the other end of the needle, lift it up.

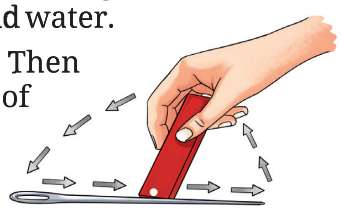


Fig. 4.7(a): Making an iron needle a magnet

- 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. 4.7b.

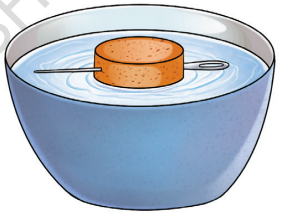


Fig. 4.7(b): A compass needle in a bowl of water

- 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?

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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. 4.7b) 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* (or *machchh-yantra*).

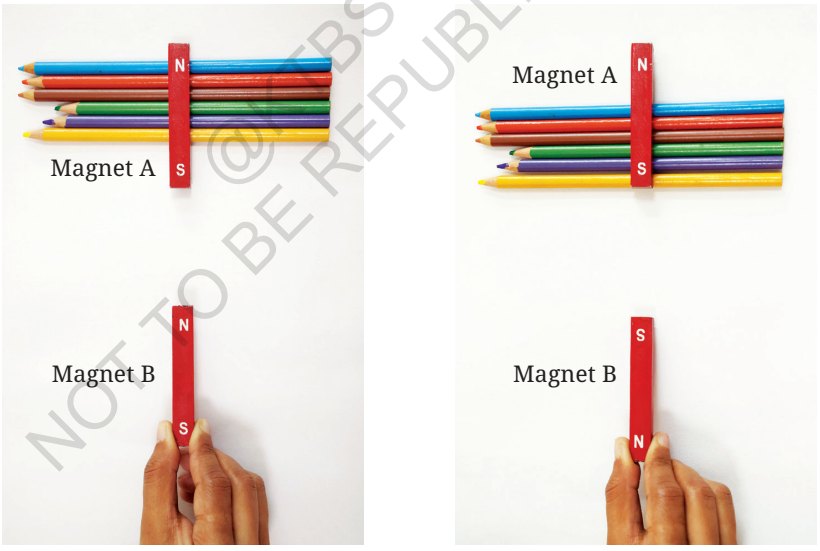


Chapter 4.indd 67 10/4/2024 3:20:34 PM

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. 4.8a.
- 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. 4.8b). 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.

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Chapter 4.indd 68 10/4/2024 3:20:36 PM

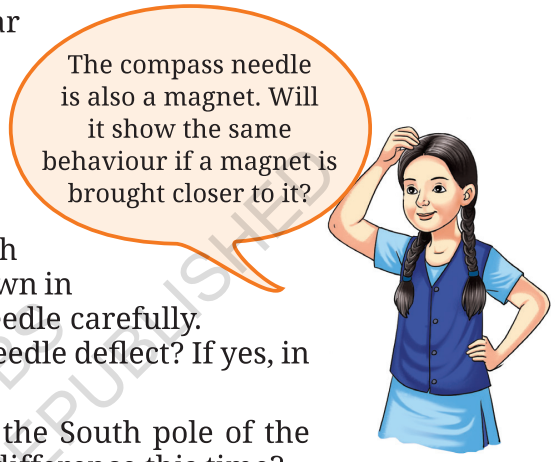
- Repeat the activity by using an iron bar in place of one of the magnets. What do you observe this time?

  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 close to the North pole of the compass needle as shown in Fig. 4.9a. 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?



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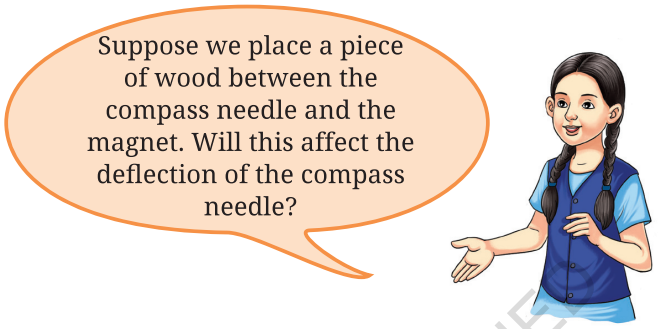


(a)

(b)

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



Activity 4.7: Let us investigate

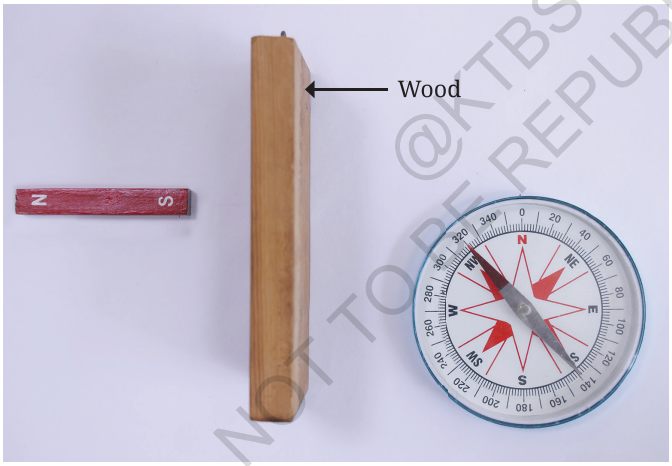


Fig. 4.10: Compass needle and a magnet with a piece of wood in between

- 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.

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Chapter 4.indd 70 10/18/2024 11:07:09 AM

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.

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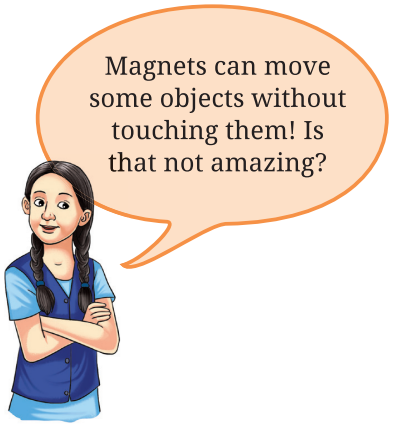
4.5 Fun with Magnets

After learning about magnets, Reshma 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



Chapter 4.indd 71 10/18/2024 11:07:12 AM

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

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)

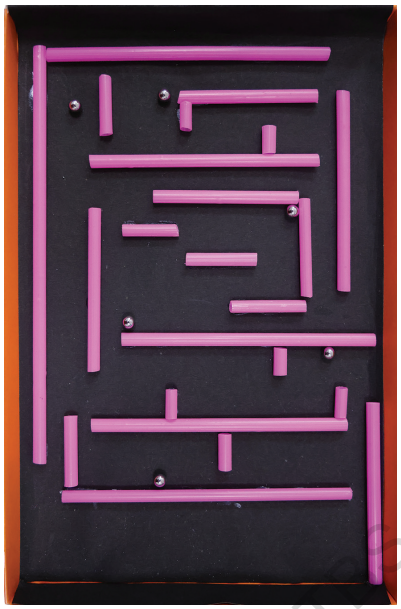


Fig. 4.12: Steel balls in a maze



Fig. 4.13: Steel paperclip in water

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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.

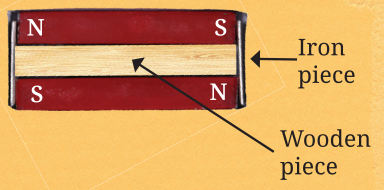
Chapter 4.indd 72 10/18/2024 11:07:24 AM



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."



"Do not heat me or drop me or hammer me.

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



More to know!

Caution
Have fun, but treat magnets with care.

Keywords

Attraction	Conclude
Bar magnet	Construct
Magnetic compass	Experiment
Magnetic materials	Explore
Non-magnetic materials	Investigate
North pole of a magnet	Observe
Repulsion	Predict
Ring magnet	Record
South pole of a magnet	
U-shaped magnet	

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Chapter 4.indd 73 10/18/2024 11:07:36 AM

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.

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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. [ ]

Chapter 4.indd 74 10/4/2024 3:22:44 PM

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	----------
N – ----------	Attraction
S – N	----------
---------- – S	Repulsion

4. Atharv performed an experiment in which he took a bar magnet and rolled it over a heap of steel U-clips (Fig. 4.15).

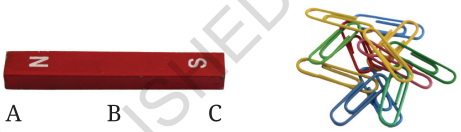


Fig. 4.15: Bar magnet and heap of steel U-clips

According to you, which of the options given in Table 4.3 is likely to be his observation?

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. Reshma 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?

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Chapter 4.indd 75 10/4/2024 3:22:46 PM

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.

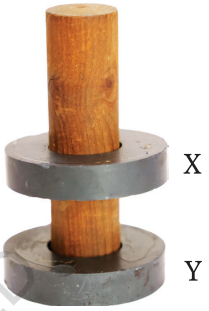


Fig. 4.16: Two ring magnets

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.

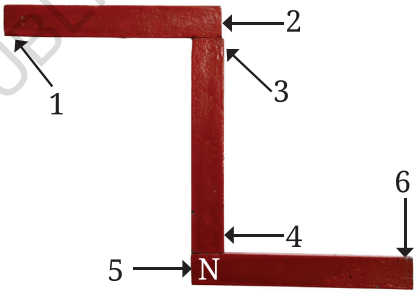


Fig. 4.17: Three bar magnets

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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

Chapter 4.indd 76 10/4/2024 3:22:59 PM

length of a scale using glue (Fig. 4.18a). Paint a frog on paper, cut along the outline and glue a ring magnet at its base. Take a transparent, flexible plastic strip (Fig. 4.18a) of a smaller size and glue it to the ring magnet which is attached to the frog.



(a) *(b)*

Fig. 4.18: My hopping frog

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When you slide the plastic strip (with frog) over the scale (Fig. 4.18b), you can observe the frog hopping.

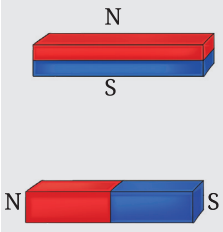
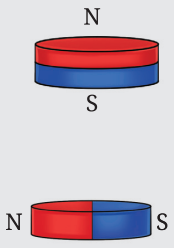
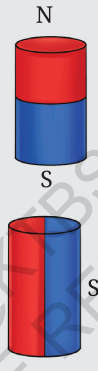
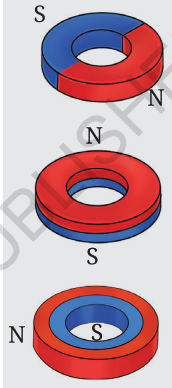
- Find out about the Maglev Train and try to make its model.
- Try to find out why there is a need to make magnets of different shapes.
- Collect information related to the use of magnets in the field of medicine.

Chapter 4.indd 77 10/4/2024 3:22:59 PM

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 Magnet	Cylindrical Magnet	Ring Magnet	Spherical Magnet
				

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Chapter 4.indd 78 10/4/2024 3:23:08 PM

Chapter 5

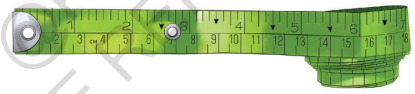
Measurement of Length and Motion



Deepa, a curious eleven-year old girl, lives in a town in the state of Haryana. 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.

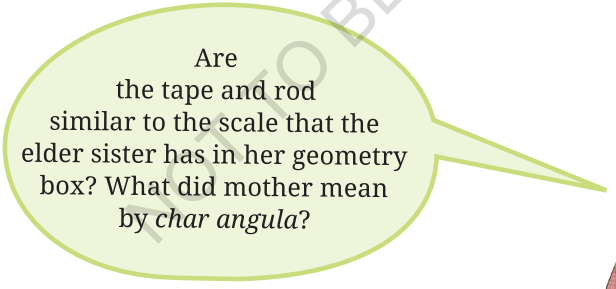
Then, the tailor takes her measurements using a flexible measuring tape. Her mother instructs the tailor to increase the length of her uniform by *char angula* (four fingers width).

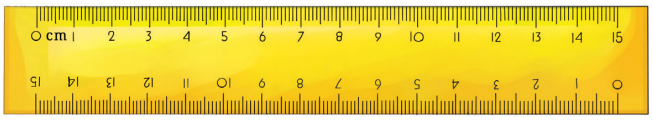




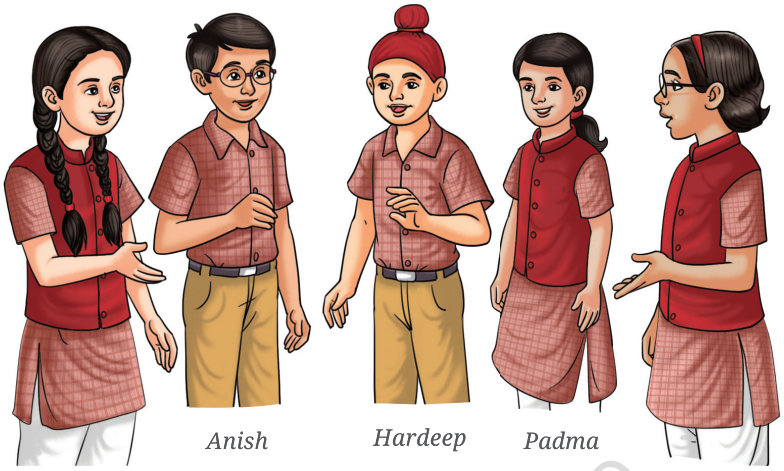
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Deepa shares her experience with her school friends Anish, Hardeep, Padma, Tasneem and this leads to a discussion amongst them.



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.

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*."

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

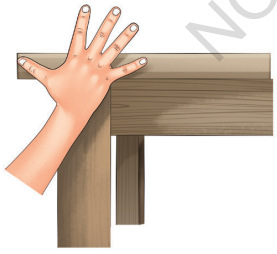


Fig. 5.1: Use of handspan for measuring

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Chapter 5.indd 80 10/4/2024 3:15:25 PM

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.

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Chapter 5.indd 81 10/4/2024 3:15:25 PM

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 mentioned in 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. 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.

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



Fig. 5.2: A metre scale

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Chapter 5.indd 82 10/4/2024 3:15:45 PM

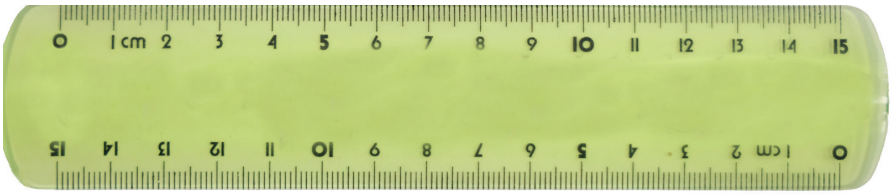


Fig. 5.3: A 15-cm scale

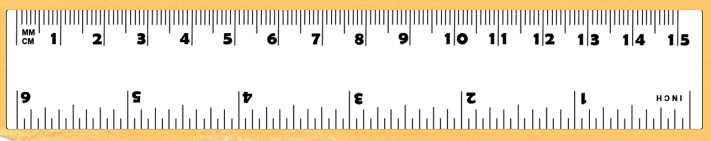
of 1 cm length are further divided into 10 equal parts. The length of one of these smaller parts is called a **millimetre** (**mm**). 1 mm is the smallest value of length that you can measure using this scale. 1 mm is equal to one-tenth of a centimeter (1 mm = 0.1 cm).

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?

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Chapter 5.indd 83 10/4/2024 3:15:57 PM



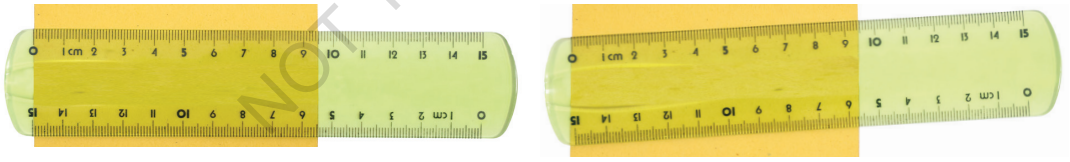
5.3 Correct Way of Measuring Length

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).

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Chapter 5.indd 84 10/4/2024 3:16:09 PM

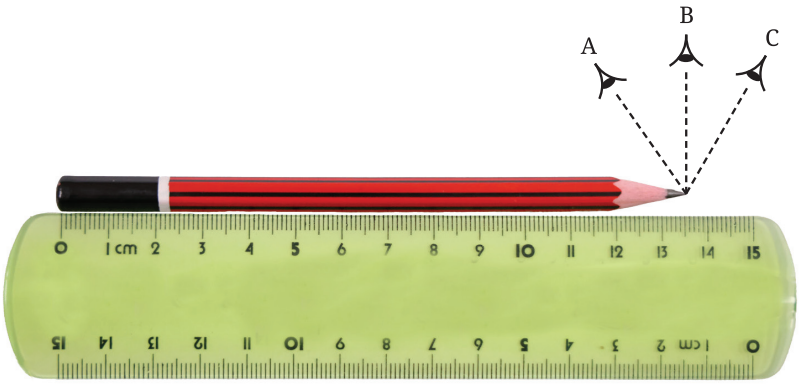


Fig. 5.5: Correct position of the eye is 'B'

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.

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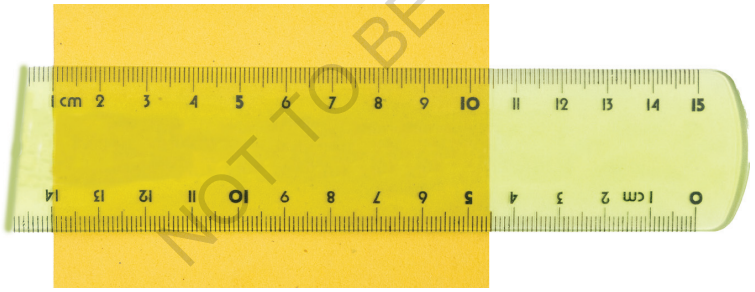


Fig. 5.6: Correct method of placing the scale with broken end

Do you know?

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



Chapter 5.indd 85 10/4/2024 3:16:24 PM

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.

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Do you know?

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.

Chapter 5.indd 86 10/4/2024 3:16:34 PM

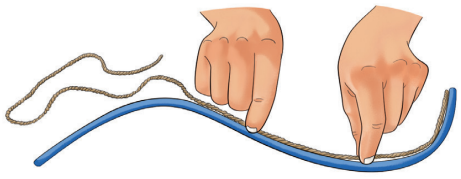
5.4 Measuring the Length of a Curved Line

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?

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. 5.7: House decorated with string lights



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

Fig. 5.8: Measuring the length of a curved line

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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).

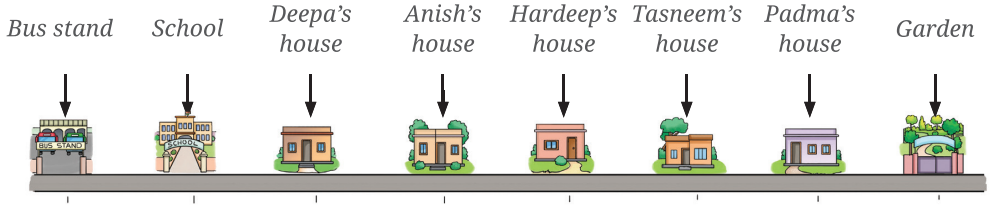


Fig. 5.9: Location of bus stand, school, garden and houses of Deepa and her friends

Chapter 5.indd 87 10/4/2024 3:16:44 PM

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)

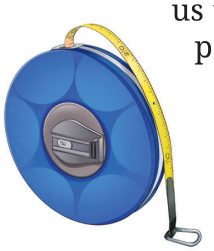


Fig. 5.10: A measuring tape

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)

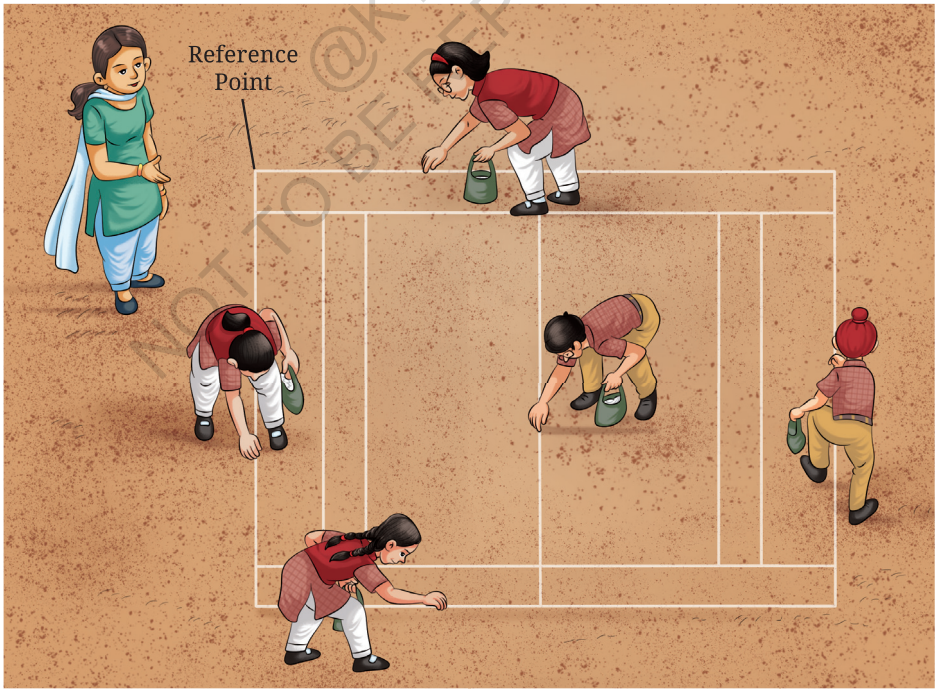


Fig. 5.11: Drawing lines for Kabaddi court

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Chapter 5.indd 88 10/4/2024 3:16:48 PM



Fig. 5.12: A kilometre stone

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

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

These kilometre stones indicated her distance from Delhi. So, Delhi 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?

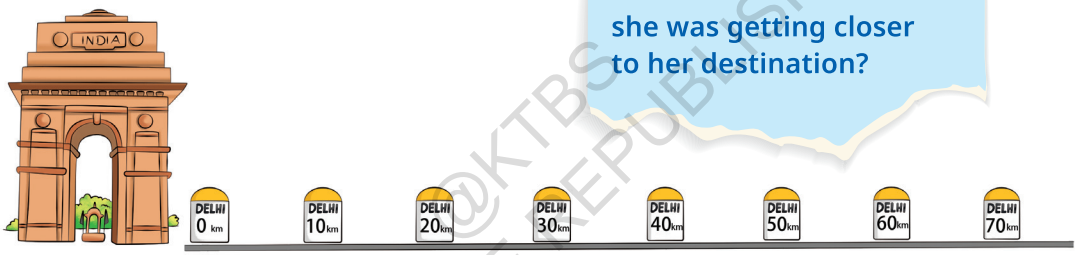


Fig. 5.13: Positions of kilometre stones with respect to Delhi as a reference point

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

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?

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Chapter 5.indd 89 10/4/2024 3:16:52 PM

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	

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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.

Chapter 5.indd 90 10/4/2024 3:16:52 PM

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?

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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).

Chapter 5.indd 91 10/4/2024 3:17:13 PM

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

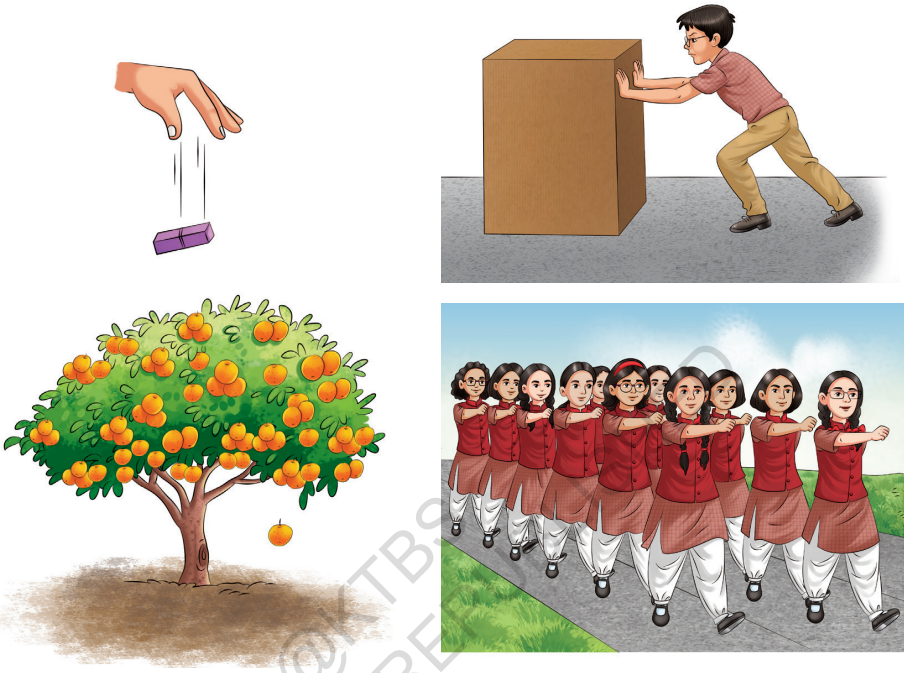


Fig. 5.14: Linear motion

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.**

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Chapter 5.indd 92 10/4/2024 3:17:14 PM

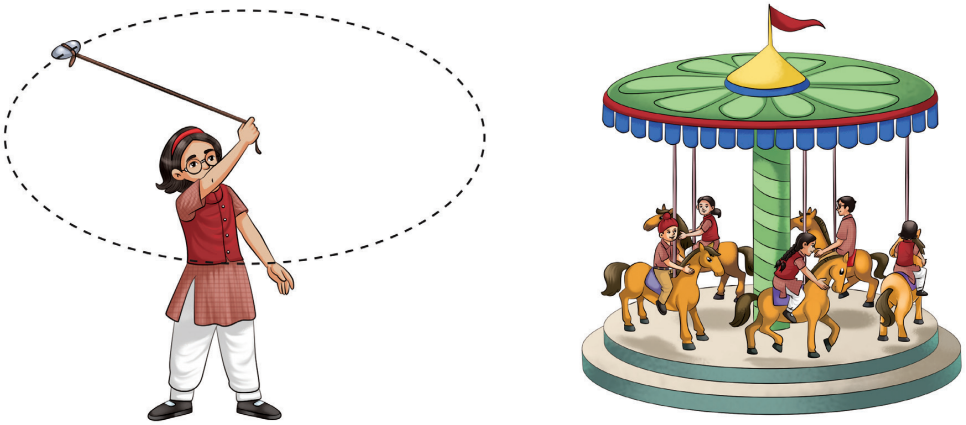


Fig. 5.15: Circular motion

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.**

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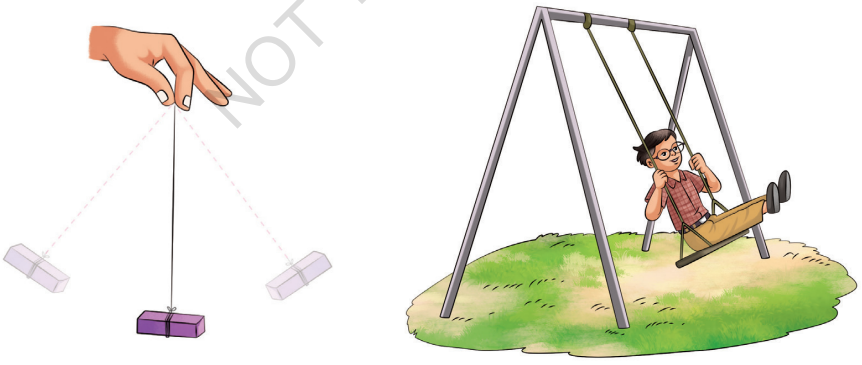


Fig. 5.16: Oscillatory motion

Chapter 5.indd 93 10/4/2024 3:17:15 PM

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

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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.

Chapter 5.indd 94 10/4/2024 3:17:19 PM



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

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Chapter 5.indd 95 10/4/2024 3:17:19 PM

Keywords

centimetre	Measurement	Classify
Circular motion	metre	Explore
Distance	millimetre	Identify
kilometre	Motion	Investigate
Length	Oscillatory motion	Justification
Linear motion	Reference point	Observe
	SI Unit of Length	

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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.

Chapter 5.indd 96 10/4/2024 3:17:55 PM

Let us enhance our learning



1. 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

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2. 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 [ ]
3. Which of the following is not a standard unit of measuring length?
   (i) millimetre (ii) centimetre (iii) kilometre (iv) handspan
4. 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.
5. Suppose the distance between your school and home is 1.5 km. Express it in metres.

Chapter 5.indd 97 10/4/2024 3:17:56 PM

6. Take a tumbler or a bottle. Measure the length of the curved part of the base of glass or bottle and record it.

7. Measure the height of your friend and express it in (i) metres (ii) centimetres and (iii) millimetres.

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. Give two examples each for linear, circular and oscillatory motion.

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	

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11. 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.

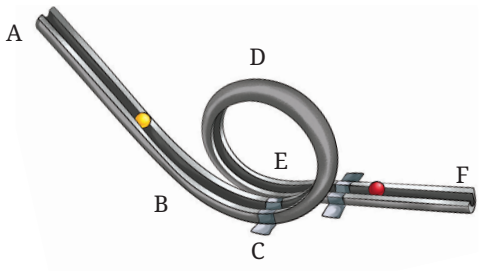


Fig. 5.19: Rollercoaster track

Chapter 5.indd 98 10/4/2024 3:17:56 PM

12. 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?

13. 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.

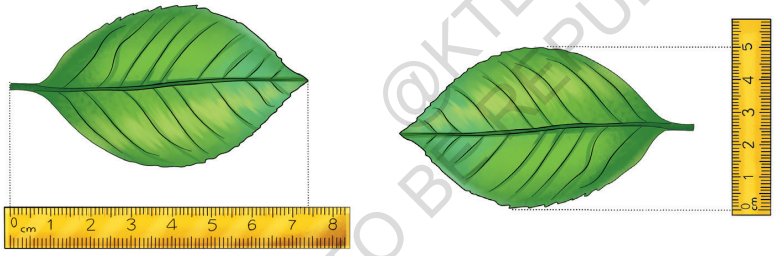


Fig. 5.20: Measuring a leaf

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.

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Chapter 5.indd 99 10/4/2024 3:18:02 PM

- 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.

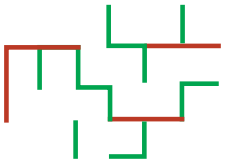


Fig. 5.21: A maze

- 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.
- 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.

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Chapter 5.indd 100 10/4/2024 3:18:02 PM

Chapter 6

Materials Around Us

"उपादानं भवेत्तस्या (मूषाया:) मृत्तिका लोहमेव च।

(रसरत्नसमुच्चय–१०.३)

The materials used to make the crucible
(a vessel used to melt substances) are clay and iron.

(*Rasaratnasamuchchaya*–10.3)"

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6.1 Observing Objects Around Us

Ghulan and Sheeta are thrilled to go to their new class after the summer break. They enter their classroom and start talking. "What have you brought to school today?" asks Sheeta.



After some time, Madam Vidya, their science teacher, enters the class and starts interacting with the students to draw their attention to many things they use in their daily life. She asks, "How are they similar to or different from each other? What are their shapes and colours? How does it feel when you touch them? Are some of them heavier than

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others?" All things are made up of some materials like paper, wood, cloth, glass, metal, plastic, clay, and so on.
Any substance that is used to create an object is referred to as **material**.

Activity 6.1: Let us identify

Make a list of objects you see around and also write the names of the materials they are made up of in Table 6.1.

Table 6.1: Identify materials

I observe	Materials they are made up of

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Based on everyday observations, one can conclude that objects are made up of various materials.



The earliest pottery found in the Indian subcontinent dates back to 7,000 to 8,000 years in the Ganga plains (Lahuradewa) and in Baluchistan (Mehrgarh). About 4000 BCE onwards, Sindhu-Sarasvatī developed techniques of wheel-turned pottery production, pigmentation, application of protective or decorative coats (called 'slips') of multiple colours, decorative painting, etc. These techniques became further sophisticated during the Sindhu-Sarasvatī (also known as 'Harappan') Civilisation (2600–1900 BCE), with a bright red surface painted with black-coloured designs displaying geometric patterns, and aquatic and terrestrial animals. The clay used for making pots, dishes, bowls and other items was carefully selected and cleaned, sieved, kneaded, turned over a wheel and finally baked in kilns (baked clay is called 'terracotta'). Pots were used for various purposes, from cooking to storage of food grains, oil, ghee, and so on. Some very large storage jars and other pottery items are exhibited at the National Museum, New Delhi.



Do you know?

Chapter 6.indd 102 10/4/2024 3:15:11 PM

Let us explore materials further.

6.2 How to Group Materials?

Activity 6.2: Let us group

- Group the objects shown in Fig. 6.1 based on any common property, such as shape, colour, hardness, softness, shine, dullness or materials they are made up of.



Fig. 6.1: Objects around us

- Which property did you use to group the objects in Activity 6.2?
- Did your friends group objects based on similar properties?
- What did you learn from this activity?

You must have noticed that an object can be made from different materials and some materials can be used to make more than one object.

The method of arranging the objects into groups is called **classification**. Objects can be classified on the basis of a common property that they have.

Similarly, we can classify materials based on certain properties.

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Chapter 6.indd 103 10/4/2024 3:15:15 PM

Activity 6.3: Let us think

Let us think what materials we can use to make a tumbler. Fill in the names of the materials in the spaces provided in Fig. 6.2.

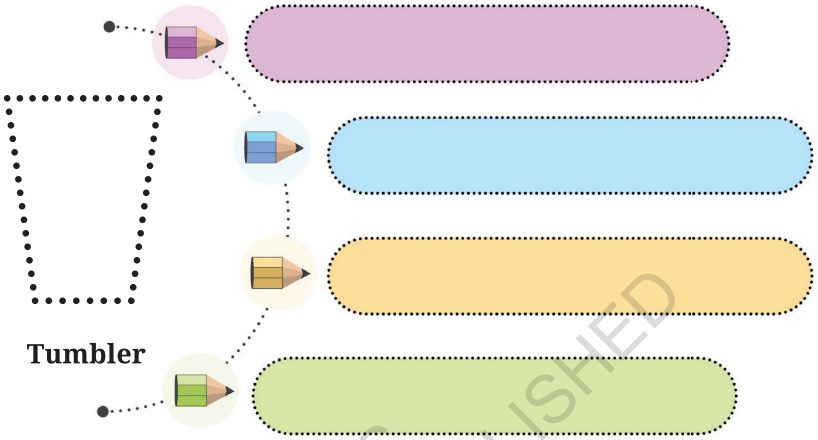


Fig. 6.2: Materials used to make a tumbler

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Would it be a good idea to use paper-like materials for making cooking utensils?

Why cannot a tumbler made of cloth be used for storing water?



The materials that are required to make a tumbler should be capable of holding water.

What decides which material should be used for making an object? We choose a material to make an object depending on its properties and the purpose for which the object is to be used.

We may use different materials for making different parts of an object. For example, a pen may be made up of different materials like plastic, metal and ink.

Chapter 6.indd 104 10/4/2024 3:15:20 PM



Activity 6.4: Let us explore

Fig. 6.3 illustrates a variety of balls that are of the same size but made up of different materials.

- Take each ball and drop it from a fixed height.
- Note the height to which the ball bounces and **record** it in Table 6.2.
- Identify the ball that achieves the highest bounce.



Tennis ball *Cricket ball* *Hand exercise ball*

Fig. 6.3: Different types of balls used for various purposes

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Table 6.2: Bouncing level of the balls

Ball	Bounce (high, medium or low)
Tennis ball	
Cricket ball	
Hand exercise ball	
Any other	

Chapter 6.indd 105 10/4/2024 3:15:21 PM

Discuss in class other properties of sports balls, such as size, colour, texture and how high they bounce and understand why balls are made up of specific materials for specific sports. Observe Fig. 6.4 and group the objects in as many different ways as possible.

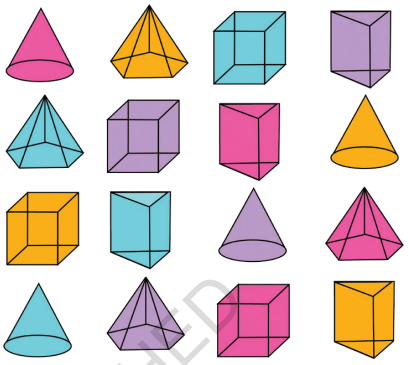


Fig. 6.4: Grouping of objects

You might have grouped these objects according to their shapes or by their colour or materials they are made up of.

We have learnt that materials may be classified on the basis of their properties.

For example, in the kitchen, we usually store things in such a manner where similar utensils are placed together. Similarly, a grocer usually keeps all types of spices in one corner, pulses and grains in another corner and so on. You may also visit any chemist shop and enquire about how medicines are arranged.

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6.3 What are the Different Properties of Materials?

Let us learn some more properties of materials.

6.3.1 Observe and identify appearance of materials

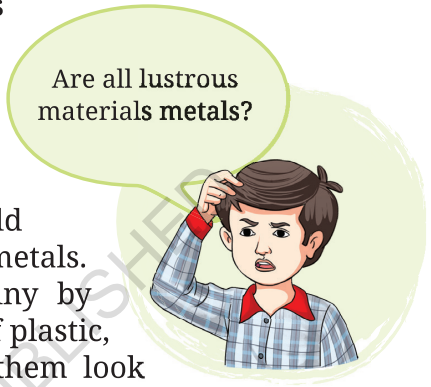
Materials often look different from each other. Freshly cut wood, which is unpolished, has a distinct appearance, quite different from that of iron. Similarly, iron looks different from copper or aluminium. However, there might be some similarities among iron, copper and aluminium that make them different from wood.

Let us do a sorting challenge! Collect small pieces of paper, cardboard, wood, chalk, copper wire, aluminium foil and any article made up of brass, bronze, steel, etc. Take a look at the pieces you have collected. Do any of these materials shine when light falls on them? Observe their texture (whether

Chapter 6.indd 106 10/4/2024 3:15:23 PM

rough or smooth), colour and other noticeable features, and record your observations in the notebook. Group the collected pieces based on their appearance.

Materials that typically have shiny surfaces are said to have a **lustrous** appearance. Such materials with lustre are usually metals. Examples of metals include iron, copper, zinc, aluminium, gold, etc. However, some metals may lose their lustre and start to look dull or non-lustrous due to the effect of air and moisture on them. As a result, we often notice the lustre only on their freshly cut surfaces. **Non-lustrous** materials are those that do not have a shiny surface. Some examples of non-lustrous materials are paper, wood, rubber, jute, etc.



"All that glitters is not gold" goes an old saying! Not all the materials that shine are metals. Surfaces of some materials are made shiny by polishing or coating them with thin layers of plastic, wax or any other material which makes them look shiny. These materials may not be metals.

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6.3.2 Which materials are hard?

When you press different objects or materials with your hands, some of them like stones, may be hard to compress, while others, like an eraser, can be easily compressed. Take a metal key and use it to scratch the surface of a piece of wood, aluminium, stone, iron, candle, chalk and any other material or object. Can some materials be scratched more easily than others? Materials which can be compressed or scratched easily are **soft**, while other materials which are difficult to compress or scratch are **hard**. However, these properties are relative in nature. For example, rubber is harder than sponge but softer than iron.

Activity 6.5: Let us observe

- Hold the objects given in Table 6.3 with your hands. Feel whether the objects are hard or soft. Find out the materials they are made up of. Enter your observations in Table 6.3.

Chapter 6.indd 107 10/4/2024 3:15:25 PM

Table 6.3: Hard or soft objects and the materials they are made up of

Object	Hard/Soft	Material(s)
Brick	Hard	Baked clay
Water bottle		
Pillow		
Tumbler		
Table		
Sweater		
Any other		

- Compare your observations with the observations of your friends and discuss.

You have learnt that materials can have different properties, like lustre, hardness, softness and colour. Can you think of any other properties that are shown by materials? Let us explore it further.

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6.3.3 Explore materials through which one can see or cannot see

Ghulan, Sheeta and Sara are playing hide and seek with their friends. Ghulan hides behind a wall, Sheeta hides behind a big tree in the garden while Sara hides behind the frosted glass door (which has a hazy surface). Sheeta's younger brother can see all of this happening through a glass window of his house.

The materials, through which things can be seen clearly, are called **transparent**. Glass, water, air, cellophane paper, etc., are some examples of transparent materials.

Why did Ghulan, Sheeta and Sara choose these places to hide?

Do you think it would be possible for Sheeta's brother to see her and her friends through a closed wooden window of the house?

Chapter 6.indd 108 10/4/2024 3:15:25 PM

There are many materials through which you are not able to see at all. These materials are called **opaque**. Wood, cardboard and metals are examples of opaque materials.

The materials through which objects can be seen, but not clearly, are known as **translucent**. Butter paper and frosted glass are examples of translucent materials.

Look at Fig. 6.5. Identify and label the nature of materials used by Ghulan (A), Sheeta (B), Sara (C) and Sheeta's brother (D).

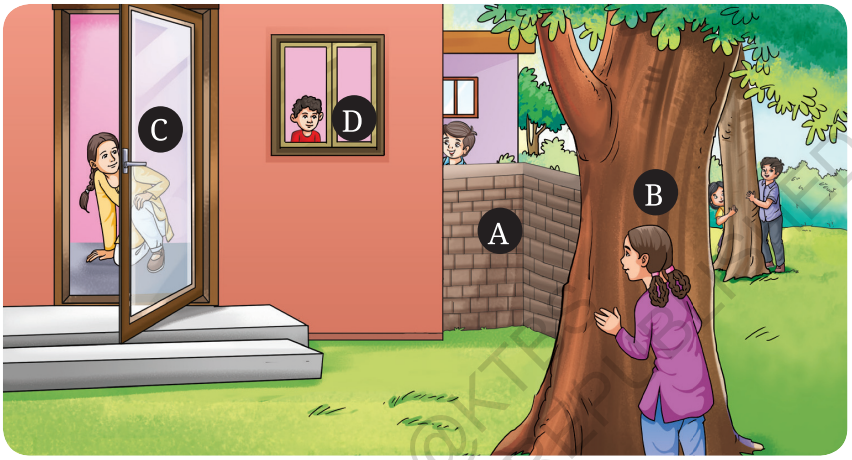


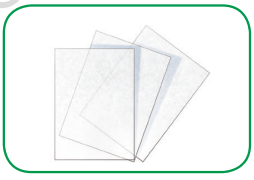
Fig. 6.5: Identify the nature of different materials

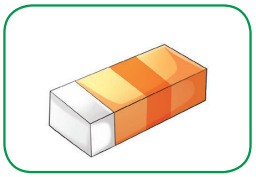
(A) _____ (B) _____ (C) _____ (D) _____.

Activity 6.6: Let us classify

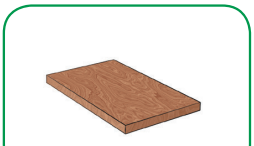
Classify the following objects as transparent, translucent or opaque in Table 6.4.

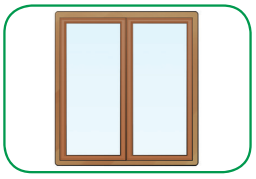

Glass tumbler


Butter paper


Eraser


Frosted glass


Wooden board


Window glass

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Chapter 6.indd 109 10/4/2024 3:15:28 PM

Is water transparent? Can it be made opaque? ?

Table 6.4: Classification of objects

Transparent	Translucent	Opaque

6.3.4 What is soluble in water; what is not?



Ghulan was sweating when he came home after playing in the evening. He was feeling tired and thirsty. Ghulan's mother mixed a spoonful of sugar, a pinch of salt and some lemon juice in a glass tumbler of water and offered him this *shikanji* (lemonade) to drink.

Ghulan noticed that while his mother was mixing sugar and salt in water, the salt and the sugar disappeared after a while.

Let us try a simple activity to explore how different materials behave when we mix them in water!

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Activity 6.7: Let us explore

- Collect small amounts of sugar, salt, chalk powder, sand and sawdust.
- Take five glass tumblers and fill them about two-third with water.
- Put a teaspoonful of sugar in the first glass tumbler, salt in the second one, chalk powder in the third, sand in the fourth and sawdust in the fifth glass tumbler.
- On stirring, **predict** what will happen in each case.
- Use a spoon to stir well the contents of each glass tumbler.
- Wait for a few minutes and watch what happens.
- Write down your observations in Table 6.5.

Chapter 6.indd 110 10/4/2024 3:15:44 PM

Table 6.5: Mixing different materials in water

Material	Prediction	Observation
	Will disappear in water/will not disappear in water	Disappears in water/ does not disappear in water
Sugar		
Salt		
Chalk powder		
Sand		
Sawdust		
Any other		

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Does everything you put in water disappear?

You might have noticed that some materials completely disappear when mixed in water. We say that these materials dissolve in water or, in other words, they are **soluble** in water (Fig. 6.6a). Some materials do not mix with water and do not disappear even after we stir them for a long time. These materials are **insoluble** in water (Fig. 6.6b). Water plays an important role in the functioning of our body because it can dissolve a large number of materials.



(a) Soluble material in water *(b) Insoluble material in water*

Fig. 6.6: What disappears, what does not?

Chapter 6.indd 111 10/4/2024 3:15:50 PM

Make your own ORS!

ORS—Oral Rehydration Solution— is used to treat dehydration due to diarrhoea or other illnesses. These ready-made ORS packets are available in primary health centres and also in the market. Each packet is dissolved in a litre of water before use. If these are not available, ORS can be prepared at home by mixing six teaspoons of sugar and half a teaspoon of common salt in one litre of boiled and cooled water.



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Some liquids get completely mixed with water. Some do not mix with water and form a separate layer when left undisturbed for some time. Similarly, some gases are soluble in water whereas others are not. For example, oxygen gas dissolves in water. It is very important for the survival of animals and plants that live in water.

6.3.5 How heavy or light?

Activity 6.8: Let us measure

- Let us take three identical paper cups (or bowls). Fill each cup half with the provided materials.
- Fill one with water and mark it as 'A', second with sand and mark it as 'B', and the third with pebbles and mark it as 'C'.
- Predict which one would be heavier and which one would be lighter?

Chapter 6.indd 112 10/4/2024 3:16:03 PM

- Weigh each cup using a balance (Fig. 6.7) and record the readings in your notebook.
- Compare the data and infer which is heavier or lighter.

From Activity 6.8, we can say that any object which is heavier or lighter can be measured in terms of a property called **mass**.

The one which is heavier has more mass and the one which is lighter has less mass.



Fig. 6.7: Weighing a paper cup containing water

Weight is sometimes used in common language for mass as it is determined by weighing. You will learn more about mass and weight and their relation in higher classes.

6.3.6 Space and volume

Next day, Madam Vidya enters the class. All the students stand up to greet her. She reciprocates and deliberately says, "Please keep your bags on your seats and sit down." Students are not able to sit because bags are kept on their seats. Madam Vidya asks, "Why are you not sitting?" The students reply that there is no place to sit because the bags have occupied that space.

Continuing the conversation, she provides two identical glass tumblers to two students and encourages them to pour the remaining water from their drinking water bottles into the respective glass tumblers. On pouring water in the glass tumblers, the students observe that one glass tumbler gets half-filled with water (Fig. 6.8a) while the other is almost completely filled with water (Fig. 6.8b).



(a) Half-filled *(b) Fully-filled*

Fig. 6.8: Glass tumblers with varying levels of water

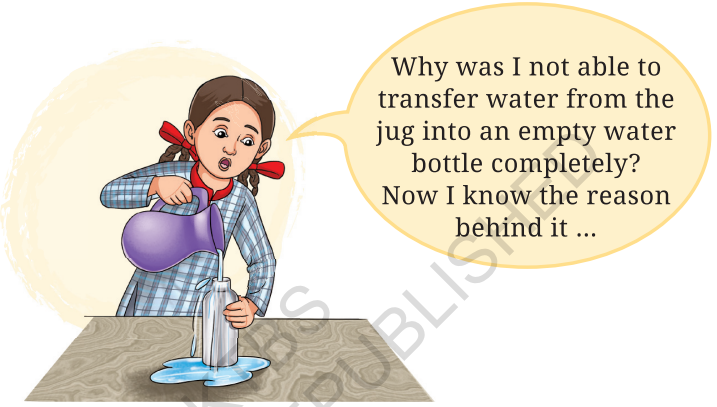
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Chapter 6.indd 113 10/4/2024 3:16:08 PM

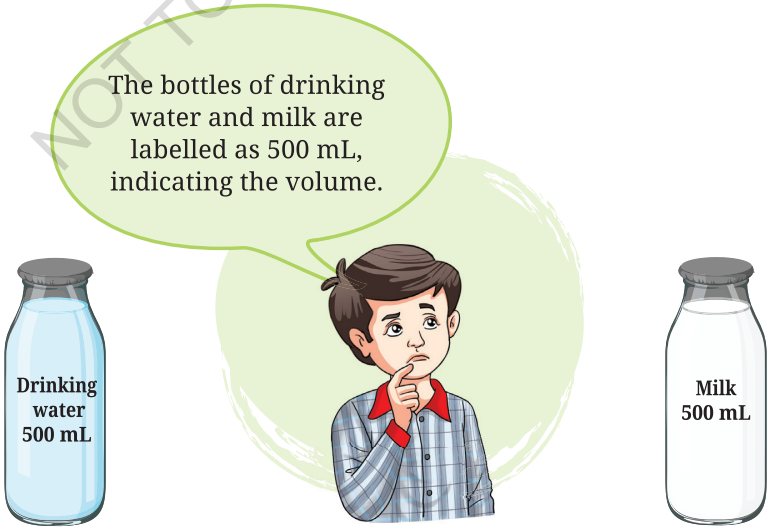
Why is the level of water different in the two tumblers?

Madam Vidya elaborates that both tumblers have the same capacity. The water levels differ in each case, which indicates that the amount of water in each tumbler is different.

The water in the first tumbler occupies less space, indicating that the volume of water in this tumbler is less than the water in the other tumbler. The space occupied by water represents its **volume**.



You may have noticed drinking water bottles of different sizes being sold in the market. Have you noticed 1 L, 500 mL, 200 mL, etc., written as net quantity on the bottles? These indicate the volume of water in the bottles.



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Chapter 6.indd 114 10/4/2024 3:16:12 PM

Now you have become familiar with many properties of materials. However, all materials do not possess all these properties.

Are there any properties which can be shown by all materials? If yes, what are those?

6.4 What is Matter?

Mass and volume are the two properties that are possessed by all materials. Can we give a general name to anything that possesses these two properties?

Anything that occupies space and has mass is called **matter**. The mass gives the quantity of matter, and the units to measure it are gram (g) and kilogram (kg). The space occupied by matter is its volume. The units to measure the volume are litre (L) and millilitre (mL).

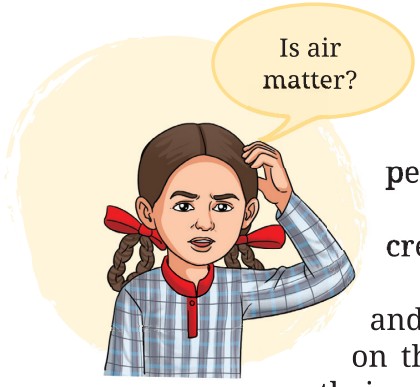
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Kilogram is the unit of mass in the International System of Units (SI). Kilogram is abbreviated in lower case as kg. There is no space between 'k' and 'g' in kg, and no full stop after the symbol, except at the end of a sentence. While writing the mass, always leave a space between the number (numerical value) and the unit. For example, if we have mass of 7 kilograms, it would be written as 7 kg and not as 7 kgs.

Similarly, litre is abbreviated as capital L and millilitre as mL. There is no space between 'm' and 'L' in mL. For example, if you have 500 millilitres of water, it would be written as 500 mL, m will be in lower case and L will be in upper case. The SI unit for volume is cubic metre, abbreviated as m^3. The abbreviation is written with a superscript 3 to denote cubic metre. For example, if you have volume of 2 cubic metres, it would be written as 2 m^3. Always leave a space between number (numerical value) and the unit. 1 m^3 =1000 L.

Do you know?

Chapter 6.indd 115 10/4/2024 3:16:21 PM



Can all the materials around us be considered as different examples of matter? Discuss with your friends.

For example, water is matter, sand and pebbles are matter and so is the cup.

Materials are types of matter used in the creation or making of objects.

We learnt that materials look different and behave differently. We grouped materials on the basis of similarities or differences in their properties.

We find grouping useful as it helps us study and observe patterns in the properties of things. Humans have been classifying not only things, but also rocks, plants and animals. We have learnt about the classification of the living world in the chapter 'Diversity in the Living World'. Just like in the living world, classification of the non-living world is also done on the basis of their properties.

Think it over!

Can you think about what changes the invention of plastic brought to humans? Is it a boon or a bane?



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Chapter 6.indd 116 10/4/2024 3:16:42 PM

A similar classification system existed in ancient India. Ayurveda, one of the Indian medical systems, too has a system of grouping things.

गुरु मन्द हिम स्निग्ध श्लक्ष्ण सान्द्र मृदु स्थिराः|
गुणाः ससूक्ष्म विशदाः विंशतिः स विपर्ययाः||

(*Aṣhtanga hṛidaya Sūtra sthāna 1.18*)

The shloka precisely talks about the 20 properties (*guṇa*—ten pairs of opposite properties), which are used to describe all physical matter in Ayurveda. These properties can also be used to describe all living systems (plants, animals and humans), the environment and also food.

These properties are:

(i)	*guru* (heavy)	×	*laghu* (light in weight)
(ii)	*manda* (slow)	×	*tīkṣhṇa* (quick, fast)
(iii)	*hima* (cold)	×	*uṣhṇa* (hot)
(iv)	*snigdha* (unctous)	×	*rukṣha* (dry)
(v)	*śhlakṣhaṇa* (smooth)	×	*khara* (rough)
(vi)	*sāndra* (solid)	×	*drava* (liquid)
(vii)	*mṛidu* (soft)	×	*kaṭhina* (hard)
(viii)	*sthira* (stable)	×	*khāla* (moving, unstable)
(ix)	*sūkṣhma* (subtle, small)	×	*sthūla* (big, gross)
(x)	*viśhada* (non slimy)	×	*picchhila* (slimy)

Do you know?

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Keywords

Classification, Non-lustrous, Classify
Hard, Opaque, Explore
Insoluble, Soft, Identify
Lustrous, Soluble, Observe
Mass, Translucent, Predict
Material, Transparent, Record
Matter, Volume

Chapter 6.indd 117 10/4/2024 3:16:52 PM

Summary

Key Points

- Objects are made from a large variety of materials. An object can be made up of a single material or a combination of different materials.
- We can use different materials to make objects with similar functions.
- The method of arranging objects into groups is called classification.
- Materials possess different properties which determine their use.
- Materials are grouped or classified based on their similarities or differences in their properties.
- Materials can be grouped based on appearance, such as lustrous or non-lustrous and based on the feel, such as hard or soft.
- Materials are grouped as transparent, translucent or opaque depending on how much we can see through them.
- Some materials are soluble in water, while others remain insoluble.
- Anything that occupies space and has mass is called matter.
- The space occupied by matter is its volume.
- Mass quantifies the amount of matter present in an object.

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Let us play

1. Find the companion.

   Link the following words by putting arrows between words that have a connection.

	Iron	
Transparent		Copper
Solid		Bottle
Plastic	Lustrous	
Wood		Opaque
	Glass	

Chapter 6.indd 118 10/4/2024 3:17:05 PM

2. Win the 'Word-hub'

The following words from the chapter like lustrous, non-lustrous, soluble, insoluble, hard, soft, matter, mass, transparent, opaque, volume and translucent are picked up.

Grid

- Students should randomly choose nine words from the given list and write them in the grid.
- Then, the facilitator either reads the definition of a word or the word itself (randomly) from the given list.
- The learners have to tick if the particular word is there in the grid.
- Whoever finishes ticking off all nine words first will shout out 'Hurray!' That person will be the winner if his/her words are marked correctly.

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Let us enhance our learning



1. Visit your kitchen and observe how your parents have organised various edibles. Can you suggest a better sorting method? Write it in your notebook.

2. Unscramble the letters (Column I) and match with their properties (Column II).

Column I	Column II
(i) T R E M A T	(a) Objects can be seen clearly through it
(ii) U L S B E L O	(b) Occupies space and has mass
(iii) T N E R P A S N A R T	(c) Shiny surface
(iv) E R U S T L	(d) Mixes completely in water

Chapter 6.indd 119 10/4/2024 3:17:17 PM

3. The containers which are used to store materials in shops and at home are usually transparent. Give your reasons for this.

4. State whether the statements given below are True [T] or False [F]. Correct the False statement(s).

   (i) Wood is translucent while glass is opaque. [ ]

   (ii) Aluminium foil has lustre while an eraser does not. [ ]

   (iii) Sugar dissolves in water whereas sawdust does not. [ ]

   (iv) An apple is a matter because it occupies no space and has mass. [ ]

5. We see chairs made up of various materials, such as wood, iron, plastic, bamboo, cement and stones. Following are some desirable properties of materials which can be used to make chairs. Which materials used to make chairs fulfil these properties the most?

   (i) Hardness (does not bend or shake on sitting even after long use).

   (ii) Lightweight (easy to lift or to take from one place to another).

   (iii) Does not feel very cold when sitting during winters.

   (iv) Can be cleaned regularly and made to look new even after long use.

6. You need to have containers for collection of: (i) food waste, (ii) broken glass and (iii) wastepaper. Which materials will you choose for containers of these types of waste? What properties of materials do you need to think of?

7. Air is all around us but does not hinder us from seeing each other. Whereas, if a wooden door comes in between, we cannot see each other. It is because air is ---------- and the wooden door is ---------- . Choose the most appropriate option:

   (i) transparent, opaque

   (ii) translucent, transparent

   (iii) opaque, translucent

   (iv) transparent, translucent

8. Imagine you have two mysterious materials, X and Y. When you try to press material X, it feels rigid and does not change its shape easily. On the other hand, material Y easily changes its shape when you press it. Now, when you mix both materials in water, only material X dissolves completely,

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Chapter 6.indd 120 10/4/2024 3:17:17 PM

while material Y remains unchanged. What can materials X and Y be? Can you identify whether material X is hard or soft? What about material Y? Justify your answer.

9. (i) Who am I? Identify me on the basis of the given properties.

   (a) I have lustre. ----------

   (b) I can be easily compressed. ----------

   (c) I am hard and soluble in water. ----------

   (d) You cannot see clearly through me. ----------

   (e) I have mass and volume but you cannot see me. ----------

   (ii) Make your own 'Who am I?'

10. You are provided with the following materials—vinegar, honey, mustard oil, water, glucose and wheat flour.

    Make any two pairs of materials where one material is soluble in the other. Now, make two pairs of materials where one material remains insoluble in the other material.

Learning further

- Gather information on different materials which can be recycled. You can take help from various sources, such as newspapers, magazines, elders in your community, and the internet.
- Recyclers buy old objects based on properties of the materials and do not bother even if an object is broken. Conduct a survey with recyclers near you and find out what properties of materials do they check before buying objects from households. Which materials do they not buy and why?
- Collect 20–30 objects from your household and classify them based on the properties of the materials they are made up of. Were you able to put them in separate groups? What relationship do you see between the properties of the materials and the use of the objects?
- Create and decorate a useful object of your choice using discarded materials and bring it to the class. Discuss with your friends what they have made and the materials they have used. Additionally, provide constructive feedback on areas for improvement, considering functionality and any other points.

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Chapter 6.indd 121 10/4/2024 3:17:20 PM

Notes

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