

SCIENCE

TEACHER'S MANUAL

CLASS FOUR



Department of School Education
Ministry of Education and Skills Development
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Cultivating the Grace of Our Mind.

MINISTER

FOREWORD

Over the years, a mystic of sorts has surrounded and choked the vast possibilities of science and scientific studies especially in developing countries, including Bhutan. The result has been an unfounded fear about its complexity and an accompanying tendency to shy away from it in favour of the perceived easier paths. The loss to societies and to nations has been incalculable.

For someone like me with so little science education, it appears that far from being removed from life and our capacity to understand it, science falls within the domain of commonsense. It is about the nature and behaviour of phenomena as they are. They are amenable to our understanding through our primary senses of sight, hearing, smelling, touching, and tasting, complemented by the receptiveness of an open mind.

The progress of science, I believe, follows the familiar path of observation, experimentation, deduction, classification and inference. There ought to be no mystic about it. As we advance though, we move from particulars to universals and understand the laws underlying phenomena. The ability to generalize based on deductive reasoning is the final fruit of scientific inquiry. And, this is what ought to be happening as we begin our romance with our surroundings and move towards the rigour of higher sciences.

In a modest attempt to build the integrity of learning in our schools and institutions, the Ministry of Education has launched a nation-wide educational reform initiative of Educating for Gross National Happiness to be realized through building Green Schools for Green Bhutan. The eight dimensions of a Green School are expected to redeem our education system from the perceived mediocrity and take it to a level worthy of our aspirations to be a knowledge-society.

Cultivating intellectual and academic greenery in particular is designed to inculcate in our educators and scholars that attitude to openness of mind and passion for learning that goes beyond the ritualistic and the routine. Whether it is Physics or Chemistry, Biology or Astronomy, Mathematics or Literature, History or Geography, these are more than mere subjects in the curriculum. They are powerful fields of inquiry. Our students need to be guided to discover what it is that sets one discipline apart from the other and what power is inherent in each of them, and how that energy informs our life and the life of our universe.

This is real learning. It is hoped that our students and teachers will be able to develop that scientific spirit of objectivity and precision even as they have fun with teaching and learning science at all levels. It will be a great disservice to our country and our people if our children and youth miss out on the promise and potentials of science in the building of our country. We need, in fact, to begin thinking of a GNH model of science.

I would like to commend the efforts of my colleagues who worked on the revised science curriculum, but the ideas in it will only come alive when our teachers and students engage with them with passion and fire. They need to be wary of any possible errors of commission and omission and quickly report them or correct them immediately.

I would like to wish all our teachers and students a most fulfilling engagement with the exciting fields of scientific studies and help build that temper and habit of mind in our scholars that will give to our country the much-needed scientific edge and profile.

Tashi Delek!


Thakur S Powdyel.

Thank you, Teacher. I can read this!

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INTRODUCTION

Science education in Bhutan formally started with the introduction of modern education in the 1960s. In 1986, the 'New Approach to Primary Education' (NAPE) was launched, seeking to orient the primary science curriculum for classes IV to VI more firmly to take account of the Bhutanese context and to promote the teaching of science based on Bhutan's natural and social environment. In 2001, textbooks were revised mainly to add content and update the learning activities. At the same time, teaching manuals were revised to include more and better quality scientific information taking into account that primary science was taught mostly by general subject teachers, many of whom did not have adequate background of science.

The Primary Science Curriculum for Classes IV – VI aims to provide learners with opportunities to develop a scientific temperament through investigations of a wide range of living things, materials and phenomena, and the forces that impact the universe in their immediate environment and every day life experiences. At this stage, learners will begin to make links between ideas, and explain things using simple models and theories and, therefore, begin to think in more abstract terms. Learners should also be able to understand that the scientific and technological developments have both positive and negative effects, both on the human life and the environment. They need to use their learning in science for planning positive action for the welfare of themselves, others and the environment in their communities. They need to carry out more systematic investigations on their own and with others as well. Learners also understand that scientists are creative and that they diligently work in order to establish cause and effect relationship in the natural world. They should also begin to understand the importance of testing ideas using evidences from observations and experiments.

The topics and pedagogies for the new science curriculum are selected and developed by taking into account of the contemporary epistemological ideals and the scientific developments across the world vital to engender a pool of scientifically literate citizens groomed by the principles of Gross National Happiness.

STEM Unit

Royal Education Council

Assessment

Educational assessment is a process of documenting, usually in measurable terms, the outcomes of knowledge, skills, attitudes and beliefs of students. This includes the processes of gathering and interpreting information about the progress of students' learning. In order to be valuable to individuals and organization, an assessment must be accurate and objective. Students should be well informed about, what will be assessed and how will they be assessed. Teachers can play an important role in students' achievement by effectively monitoring their learning and giving the learners the feedback on how they can improve.

Assessment is an integral part of teaching-learning process because it:

- helps improve students' learning through the provision of feedback and comments.
- enables teachers to identify which strategies and resources work best.
- empowers students to be self-reflective learners who monitor and evaluate their own progress.
- assesses the strengths and weaknesses of students in learning, as well as in the personal development, and identify their special needs and realise their innate talents.
- guides teachers to incorporate varied teaching and learning strategies and resources to ensure that the students are improving their academic learning as well as in their personal development.
- provides evidences to grade and promote students to the higher level.
- helps to inform parents and other stakeholders about the achievements of students.

I. Components of Assessment in Primary Science

The assessment in primary science focuses on measuring students' performance and achievements based on the three domains of science learning objectives, which are briefly described below.

i. Scientific knowledge

Through this domain, learners will be assessed on the following areas.

- **Life process:** Students' understanding of the biology of human and other living things, and their relationships with each other and the natural world.
- **Materials and their properties:** Students' understanding of the particle structure of materials and their properties.

- Physical processes: Students' understanding of the key scientific concepts, such as force and motion, energy, light and sound, waves, and their applications in people's day-to-day life.

ii. Working scientifically

Through the domain of working scientifically, students will be assessed on the following.

- How science works: Students' understanding on the nature of science as a human activity of intensive investigations and experimentation to formulate the scientific concepts, ideas and principles.
- Investigation and experiment: Students' abilities to use scientific methods of hypothesizing, predicting, experimenting, observing, measuring, inferring and communicating, and solve problems.

iii. Scientific values and attitude

Through the domain of scientific values and attitudes, students will be assessed on the following personal attributes:

- Curiosity and intellectual drive: Students' ability to formulate questions, exhibit anxiety on the scientific and technological phenomena and events, and their willingness to share and accept diverse views of others.
- Responsibility and team spirit: Students' understanding of the importance of team work and, are able to work with their peers and teachers to complete the assigned tasks on time. Views of other people, however diverse are given due consideration as the right of the individual to express their opinions and views. Students share responsibilities in the group activities and demonstrate self discipline in accepting the general rules of the class.
- Belief on causes and effects and critical thinking: Students' demonstration of critical analysis of the consequences of the science and technology on the environment and the well being of people in the society. Students, accordingly, propose strategies that are socially and environment friendly and, the students exhibit concern and commitment for the cause of the environment, oneself and the well being of people in the society.
- Creativeness: Students' ability to create different means to translate and apply the learnt scientific concepts and skills into their real life situation and use varieties of communication tools to present their ideas to others.
- Integrity and humility: Students' demonstration of endurance and

commitment to the tasks assigned, wherein, observations and measurements are done objectively, and the inferences made are grounded on sound scientific concepts and principles. Any disputes that arise in the groups are clarified with humility and trust.

II. Types of Assessment

The achievement and performance of students in primary science are assessed through the following schemes of assessment.

1. *Continuous Formative Assessment (CFA)*

Formative assessment is used to provide feedback to teachers and students on a continual basis, so that teaching and learning can be improved through the provision of feedback and remedial learning opportunities for the needy learners as identified from the assessment. It also enables teachers to understand what teaching methods and materials work best.

CFA facilitates teachers to diagnose the learning needs of the students, and recognize and understand their individual differences in learning. The feedback encourages students to reflect on their achievement and performance, by which they are able to understand their strengths and weaknesses.

CFA should happen daily throughout the teaching-learning processes of the academic year. It is NOT graded as it is used only to give continuous feedback to the students.

The tools and techniques for CFA can be seen in the Assessment Matrix, wherein the identified techniques of CFA for each domain are as follows:

Work scientifically: Class work, observations, immediate interaction with the students, etc.

Scientific knowledge: Question and answer, home work, class work, etc.

Scientific values and attitudes: Observations of students' conduct guided by scientific and social values.

The tools identified for CFA are checklist and anecdotal records. However, the sample checklist provided in this guide book are only suggestive, in order to guide teachers to develop their own checklist based on their needs. Checklist must be maintained for each topic and recorded for future references.

2. *Continuous Summative Assessment (CSA)*

Continuous Summative Assessment is another form of continuous assessment. It helps in determining the students' achievement and performance, and the

effectiveness of the classroom instructions. The feedback from this assessment is to help them to improve their learning and mandate teachers to incorporate varied teaching strategies and resources in ensuring quality teaching and learning in science classes.

The CSA grades students' performances and achievements. This ensures students' active participations in the teaching-learning processes.

The tools and techniques for CSA can be seen in the Assessment Matrix, wherein the identified techniques of CSA for each domain are as follows:

Work scientifically:

Project work in the first term with the weighting of 10 marks, and science journal and scrapbook in the second term with the weighting of 10 marks. However, students must be instructed to maintain the scrapbook from the beginning of the academic year which is checked when the project work is handed in. This is to ensure that the maintenance of the scrap book is a continual and progressive, not one time, activity of each learner as a personal enterprise.

Scientific knowledge:

Although the home works are given regularly, teacher only grades learners' homework at the end of every chapter with the weighting of 5 marks in each term, and the chapter end test conducted for each chapter with the weighting of 5 marks in each term.

Scientific values and attitudes:

Teachers must do observation of learners' conduct in the science classroom and while doing learning activities outside the classroom by using a rating scale, at least twice in each term. It has the weighting of 5 marks for each term.

The main tools for CSA are rubrics for homework, scrapbook / journal, project work; rating scale for the observation of learners' conduct; and pencil paper tests for class test. The scores from the rubrics, the rating scale and paper pencil tests should be converted to the weighting prescribed for each technique for each domain in each term.

3. Summative Assessment

Summative assessment is conducted at the end of a term and at the end of the year to determine the level of learning outcomes achieved by the students. The information gathered is used by teachers to grade students' for promotion and to report to parents and other stakeholders.

The identified tools and techniques for SA can be seen in the Assessment Matrix, which include term examinations with the weightings of 20% for the first term and 30% for the second term, respectively. The questions for the term examinations should cover all the three domains of science learning objectives using the Bloom's taxonomy. Therefore, it mandates teachers to prepare the test blue print prior to the setting of questions for the term examinations.

III. Assessment Techniques and Tools

The following section describes the techniques and tools that are to be used to assess student's performance and achievement in the primary science.

1. Continuous Formative Assessment (CFA)

The assessment through the CFA is purely to facilitate teachers to take corrective measures in their teaching and use of materials and provide feedback on the students' learning. No scores are provided unlike in the CSA. Therefore, it must be continuously used in the regular teaching learning process by using the suggested tools as stated in the Assessment Matrix. The suggested techniques to assess learners through CFA are as follows:

i. Classwork and homework

Regular class work and homework must be given to students to assess their scientific knowledge, skills, and scientific values and attitudes. Class work is a planned learning activity, related to the lesson taught and is carried out by students in the classroom during the teaching period under the supervision and guidance of the teacher.

Class work, as an assessment technique, is used in the classroom to:

- encourage independent and group work habits in students.
- evaluate the effectiveness of the teaching learning processes.
- identify the learning needs of students.
- provide opportunities for students to practice the application of the knowledge and skills learnt.
- reinforce the concepts and skills learnt.

Homework is a task given to students to be completed at home. Homework includes problems to be solved, reading to be carried out, writings to be completed or other skills to be practiced. The work given to the students should be done on their own.

Homework, as an assessment technique, is assigned to students to:

Assessment Matrix

Types of assessment	CFA		CSA		SA
Definition	It is a continuous process of assessing student's problems and learning needs; provide feedbacks and to identify the needs for the remedial measures to improve student's learning. It also enables teachers to understand what teaching methods and materials work best.		It is a continuous process of grading student's performances and achievements. Based on their performance, teachers provide feedbacks for improvement. It also enables teachers to understand what teaching methods and materials work best.		Assesses student's cumulative performances and achievements at the end of each term.
Domains	Scientific knowledge (SK) (Cognitive)	Working scientifically (WS) (Psychomotor)	Scientific values and attitudes (SV) (Affective)	Scientific values and attitudes (SV) (Affective)	SK, WS & SV
Techniques	Quiz & debate, self & peer assessment, class presentation, home work, class work, immediate interaction with students.	Immediate interaction with students, class work, home work, experiments, exhibition	Observation of student's conduct, group work, field trip, excursion, self & peer assessment, immediate interaction with students.	Observation of student's conduct guided by scientific and social values	Term examination Test blue print and paper pencil test
Assessment Tools	O&A, checklist and anecdotal records	Checklist and anecdotal records	Checklist and anecdotal records	Rubrics	Test blue print and paper pencil test with: Objective type questions (MCO), close test, matching, true or false (T/F). Short answer questions (SAQ) and extended response questions (ERQ)
Components in books	Check your progress, test yourself Do you know? and debate	Experiments, outdoor activities, designing and making, field trip, survey, and interview	Experiments, outdoor activities, designing and making, field trip, interview, and survey	Work: in pairs, in groups, individually field trip, display of charts, precaution and safety	Term examination. Question should cover all the three domains
Frequency interval (when & how)	Checklists and anecdotal records must be maintained for each topic throughout the academic year		PW- ^{1st} term, JSB-assess at the end	Twice a term	Once in the year
Format in Progress Report			SK	SV	Annual Exam
Weightings			T1=10 T2=10	T1=5 T2=5	T1=20 T2=30

- check the student's conceptual understanding of the topics taught.
- reinforce student's learning and prepare them for the next lessons.
- provide feedback on learner's work for further improvement.
- assess students' abilities to explore various sources of information.
- provide opportunity for the parents to participate in their children's education.
- provide opportunity to students to design and make technological items.

It is expected that the teachers will give homework on regular basis to ensure the students' progress in learning, and feedback with correct responses provided to them. It is perceived that, unless the appropriate feedback are provided, the assessment will serve no purpose.

ii. Self and peer assessment

This is one of the techniques of assessing students' own learning or their peers. For such assessment, teacher should ensure to create friendly and supportive learning environment that is to encourage students to be sincere in providing constructive feedback in their own work, and the work of their peers.

Self and peer assessment is carried out to:

- encourage students to be independent learner and help each other in the learning.
- help students to be reflective learners.
- develop critical and analytical thinking abilities.
- reinforce their learning.

Although this technique may serve teachers best in saving time, many a times, students may neither assess their own nor the peers' work with integrity and diligence, so teachers must ensure to follow up with the learner's self assessment and the peer's assessment.

iii. Quiz and debate

Quiz and debate can be conducted on specific topic to assess the student's conceptual knowledge and understanding and to improve scientific language. It can be conducted as formal or informal activities.

Quiz and debate, as an assessment technique, are conducted to:

- check learner's general knowledge in science.
- assess the learner's communication and interaction skills.
- assess critical and analytical thinking skills.

iv. Group work presentation

Students working in groups provide a context in which individuals help each other to achieve a common goal, as it is in their daily life. Group work provides students a constructive experience of membership in a group, so that they may develop further as individuals and be able to contribute to the life of the community.

Group work presentations have to be carried out on regular basis since they provide teachers the opportunity to assess the learner's abilities to articulate and apply the scientific skills and values to the assigned task.

The group work and classroom presentation, as an assessment technique, is prescribed to:

- assess student's progress in the development of social skills to work as a team.
- evaluate their abilities to share responsibilities in carrying out the learning activities.
- assess student's ability to respect others views and opinions.
- assess learner's ability to manage resources in completing the assigned task.

v. Immediate interaction with learners

The teachers' interaction with students is an integral part of the teaching learning process. It helps in understanding the progress of the students in learning and to identify their learning needs. At the same time, immediate interactions with students can help teachers to enhance rapport with learners, crucial in building trust and confidence of learners with teachers.

Immediate interaction with students must be carried out to:

- assess progress in students' learning and to provide immediate feedback.
- assess students' communication skills.
- assess students' display of integrity, honesty, critical thinking, and attitudes towards science.
- check students' abilities to follow verbal and written instructions.

vi. Experiments and exhibition

Science experiment is a scientific procedure undertaken to make a discovery, test a hypothesis, or demonstrate a known facts, while science exhibition is a public display or demonstration of scientific skills. Since the conduct of scientific experiments and exhibitions are guided by the level of learner's knowledge and attitudes towards science, this can be used as a technique to assess the mastery

of the learner's scientific knowledge, skills and values.

Experiments and exhibition must be carried out to:

- assess the display of scientific ideas and concepts of students in the form of models, charts and posters.
- assess student's ability to demonstrate the use of scientific processes.
- assess student's abilities to relate the scientific concepts to their life and immediate environment.
- assess student's ability to handle scientific equipment with accuracy and safety.

vii. Observation of student's conduct

Observing the students carefully helps teacher to know them better. The information derived help teacher to plan, implement, assess and evaluate the teaching learning process. In the primary science curriculum, this technique is vital to assess the students' ability to demonstrate the essence of working scientifically and the display of scientific values of critical thinking, honesty, integrity, curiosity, team spirit and intellectual drive in the classroom.

Observation, either as incidental or planned activity, must be carried out throughout the teaching learning process.

Observation of student's conduct, as an assessment technique, is important to:

- assess student's level of participation in learning activities.
- assess student's behavioural conduct with teacher, friends and community.
- assess student's ability to handle scientific equipment safely.
- check the demonstration of concerns towards oneself, others and environment.

viii. Field trip or excursion

Field trip or excursion is a trip taken by a group of students to a place away from their normal classroom environment. The purpose of the fieldtrip is usually for observation of natural and scientific phenomena in the real field for gaining first hand experiences outside their classroom activities. Many activities in the primary science curriculum mandate students to do case study, investigation, survey, industrial visit or collect information from the community. Through the conduct of field trip or excursion, teachers can assess students' ability to demonstrate the use of scientific processes to gather information, investigate, explore the natural world, and the scientific events and phenomena in the locality or in the region.

Field trip or excursion must be conducted as an integral part of science teaching

learning process to:

- assess student's ability to use different tools, conventional or non conventional, to gather information.
- assess student's ability to explain the natural phenomena based on the scientific concepts and ideas.
- assess student's level of participation in learning and social activities.
- check the demonstration of concerns for oneself, others and environment.
- assess student's ability to explore and investigate scientific issues and concerns.
- assess the student's ability to interpret and communicate the field trip findings to their colleagues.

The following suggested tools can be used to assess the students, while using the above techniques.

a. Checklist

It is a list of items required, things to be done, or points to be considered and used as a reminder. In the primary science curriculum, checklist is a listing of specific concepts, skills, or behaviour traits, the teacher wishes to observe in the students.

Checklist is a tool for recording whether a characteristic is present or absent, an action is taken or not, or whether learning has taken place or not with 'Yes' or 'No' judgment. In teaching science, the teacher makes a listing of scientific concepts that the learners would have learnt, skills that they would have developed, and scientific values and attitudes that they should exhibit at the end of every topic teaching.

In preparing a checklist, the names of the learners, the data of the class, name of the activity and the descriptors have to be entered before the class starts. In the class, a teacher pays attention to the group of students, on which he/she has selected to build an impression of the group's level of learning in terms of scientific content, the execution of scientific skills and processes, and the display of behaviour traits teacher wishes to record. Checklist must be used on daily basis and recorded to provide necessary feedback to students.

Since there is no standard checklist developed, teacher has to develop his/her own checklist for the three domains - scientific knowledge (SK), working scientifically (WS), and scientific values and attitudes (SV), of the assessment in science, as per the topic's learning objectives and learner's learning needs.

Therefore, only a sample checklist is provided in this manual.

Checklist for continuous formative assessment (CFA) on three domains in science
Sample checklist: Scientific knowledge (SK)

Sl No.	Class:	Scientific knowledge (SK)							Comments
	Topic: Making water safe for drinking	Identifies at least one source of fresh water.	Tells at least one way of purifying water for safe drinking.	Explains how water gets contaminated.	Describes the steps in making SODIS water.	Use the findings to answers the activity questions correctly.	Explains the importance of drinking clean water.	Synthesizes the scientific concepts and ideas to explain the scientific phenomena and processes.	
1	Jigme								
2									

Sample checklist: Working scientifically (WS)

No.	Class:	Working scientifically (WS)										Comment
	Topic: Making water safe for drinking	Follows the activity instructions correctly.	Participates actively in group activities.	Predicts the quality of water after SODIS treatment.	Design and makes a model of water filter using the given materials.	Demonstrates the ability to purify water for safe drinking.	Evaluates the quality of the water filter made.	Draws reliable conclusion from the learning activities.	Ability to use observations to answer the questions in the learning activities	Demonstrates correct procedures in making SODIS water and improvising water filter.	Displays ability to collect relevant materials to make water filter and SODIS water.	
1	Dorji											
2												

Sample checklist: Scientific values and attitudes (SV)

SI No.	Class :	Scientific values and attitudes (SV)						
	Topic: Making water safe for drinking							
	Key: √- Yes X- No Learning objectives Name:	Respect others views in the group discussion.	Shares responsibilities in making water filter and SODIS water.	Shows cooperation in group discussion and activities.	Demonstrates willingness to learn and try new things.	Exhibits concerns for self, others and environment.	Demonstrate curiosity to learn more on the topic.	Comments
1	Zomba							
2								

b. Anecdotal records

Anecdotal records are used to assess student’s learning which is not identified by other assessment tools. Anecdotal records are written descriptions of the casual or focused observations made on learners. They are brief descriptions of incidents and behaviours that offer the teacher a way of assessing and recording the aspects of student’s learning. It can be used in a more directed way when teachers want to collect information on particular areas, such as social development, work habits, aspects of scientific language use, and the children’s development as science learners.

Anecdotal record requires little pre-planning and can be used to capture behaviour as they happen. Entries must be made with appropriate frequency to show the development over a period of time. They should eventually cover all the learners, although some may require more entries than others.

Anecdotal records are usually collected in an exercise book or a folder. Record should include the following entries:

- Name of the student observed, class, and the date and time.
- Observation areas may include individual student's behaviour, skills, and attitudes in relation to outcomes of the study programmes.
- Setting can be either in group or individual.
- Record the observations with comments to share with learners and parents.

c. **Questions and answer**

Asking question is a natural feature of teacher's interaction with students in the class in assessing mainly the content knowledge of the students in the teaching learning process. Therefore, questioning is crucial to the way teachers manage the class, engage students in content learning, encourage students participation in enhancing their understanding. Asking question is widely used as an assessment tool in the teaching and learning process. Questioning may be in the form of:

- verbal questioning
- written question
- interviews
- self assessment questionnaires

While asking questions, the following guidelines may be considered:

- Questions must be short and focused on not more than one key concept. Questions should not be ambiguous.
- Use 'open-ended questions, such as, 'what if...?' and 'why...?' questions, rather than closed questions.
- Look at the learner while asking questions.
- Encourage a conversational approach with the learner to put him or her at ease.
- Listen carefully to the answers for opportunities to find both expected and unexpected evidences.
- Follow up responses with further questions, if useful, to draw out more evidences or to make links with the conceptual ideas.
- Compile a list of acceptable responses to ensure reliability of the assessments.

2. Continuous Summative Assessment (CSA)

The techniques to assess learners through CSA are as follows:

i. Homework

The homework, as described under the CFA, is a task given to learners to be completed at home. The tasks may include, problems to be solved, reading to be carried out, writings to be completed or designing and making of scientific models. However, under no circumstances shall the classroom learning activities be assigned as homework for CSA, for the reason that the learning activities involve the learning of the new conceptual ideas under the guidance of teachers.

The criteria given below is to ensure that the work given to the students are done on their own.

Criteria for home work

Name of student	Criteria					Total Marks
	Completion (4)	Accuracy (4)	Presentation (4)	Creativity & originality (4)	Submission date (4)	(20)
Karma						

The homework in CSA is assessed based on the “Criteria for homework” template, where the score is translated from the rubric description score. Based on the rubric, homework is graded out of 20 marks for every chapter, and the cumulative marks obtained are converted to 5 marks at the end of each term and reflected in the student’s progress report. If a student fails to submit the homework after three days of the due date, the submission date criteria may be awarded zero mark. It is mandatory for teachers to assess homework with grading at least once for every chapter and necessary feedbacks provided for students to improve their learning.

The rubric to assess homework in CSA is provided below:

Rubric for Homework

Criteria	Marking range				Scores
	4	3	2	1	
Completion	Homework is 100% complete.	Homework is 70% complete.	Homework is 30% complete.	Home work is 20% complete.	
Accuracy	Homework is 100% accurate.	Homework is 70% accurate.	Homework is 30% accurate.	Home work is 20% accurate.	
Presentation	Student work is thorough, clear, and legible for all problems. Student has included all relevant illustrations.	Student shows an adequate amount of work for each problem and is legible. Student has included some relevant illustrations.	Student shows some work, but it is inadequate. Student has not included relevant illustrations.	Student shows very poor work, poor handwriting, and no illustrations.	
Originality and creativity	Display of original and creative ideas.	Partial display of original and creative ideas.	Little display of original and creative ideas.	No display of original and creative ideas.	
Submission date	Submitted on due date.	Submitted one day after the due date.	Submitted two days after the due date.	Submitted three days after the due date.	
Total score					

Teachers can adapt the above format to suit their needs based on the learning objectives teachers wish to pursue through different teaching learning activities.

ii. Chapter end test

A pencil and paper test is conducted at the end of each chapter. This is mainly to assess the student's conceptual understanding of the topic. It is important to balance the items selected for the test to include questions involving concepts, skills, values and attitudes.

The chapter end test must be conducted for each chapter, and necessary feedback provided for students to improve their learning. The teacher should maintain the record of marks obtained by individual learner for every chapter end test conducted. The cumulative marks of the chapter end test are then converted to 5 marks at the end of each term and reflected in the student's progress report.

There is no other tool suggested for this technique here, other than the pencil and paper test.

iii. Journal and scrapbook

Keeping a journal by writing down of interesting scientific observations witnessed by students in and around the classroom, or in the natural setting with thoughtful reflection is a powerful way to help students develop their scientific knowledge, skills and values, and foster in learners the habits of record keeping and improve their scientific language.

Students should be encouraged to develop and maintain a scrapbook to collect scientific clippings, specimens, study samples, art works, print media, pictures, photographs and other science related scrap works, which are appealing and are of students' interests. It is similar to the portfolios maintained in other subjects. Writing journal and making scrapbook can be of great fun and engaging for students. It helps students become creative and self-reflective as they write and keep record of the scientific events and their observations of natural phenomenon with which they interact and have relevance to their day to day life. An exercise book can be maintained by each student to make a maximum of 20 entries in their journal and scrapbook. They have ample opportunities to collect and write about anything that interest them in their journal and scrapbook. Samples collected from field trips, excursions, exhibitions, science club activities can find there place in the scrap book.

The following are the suggested entries, but NOT limited to:

- Clippings from newspaper, magazines, comics, newsletters, fliers, pamphlets, and even including download from internet.
- Specimens may include dry leaves, cereals, pulses, dyes, bird feathers, grains, exoskeleton of insects, dried flower petals, nuts, plant parts, etc. with a few statements of the students' reflection.
- Write up on any interesting scientific events and natural patterns like rainbows, clouds, bird nests, leaf patterns, insect home, bird's sounds, stream, animal tracks, animal bones, animals caring their young ones, animal teeth with students' personal thoughts and reflections.
- Report on any experiment or research work that the students have conducted during the school science activities or science exhibition. The student has to write about, how it has been done, why it is important and how it can benefit in his or her life.

While making entries, students are expected to follow the common format provided below:

- Date and time for each of the entries.
- Explicit reasons for selecting the particular entry must be written for every entry.

- In case of inventory study, students must answer questions like, how the study was conducted, what is the relevancy of the study to their life, how can it benefit the community must be explained and described in detail.
- The sources of the entries should be mentioned clearly in their entries.
- Every entry must contain teacher's comments and feedback.

The maintenance of science journal and scrapbook can facilitate teachers to assess the display of scientific skills and values and attitudes by students. Therefore, teacher must ask students to maintain journal and scrapbook from the beginning of the year. The teacher should have a schedule to collect them to provide regular feedback, and to ensure that students make entries throughout the year, rather than filling up at the end of the year. However, journal and scrapbook should be assessed only at the end of the year by using the rubrics suggested in this manual. If a student fails to submit the work, he or she will be awarded zero (0) mark.

Criteria for the Journal and Scrapbook

Name	Criteria					Total marks (20)
	Cover design (4)	Format (4)	Entries (4)	Presentation (4)	Creativity (4)	
Dorji						

Students can be asked to exhibit their science scrapbooks in the class, during the school science exhibition, parent-teacher meeting, or, in any other science functions in the school.

NB: *Students should not be allowed to include acids, corrosive substances, degradable and other flammable materials as their entries in their journal and scrap book.*

Rubric for journal and scrapbook

Criteria	Marking range				Scores
	4	3	2	1	
Cover design	Cover has title of the book, name of the author and grade, cover is very attractive.	Cover has all the three components but the cover is less attractive.	Cover has only two components and cover is less attractive.	Cover has only one of the components and cover is very simple.	
Format	The work contains date, reasons for the entry, source or place of collection, regular feedback from teacher and has critical reflections.	Missing 1 of the 4 components and reflection is less critical.	Missing 2 of the 4 components and poor reflection.	Missing 3 of the 4 components and reflection is absent.	

Entries (samples/ specimens/ photographs/ pictures, scrap works, etc.)	Included 16-20 entries with varieties. All the entries have detailed information.	Included 11-15 entries with few varieties. Few entries do not have detailed information.	Included 6-10 entries with fewer varieties. Most of the entries do not have information.	Included 1-5 entries with one or two varieties. Only one or two entries have information.	
Presentation	Ideas in journal are logically sequenced and neatly written. The scrapbook entries are well organized.	Ideas in journal lack proper sequencing though neatly written. The scrapbook entries are less organized.	Ideas in journal are partially sequenced and no neatness in writing. The scrapbook entries are poorly organized.	Ideas in journal are not in sequence and poorly written. The scrapbook entries are not organized.	
Creativity	Scrapbook entries are unique and grab attention throughout. The written journal has imaginative and new scientific ideas.	Scrapbook entries are generally related to commonly observed phenom- enon. The written journal has less imaginative and less new scientific ideas.	Scrapbook ent- ries are mostly related to com- monly observed phenomenon. The written journal has poor imaginative and a few new scientific ideas.	Scrapbook entries are not related to scientific phenomenon. The written journal has neither the imaginative nor the scientific ideas.	
Total score					

Teachers can adapt the above format to suit their needs based on the learning objectives teachers wish to pursue through different teaching learning activities.

iii. Project Work

Project work is one of the best ways to practice the application of scientific conceptual ideas and skills. The very purpose of including project work is to provide opportunity to explore and extend their scientific knowledge and skills beyond the classroom. Students learn to organize, plan and piece together many separate ideas and information into a coherent whole. Through project work, learners learn various scientific techniques and skills including data collection, analysis, experimentation, interpretation, evaluation and drawing conclusion, and to foster positive attitude towards science and environment.

The new science curriculum, therefore, mandates students to carry out project work to help them to:

- develop scientific skills of planning, designing and making scientific arte-

facts, carrying out investigations, observation, analysis, synthesis, interpretation, organization and recording of information.

- enhance deeper understanding of social and natural environment.
- develop student's ability to work in group and independently.
- provide opportunity to explore beyond the classroom in enhancing their scientific knowledge and skills, which will contribute towards the development of positive attitudes and values towards science and environment.
- understand how science works and the nature of scientific knowledge.
- inculcate the sense of pride in completing their work.
- develop oral and written communication skills.

Teachers can facilitate students to carry out the project work by considering the following suggested guidelines.

- Allow students to select their own project ideas and topics.
- Encourage students to be scientifically creative and productive.
- Provide a clear set of guidelines for developing and completing projects.
- Help students to locate sources of information, including workers in science-related fields who might advise them about their projects.
- Allow students the option of presenting their finished projects to the class.
- Inform students about the general areas on which assessment may be made. For example, scientific thought, originality, procedures, and presentation.
- Advise students to contact their teacher for further assistance or consultations.

Learners must be closely guided by the teacher starting from the selection of topic, doing investigations, data collection and analysis, and writing report in a formal style.

The project work in science should emphasize students to carry out simple specific scientific enquiry related to the topic covered in classes IV to VI science syllabus. Some examples of topics are given below:

- a. Is spring water cleaner than river water?
- b. How many centimetres does a pea plant grow in a week?
- c. What are the benefits of domestic animals?
- d. What is the daily rainfall in the school for the month of July?
- e. What are the solid waste pollutants in the school?
- f. What common diseases mostly affect the people of the local community?
- g. How many varieties of flowers are there in the school campus?

At the end of the project work, every learner must prepare a project work report in the formal format, suggested in the following section. The project work is assessed out of 24 marks which should be converted to 10 marks in the first term. Project assigned should be as per the grade level of the learner. Students can share their project work findings, either in the form of class presentation or presentation to the school.

The product of the project work must be inclusive of write ups, illustrations, models or collection of real objects. The extent of the project work for each class can be guided by the minimum number of words suggested below:

- Class IV - minimum of 300 words
- Class V - minimum of 450 words
- Class VI - minimum of 600 words

The format for project work write-up (report) should include the following aspects:

- The title of project work.
- Table of content.
- Introduction: What is the topic about and why was it chosen?
- Method: How the information is collected, sorted out, and analysed.
- Presentation: Organization of the information collected in a logical order with illustrations, photographs, and drawings where appropriate and necessary to support their ideas.
- Conclusion: Reflection of the findings, learner's experiences and opinions regarding the project.
- Acknowledgement: Show courtesy to thank the people and organizations for the help received.
- References: List of the sources of the information.

The teacher will use the rubric given below to assess the student's project work. Viva-voce is a must to authenticate the originality of students' work.

Criteria for project work assessment

Name	Criteria						Total marks (24)
	Content (4)	Presentation (4)	Viva voce (4)	Process (4)	Originality and creativity(4)	Submission date(4)	
Dorji							

Rubrics for project work assessment

Criteria	Marking range				Scores
	4	3	2	1	
Content	Information presented is relevant, accurate and in logical order.	Information presented is substantially relevant, accurate and in logical order.	Information presented is to some extent relevant, accurate and in logical order.	Information presented is not relevant, accurate and in logical order.	
Presentation	Exceptionally clear and precise expression of ideas, transfer of ideas into product with appropriate illustrations.	Clear and precise expression of ideas, transfer of ideas into product with appropriate illustrations.	Little expression of ideas, transfer of ideas into product with appropriate illustrations.	No clear and precise expression of ideas, transfer of ideas into product with appropriate illustrations.	
Process	Proper planning with regular consultations.	Partial planning with some consultations.	Little planning with a few consultations.	Has neither the proper planning nor the consultations.	
Viva voce	Communicates ideas clearly and precisely, explains the concepts accurately.	Communicates most of the ideas clearly and precisely, explains most of the concepts accurately.	Communicates some ideas clearly and precisely, explains some concepts accurately.	Unable to communicate ideas clearly and precisely, not able to explain concepts clearly.	
Originality and creativity	Display of original and creative ideas.	Partial display of original and creative ideas.	Little display of original and creative ideas.	No display of original and creative ideas.	
Submission date	Submitted on due date.	Submitted one day after due date.	Submitted two days after due date.	Submitted three days after due date	
Total score					

Teachers can adapt the above format to suit their needs based on the learning objectives teachers wish to pursue through different teaching learning activities.

iv. Observation of learner's conduct

Observing carefully helps teacher know better about his or her students. The information derived from the observation helps teacher to plan, implement, assess and evaluate the teaching learning process. In the primary science curriculum, this technique is vital to assess the students' ability to demonstrate the essence of "working scientifically" and to understand their values and attitudes towards science and environment.

Observation, either as incidental or planned activity, must be carried out throughout the teaching learning process.

Observation of student's conduct is important to:

- assess the student's level of participation, cooperation, and responsibility in the learning processes.
- assess the student's behaviour and conduct with teacher, friends and community.
- assess student's display of work ethics, honesty, integrity, and sincerity.
- check the demonstration of concerns towards oneself, others and the environment.

The teacher should use a rating scale to assess the students' display of scientific values and attitude throughout the learning processes. The observation should be graded out of 40 marks at least twice a term. The average marks obtained should be converted to 5 at the end of each term and reflected in the student's progress report.

Sample rating scale for recording the marks for observation

Class:	Participation in learning activities (4)	Respect for others views (4)	Curiosity for exploration (4)	Responsibility (4)	Empathy for others (4)	Punctuality (4)	Honesty in scientific observation (4)	Intellectual drive (4)	Concern for environment (4)	Perseverance (4)	Total (40)	Teacher's comments
Dawa												
Pema												
Sangay												

Teachers can adapt the above format to suit their needs based on the learning objectives teachers wish to pursue through different teaching learning activities.

3. *Summative assessment*

The techniques and tools for assessment through summative assessment (SA) are the term examinations and the end of year examinations, with the weighting of 20 and 30 marks respectively. In SA, students are graded and marks reflected in the student's progress report. The main purpose of the assessment through SA is to assess student's conceptual knowledge, understanding of the scientific processes, and the inculcation of values and attitudes towards science.

Topic-wise time allocation and weighting for Class IV

Chapter	Sub-topics	Maximum time required (mins)	Total Weighting (%)
1. Materials in Our Surrounding	1.1 Everyday Materials	80	11
	1.2 Sorting Materials	160	
	1.3 Floating and Sinking	120	
	1.4 Natural and Human-made Things	160	
	1.5 Degradable and Non-degradable Things	200	
2. Matter	2.1 What is Matter	120	12
	2.2 Solid as Matter	160	
	2.3 Liquid as Matter	120	
	2.4 Gas as Matter	160	
	2.5 Heating and Cooling of Substances	200	
3: Materials in Mixtures	3.1 Pure Substances and Mixtures	120	9
	3.2 Soluble and Insoluble Substances	160	
	3.3 Solid-solid Mixtures	80	
	3.4 Solid-liquid Mixtures	80	
	3.5 Liquid-liquid Mixtures	160	
4: Separating Mixtures	4.1 Sedimentation and Decantation	80	8
	4.2 Separating Insoluble Substances by Sedimentation and Decantation	120	
	4.3 Separating Insoluble Substances by Filtration	120	
	4.4 Making Water Safe for Drinking	200	
5: Forces	5.1 Let Us Look at Forces	120	6
	5.2 What a Force can do	80	
	5.3 Contact Force	80	
	5.4 Non-contact Force	120	

6: Light and Sound	6.1 Sources of Light	80	9
	6.2 How Light Travels	120	
	6.3 Light and Shadow	120	
	6.4 Making Sound	120	
	6.5 Fading Sound	120	
7: Electricity and Magnetism	7.1 Sources of Electricity	120	9
	7.2 Where Electricity is Used	80	
	7.3 Making Connections	160	
	7.4 Things that are Magnets	80	
	7.5 Magnets at Home	120	
8: Living Things and their environment	8.1 Living Things and Non-living Things	120	11
	8.2 Plants and Animals in their Habitat	120	
	8.3 How Plants Adapt in their Habitat	120	
	8.4 How Animals Adapt in their Habitat	120	
	8.5 Living Together	160	
	8.6 Feeding Habits	120	
9: Green Plants	9.1 Effect of Light on the Growth of Plant	160	9
	9.2 Effect of Air on the Growth of Plants	80	
	9.3 Effect of Temperature on the Growth of Plant	120	
	9.4 Effect of Water on the Growth of Plant	80	
	9.5 Flower	120	
10: Food	10.1 Different Kinds of Food	120	8
	10.2 Food for Activity	120	
	10.3 Food for Growth	80	
	10.4 Food for Protection	80	
	10.5 Eat All Types of Food	120	
11: Our Earth	11.1 Shape of Earth	80	8
	11.2 Rotation of the Earth	80	
	11.3 Day and Night	80	
	11.4 Revolution of the Earth	120	
	11.5 Seasons in a Year	160	
	Total	6440	100%

The actual teaching 6440 minutes or 161 periods of 40 minutes in a period.

Chapter 1

Materials in our surrounding

This chapter aims to enable students to classify materials based on the relationship and or patterns. The skill of classification enables students to recognise materials based on certain characteristics, which encourages them to define and organise the diverse world around them.

Learning Outcomes

By the end of the chapter, students should be able to:

- classify materials in their surrounding into different groups according to their properties.
- categorise materials as degradable and non-degradable.
- identify the objects that sink or float in water.

1.1. Everyday Materials

Time: 80 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- name everyday materials that are seen around.
- identify things that are made of different materials.
- classify things into groups based on materials they are made of.

Key Competencies

When students perform activities in groups or in pairs, they establish positive relationships among them, and learn from each-other. They share their findings to the class after the activities. While doing the group activities, the cooperative skills and collaborative skills are enhanced and they also learn to respect each other, the environment and living things around them.

New terms

Materials, things

Activity A

- Arrange things like test tube, pebble, toy car, ruler, potato, feather, leather purse, geometry box, stick, leaf, flower, beaker, nail, paper clip, etc., into the categories given in Table 1.1. Teacher can guide the students to identify and classify things based on the materials that they are made of. For example, geometry box may be made of metal or plastic.

This activity ensures the participation of every student to observe and identify the things based on materials that they are made of or obtained from.

Teacher may repeat the activity until all the students are able to identify and classify things into groups: plant, animal, metal, plastic, rock and glass.

- Students go out in pairs and collect five things that they see around and bring them inside the class room (small things).

Precaution

Students should be instructed not to uproot any plants.

The five things that are collected are displayed on the work table by students. They observe, discuss, identify and finally classify things into groups based on the type of materials that they are made of. Teacher must guide students when they go out. Safety of the children must be ensured when they go out and collect things.

Activity B

- The children sit and observe things around in the classroom. They may touch and feel the thing to classify them into groups based on the materials they are made up of.
- The activity can be extended to classify things found in their homes.

Assessment

- Diagonise students' cognitive skills prior to start of the lesson.
- Explain that things are made up of suitable materials, such as cooking utensils are made up of metals, window panes are made up of glass, tyres are made up of rubber, etc.
- Students' manipulative skills of sorting things while working in pairs to classify things into different groups.
- Students' manipulative skills during the activity when they investigate to identify materials of toy, scale, geometry box, etc., and observation skills using their senses.

Reinforcement

Students explore things in the kitchen at home and name things that are made of metal, wood, plastic, and glass.

Precaution

Avoid things made up of toxic materials.

1.2. Sorting Materials

Time: 160 minutes

Learning objectives

By the end of the lesson, students should be able to:

- write the characteristics of different materials.
- sort the materials based on their characteristics.

Key Competencies

When students use the previous knowledge of classifying everyday materials to sorting of the materials, it involves transfer of learning. As they engage themselves in group or pair work, they participate, contribute, listen and share their views. They should be able to recognise characteristics of basic materials found in the surroundings suitable for making things for specific purpose.

New terms

Transparent, opaque

Activity A

- In this activity, students can recognise that classroom objects are made of different materials and categorise them accordingly in Table 1.2. Teacher guides students to classify things based on the materials like wood, glass, paper, plastic, metal, etc. This enable student to relate the materials to the usefulness of things. Students also explore other types of materials that are used to make classroom objects.

Activity B

- In this activity, students categorise more objects based on the characteristics of the materials that things are made of and record in Table 1.3. The characteristics of the materials, such as heavy, light, transparent and opaque are used while sorting things. This enables students to understand that things are made up of different materials possessing different characteristics. The usefulness of things in day to day life is generally related to their characteristics. For

example, glasses are generally used to make window panes as they are transparent and allow light to pass through. Teacher may ask each group to write two useful things which are

related to the characteristics of materials. These things can be window panes, chart paper, pots, pans, paper weight, etc. Students further observe and feel the materials and identify their characteristics, such as hard, soft, elastic, smooth, rough, etc. and then define term 'characteristics of materials' in their own words.

Precaution

Avoid things made up of toxic materials.
Handle things made up of glass carefully

Assessment

- Purpose of specific materials used for certain things, such as glass are used for making window panes, cotton are used to make pillows, metal is used to make hammer, etc.
- Students' ability to compare classroom objects based on the type of materials used.
- Students' observation and classifying skills.

Reinforcement

Students observe a few things at home and explain why things are made up of materials of specific characteristics. For example, window pane is made of glass because it is transparent and allows light to pass through. They can also be made up of thick colourless plastic, which is transparent.

1.3. Floating and Sinking

Time: 120 minutes

Learning Objectives

By the end of the lesson, student should be able to:

- predict whether an object floats or sinks.
- identify the objects that sink and float.
- explain why the objects sink or float.
- design an experiment to find out if objects float easily when they have air inside.

Key Competencies

When students go out and collect things, they learn to explore the environment and engage themselves in thought processing skills, such as whether objects selected fits inside a bucket of water, dissolve in water, float or sink, etc. Engaging in group work contributes to learning with others and build positive relationships.

New terms

Sinking, floating

Activity A

- In this activity, student will predict and test their hypothesis about floating and sinking of an object. Predictions are based on whether the objects float or sink in water. Students put each object at a time in water to find out whether object sinks or floats and classify them into light or heavy objects. Children develop the manipulative and investigative skills during this activity. After classifying heavy and light objects, students discuss and reason the following:
 - The common characteristics among the objects that float (Example, objects made of wood/paper/light material will usually float.).
 - The common characteristics among the objects that sink.(Example, objects made of metal/stone/heavy materials will usually sink)
 - Children may come to the conclusion that heavier objects generally tend

to sink in water and lighter objects float in water.

Activity B

- This activity helps students to explore and learn that objects can also float if they contain air inside them. Relate to some of the real life examples of floating when objects contain air inside them. For example, life vest used during swimming, inflated ball, hot-air balloon, etc. The experiment designed by students should clearly show that the object or material sinks in water in normal conditions and the same object or material floats when air is pumped in.

Assessment:

- Students' prediction skills on whether the object sinks or float.
- Discuss, explain and report observations, and give reasons for the sinking or floating of the objects.
- Drawing of inferences based on observations.
- Manipulative skills while putting the objects in the bucket of water to test whether objects float or sink.

1.4. Natural and Human-made Things

Time: 160 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define natural and human-made things.
- define raw material.
- classify things into natural and human-made things.

Key Competencies

When students carry out activities in groups, they establish positive relationships among themselves, and learn from each other. When they make predictions, analyse and compare natural and human-made things, they draw inferences that human-made things are made from natural things. They develop skills in consolidating data, drawing inferences, and presenting their findings.

New terms

Nature, natural things, human-made things, raw materials

Activity A

- In this activity, students classify things as natural or human-made things. Students identify certain characteristics like whether the things are processed or present in their natural state. For example, limestone, clay, gypsum, etc., are in natural state and are natural things, whereas cement is human-made as it has undergone certain processes to make it. Students discuss on and classify things into natural and human-made things and further share their views on impact of human-made things like toys, bottles, bags, etc. on the environment.

Activity B

- In this activity, students learn that human-made things are generally made from natural things. These natural things used to make human-made things are called raw materials. Students identify and list that wood is the raw material for paper, cotton is the raw material for gho or kira, plastic and metal are used

to make pen, and sand, mud, lime and clay are used to make bricks. It is to be made clear to students that one or more things, natural or human-made, are used to make other things.

Activity C

- In this activity, students can make a toy by using materials available at home, like cloth, paper, cotton, straw, clay, etc., which may be natural or human-made things. The activity develops psychomotor skill, fosters creativity and innovation, and refines manipulative skills of the students.

Assessment

- Classify a list of things like cars, buildings, sun, moon, trees, stars, mountains, rivers, lakes, etc., as natural and human-made things.
- Observation and manipulative skills while handling tools and objects.
- Creativity and innovation in making a toy out of available materials and things.

Reinforcement

- Students make a list of five human-made things they see at home and discuss how each of them are used.

Students can also list the raw material(s) used for making each of the things identified.

1.5. Degradable and Non-degradable Things

Time: 200 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define micro-organisms with examples.
- differentiate degradable and non-degradable things.
- investigate the process of decay.

Key Competencies

Things present in our surrounding are either degradable or non-degradable. Degradable things are decomposed by microorganisms such as bacteria and fungi where as non-degradable things cannot be decomposed by microorganisms. They carry out an experiment to observe the decomposition. In the process, they acquire scientific skills such as observing, predicting, inferencing and experimenting.

Activity A

- Students carry out this activity using bread to culture bread mould in a jar as per the instructions given in the textbook. Student may also use a piece of cheese or an old shoe to carry out this experiment. After setting up the experiment, ensure that students observe the piece of bread every day using hand lens and record the changes. After a week or so, a growth of greenish mass on the surface of the bread is observed. This greenish mass is a fungus that causes the bread to decay. Through this experiment, students realise that the piece of bread decay due to the action of microorganism. If students are not able to distinctly see the fungus, teachers may supplement with the magnified pictures of fungus on the bread. Students may visit the following website: : http://bcs.whfreeman.com/webpub/Ektron/Hillis%20Principles%20of%20Life2e/Animated%20Tutorials/pol2e_at_2201_Life_Cycle_of_a_Zygosporangium_Fungus/pol2e_at_2201_Life_Cycle_of_a_Zygosporangium_Fungus.html
- Teacher assist students to set up a control experiment by placing a piece of non-degradable material like plastic bag in a jar. Maintain the same condition as in the experimental set up and observe every day. This ensures students learn

that non-degradable materials do not decay and degradable materials decay.

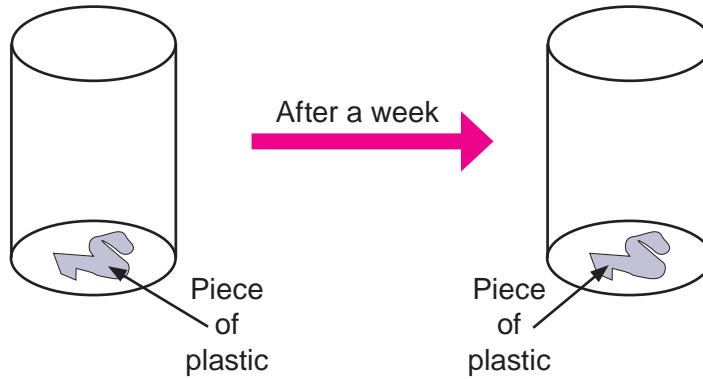


Figure: 1.1. Control experiment on non-degradable things

Activity B

- In this activity, students predict and sort out degradable and non-degradable things from the list provided in the textbook. They may use Table 1.1 to list down the materials.

Table 1.1. Degradable and Non-degradable things

Degradable things	Non-degradable things

Activity C

This activity is to be carried out as a class project work. Students identify a safe place within school campus and dig two pits (pits can be 0.5-1 m in depth and diameter) and label them as Pit 1 and Pit 2. In Pit 1, students put plant and animal wastes, and in Pit 2, they put plastic bottles, plastic bags and pieces of glasses and metals. Pits need to be covered with soil. After every two weeks, students redig both the pits, observe the waste materials, and record the changes they observe in terms of colour, size and smell. Observation may be done till the sixth week. Students must realise the need of segregating wastes into degradable and non-

degradable wastes to avoid litter and pollution and conserve our environment.

Precaution

Instruct students not to play with garden tools that are used for digging pits. Remind them to be very careful while collecting materials like bottles, glasses and metal pieces. Ensure students wear safety gloves and goggles while working in the pit.

Assessment

- Observation record of the experiment maintained by students.
- Conceptual understanding of degradable and non-degradable things.

Reinforcement

- Students watch video in the internet by following the link given below and discuss: https://www.youtube.com/watch?v=SWfT_E2YvZM.
- Students maintain separate dustbins for degradable and non-degradable wastes in the classroom.

Content Summary

All things are made of materials. Different things are made of different types of materials like, nail is made of metal, mirror is made of glass, and table is made of plastic, wood, metal or glass. Things are classified into different categories based on materials they are made of or obtained from.

Characteristics are the distinguishing qualities of a material. For example, materials may be classified based on the amount of light that can pass through them. If all the light passes through the object, then it is a transparent object. For example, glass, clean water and air allow all the light to pass through and therefore are transparent. We can see through a transparent material. If no light passes through the object, then it is an opaque object. For example, cardboard, milk, table, etc. do not allow light to pass through and therefore are opaque.

Things can be classified as floating or sinking objects. Objects like stones, nails, scissors, spoons, plates, etc., are heavy and sink in water. Objects like papers, leaves, dry sticks, rubber, etc., are light and float in water. Besides, objects containing air in them, like inflated football, inflated balloon, inflated tubes, etc., also float in water.

Things which are found in nature are called natural things and these made by humans are called human-made things. Materials which are used to make human-made things are called raw materials. Raw materials can be obtained from nature. Natural and human-made things form another important basis for classifying things.

Those things that decay are called degradable things and those that do not decay are called non-degradable things. Things like paper, leather, wood, kitchen waste, animal and plant materials are degradable things. They are degraded or decayed by the microorganisms like bacteria and fungi.

Things like stones, plastics, rubbers, metals, etc., are non-degradable things and are not degraded by microorganism.

Chapter 2

Matter

In this chapter, students learn three states of matter: solid, liquid and gas. The identification and classification of matters as solid, liquid and gas are based on their characteristics and properties. Applications of matter in day to day life depend on their properties.

Learning Outcomes

By the end of the chapter, students should be able to:

- describe three states of matters.
- explain the changes that occur when materials are heated or cooled.

2.1. What is Matter

Time: 120 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define matter.
- write examples of matter.

Key Competencies

During the activity, students have to weigh, observe, record, interpret and analyse information to make informed decisions. When they do their activities in groups, they collaborate with each other and in the process peer-learning takes place.

New terms

Matter, mass, pan balance

Activity A

- This activity is designed to give students the conceptual knowledge of matter. It can be linked to previous knowledge about the identification and classification of things as natural or human-made things. The characteristic features like transparent and opaque, light and heavy, hard and soft etc., can be used to describe things. Further, students learn that all things are made of matter by describing that matter has mass and occupies space. Students provide a few examples of matter.

Activity B

- The children sit and observe things around in the classroom. This activity helps them to develop observation and recording skills, which are fundamental to all scientific studies. Accurate mass with proper units of measurement must be made by using the pan balance. To do so, provide different things like pan balance, lock, potato, stone, notebook, hammer, etc. Teacher may guide students to measure mass and draw the outline of the objects.

Through this activity, students will confirm that matter has mass and occupies space. They may provide a few non-examples of matter, such as shadow, light, electric current, etc.

Assessment

- Students' ability to answer "Test Yourself" questions.
- Students' skills like drawing, observing, reading, recording and inferring while students measure mass and space occupied by the objects.

Reinforcement

- Students categorise water, electric current, air, sound, dust particles, colour, light and cotton as matter and non-matter using Table 2.1.

Table 2.1. Matter and Non-matter

Matter	Non-matter

- Show the video about states of matter from the given web link:
<https://www.youtube.com/watch?v=PjZSMu2SXt4>

2.2. Solid as Matter

Time: 160 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- investigate that solid has mass and occupies space.
- describe solid as one of the forms of matter.
- define meniscus.

Key Competencies

Students are engaged in the process of inquiry through experimentation when they measure the volume of water by dipping the stone into it. As students engage themselves in group work, they actively participate and contribute to the group, listen to others' view, voice out their opinions, involve in critical thinking, take risks and therefore formulate solution to solve a problem. They also enhance their manipulative skills and refine their observation skills while taking measurement.

New terms

Meniscus

Activity A

- Students explore method to measure space occupied by solid using water in a measuring cylinder. Students observe change in volume of water in measuring cylinder and translate the observation to space occupied by the solid. Like the previous activity, students can draw the outline of a solid object to show that an object occupies space.

Remind students to strictly follow the procedures.

Observe the lower meniscus to make measurement.

Activity B

- In this activity, students determine that solids not only occupy space but also have mass. Students design their own experiment to show that solid has mass. Students can follow the method as shown in Figure 2.1, using a small stone, thread, metre scale, simply to show (not measure) that solid has mass.

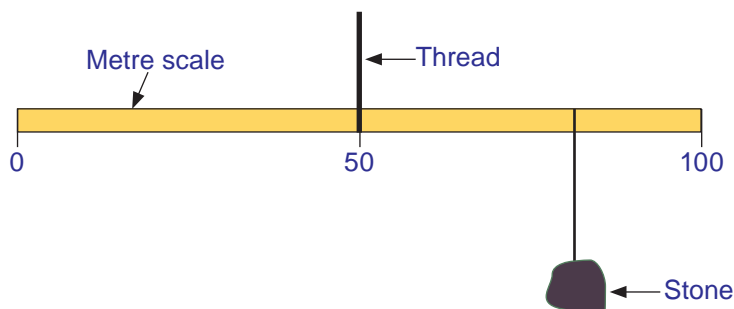


Figure 2.1. Simple design that shows stone has mass.

Assessment

- Students' skills like observing, handling, drawing, recording etc. while finding the space occupied by a stone using water in a measuring cylinder.
- Students' creativity and innovation in designing an experiment to show that a stone has mass.

Reinforcement

Students make a list of five objects at home that are solid and write two characteristics of each object identified.

2.3. Liquid as Matter

Time: 120 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- measure the mass and volume of liquids.
- describe liquid as one of the forms of matter.

Key Competencies

Recognise that all liquids are a form of matter because they occupy space and have mass. During the group activities, students share and discuss their views with each other, establish positive relationships and enhance the skills of cooperation and collaboration. They refine their manipulative skills and learn the basics of recording observations.

New terms

Liquid, volume.

Activity A

- Students learn to measure mass of liquid using pan balance. They need to accurately record the mass using correct units of measurement. The mass of water is calculated by subtracting the mass of empty bottle from the mass of bottle filled with water. In this way, students can measure the mass of any liquid in their daily lives.

Activity B

- Students design their own experiment to show that liquid occupies space using water and empty containers.
- Teacher can provide materials like measuring cylinder, water and transparent empty containers of different shapes and sizes. Students fill water (equal volume) in empty containers of different shapes and observe the shape of the

water. The space occupied by any liquid is equal to the volume of the liquid in the container.

Assessment

- Students' ability to investigate, measure, record and compare the observation while carrying out the experiment.
- Students' creativity and innovation in designing an experiment to show that liquid occupies space.

2.4. Gas as Matter

Time: 160 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- measure the mass and volume of gas.
- describe gas as one of the forms of matter.

Key Competencies

Recognise that gas is a form of matter as they occupy space and has mass. When students are involved in group/pair activity, they discuss, share and compare their observations and results. They strengthen their inquiry skills and manipulative skills.

New term

Gas, air pressure, meter scale

Activity A

- This activity helps students learn about the mass of gas. Teacher can guide students to blow air inside the balloon. Air contains a mixture of gases. Students use balloons and a meter stick to investigate that air has mass. The experiment needs to be carried out in a room with closed doors and windows to avoid the effects of breeze or wind on the set up. The need for control set up has to be explained by the children.

Activity B

- This activity helps students to understand that a container, which is apparently empty, is not actually empty as it contains air inside. They can use this concept to know that it is difficult to blow an air inside an empty bottle because it already contains air in it. Students should strictly follow the instruction or else the water will fill the beaker and wet the paper and the investigation will fail. Teacher can demonstrate the procedure to fit the paper in beaker correctly and

the right way to immerse beaker with paper in the water.

- Students are provided with materials like a bottle, funnel and clay/dough and instructed to carry out the activity as per the following procedure.
 1. Place the funnel into the empty bottle and seal the space between funnel and mouth of the bottle.
 2. Slowly pour the water in the funnel. Observe the flow of water into the bottle.
 3. Remove the seal and observe the flow of water into the bottle.
 4. Discuss in groups and present the reasons for the observations made in both the cases.

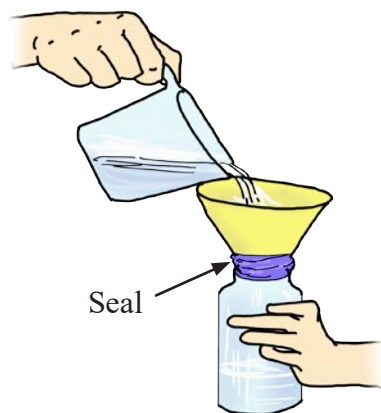


Figure 2.2. Pouring water into the bottle with a seal



Figure 2.3. Pouring water into the bottle

- In the first case, water just stays in the funnel and does not flow into the bottle as air occupies space in the bottle. Water cannot enter the bottle unless some air is pushed out of the bottle. In the second case, as the seal is removed, water enters as the air inside the bottle is pushed out through small space between the funnel and the mouth of bottle.

Assessment

- Students' ability to answer 'Test Yourself' questions verbally.
- Students' skills like observation, recording, drawing conclusion while investigating gas has mass.
- Students' participation, performance and contribution while carrying out the group activities.

Reinforcement

- Students design a simple experiment using paper or a plastic bag to show that air occupies space and takes the shape of the bag.
- Students watch video clip that shows air has mass from the web link given below.

https://www.youtube.com/watch?v=Bv_tS6-Qcj4&t=40s

- Students watch video clip that shows air occupies space from the web link given below and ask the following question.

<https://www.youtube.com/watch?v=WBNNfKT6Kk0>

What happens to the tissue paper inside the glass when it is pushed into the water? Give reason.

2.5. Heating and Cooling of Substances

Time: 200 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- write the effect of heating and cooling.
- explain that substances change their properties on heating and cooling.

Key Competencies

Observe that the heating and cooling brings about change in temperature affecting the properties of the substances. The change in state of the substances and colour are observed through experiments. Scientific skills are learnt through hands-on experiments.

New terms

Expansion, contraction

Activity A

- The changes in substance due to heating and cooling can be observed in terms of shape, size, colour, taste, etc. Provide substances like water, ice, butter, oil, ice cream, etc., to demonstrate the effect of heating and cooling. Ensure that student uses test tube holder while heating the substances and the mouth of the test tube is pointed away from other students. One of the students in the group can keep the time for heating and cooling.

Precaution

Be careful while handling hot substances and flames.

Activity B

- The following materials should be arranged for this activity: beaker, water, spirit lamp, wire gauze, tripod stand and match box/lighter. Demonstrate the process of heating water and show the vaporisation process. The activity promotes further development of the concept that heat brings

about change in the state of matter, i.e, from liquid to gas (vapour). Teacher need to show the dexterity of manipulative skills during the demonstration.

Activity C

- Students investigate the expansion and contraction of gas upon heating and cooling respectively. They explain that the expansion of gas on heating increases the volume of the gas, thereby inflating the balloon. Similarly, when inflated balloon is cooled in cold water, the balloon shrinks due to contraction of the gas. Therefore, students conclude that heating generally causes the expansion of substances while cooling causes contraction. Teacher should ensure that student uses test tube holder while heating the substances.

Precaution

Be careful while handling hot substances and flames.

Students plan an investigation to understand the effects of heat on ice, raw egg and solid butter. The predicted temperature and the actual temperature at which each substance changes should be recorded in the Worksheet 1.

To plan the investigation, the following guiding questions need to be answered.

- What do you think will happen to substances on heating or cooling? (hypothesis)
- What tools are needed to verify the hypothesis?
- How can findings be recorded ?

Heat the substance one at a time and observe the changes. When the change is complete, read the temperature of the substance and record on the Data table in Worksheet 1. Raw egg is in liquid state which on heating solidifies. It is a permanent chemical change and the egg cannot be converted back to liquid on cooling.

Now, cool all the substances by placing them in a freezer.

Remove the substance from the freezer and observe. Read the temperature of each substance and record in the data table. Water can be refrozen, butter will solidify and probably there can be no visible effect on an egg. Students check to see if their hypothesis are proven. One group of students can compare their findings with the other groups.

Ask students what they have learned about the effect of heating and cooling on the substances. Some life related questions may be asked, such as:

- Why do we keep food and drinks in the refrigerator?
- It is not advisable to keep ice creams in open area in hot weather. Explain.

Worksheet 1 – Heating and Cooling

Name/ Group -----

Investigation- Plan and investigate the effect of heat on ice, egg and butter.

Write the steps to carry out the investigations

Prediction – Predict the effect of heat on each substance.

-----Data table

Substance	Temperature (Room)	Observation	Temperature (Hot)	Observation	Temperature (Frozen)	Observation

Assessment

- Students' collaborative skill while working in groups.
- Students' scientific skills while carrying out the activity of heating and cooling.
- Students' construction of knowledge by generalising the effect of heating and cooling on different substances.

Reinforcement

Students identify a natural phenomena which is dependent on heating and cooling of water.

Content Summary

Things that you see around are all matters as they have mass and occupy space. Solid is one form of matter. Solids occupy space and have mass. Mass and space occupied by solids can be measured with the help of simple devices.

Liquids like milk, oil, ink, alcohol, kerosene, petrol, etc., and gases like air are also matter as they have mass and occupy space.

Air is a mixture of several gases and is generally invisible. All matter expands or contracts on heating or cooling respectively. A gas expands or contracts to a greater extent on being heated or cooled. Some examples of gases are air, smoke, water vapour, etc. Matter can be changed from one form to another.

Chapter 3

Materials in Mixtures

In this chapter, students learn three states of matter-solid, liquid and gas. This chapter deals with the materials that are made up of pure substances or mixtures. Students learn the characteristics of pure substance and mixtures and differentiate them. Students investigate the solubility of substances in liquids and describe the types of mixtures.

Learning Outcomes

By the end of the chapter, students should be able to:

- differentiate between a pure substance and a mixture.
- create different types of mixture using solids and liquids.

3.1. Pure Substances and Mixtures

Time: 120 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define, impurities, mixture and a pure substance.
- differentiate pure substance and mixture.

Key Competencies

In this topic students learn about impurities and their presence in pure substances form a mixture or more than one pure substances can form a mixture. They can classify the substances as pure substance and mixture. Student can form a mixture using different substances provided. Collaborative and manipulative skills are enhanced.

New terms

Mixtures, pure substance, impurities

Activity A

- This activity introduces the concept of pure substance, mixture and impurities to students. Teacher must show some examples of pure substances like sugar, salt, water, iodine, copper, etc., and demonstrate how a mixture can be prepared from two or more pure substances like soil, sand, gravels, and water by mixing them. Students identify mixture (muddy water), pure substance (water) and impurities (soil, sand, gravels).
- Show a video on pure substance and mixture from the web link given below.

<https://www.youtube.com/watch?v=88MBCyiaPSM>

After watching the video, students to draw a flow chart using words 'matter', 'pure substance' and 'mixture' with their examples. This would help students understand the concept of pure substance and mixture as two types of matter.

Activity B

- Students go to the science laboratory prior to the activity and introduced to some simple scientific apparatus like beaker, measuring cylinder, watch glass, glass rod, etc. Do not allow the students to eat anything inside the laboratory.

This activity develops the students' observation skill and psychomotor skills. They make their own mixture using salt and water. They identify other pure substances that may be used to create mixtures.

Activity C

- Students use a list of substances given in the textbook. Students discuss in groups to identify the characteristics of the given substances and classify them into pure substances and mixture. Teacher can guide the students on this minds-on activity. Students confirm their conceptual understanding on mixture and pure substance.

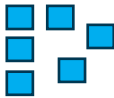
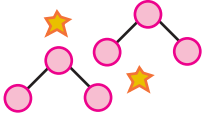
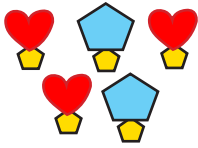



Assessment

- Students' ability to answer 'Test Yourself' questions verbally.
- Students' manipulative skills while carrying out the activity.
- Students' conceptual knowledge on impurities, mixture and pure substances.

Reinforcement

Students classify the following as pure substance or mixtures using the Work Sheet 2 provided below.

Work Sheet 2

 <p>a. _____</p>	 <p>b. _____</p>	 <p>c. _____</p>
 <p>d. _____</p>	 <p>e. _____</p>	 <p>f. _____</p>

3.2. Soluble and Insoluble Substances

Time: 160 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define soluble and insoluble substances.
- give examples of soluble and insoluble substances.
- differentiate soluble and insoluble substances.

Key Competencies

Learning by doing is a fundamental principle in teaching and learning. When students engage in activities involving dissolving, soluble and insoluble substances, they are able to relate the teaching and learning experience to the real world. The experience also makes them inquisitive of the phenomenon where they interact with dissolving, soluble and insoluble substances on a daily basis.

New terms

Dissolve, soluble, insoluble

Activity A

- Students discover that substances may or may not dissolve in water. In this activity, they focus on some of the basic scientific skills like hypothesising, observing, handling apparatus, measuring, etc. They understand the process of dissolving, soluble and insoluble substances. Students also learn to accurately measure the volume of a liquid.

This activity helps students to predict and compare their predictions with actual experimental findings. They predict the solubility of substances like sugar, chalk powder, copper sulphate, glucose and flour as soluble or insoluble in water. Then they investigate their predictions by manually mixing each substance separately

Precaution

Do not to taste any substances used in the activity

with water to find out whether their prediction is correct or incorrect. This enhances their ability to make reasonable predictions which can be tested through experimentation.

Assessment

- Students' ability to make predictions based on scientific reasoning.
- Collaboration, team dynamics, listening to and respecting other's views, offering contradicting and thought provoking opinions.
- Skills such as experimenting, observing, recording, inferring besides constructing knowledge about soluble and insoluble solids in water.

Reinforcement

- Students watch video from the given web link and ask students to list the examples of soluble and insoluble substances.

<https://www.youtube.com/watch?v=tIeDkkyoAPw>

- Students to watch video from the given web link on soluble and insoluble substances to distinguish soluble substances from insoluble substances.

https://www.youtube.com/watch?v=ZgI_dd1gV_Q

3.3. Solid-Solid Mixtures

Time: 80 Minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define solid–solid mixture.
- give examples of solid- solid mixtures.

Key Competencies

During the activity students discuss, explain, or share their findings with the class on solid-solid mixtures. Students relate the previous knowledge or experiences with the present learning, building grounds of learning to their context. They participate in group works, which facilitate peer learning.

New Terms

Solid-solid mixture

Activity A

- For this activity, provide the solids given in the textbook or any other solids. Students mix these solids to form solid-solid mixture. Using the same group of solids, students discover that several solid-solid mixtures can be formed. It has to be highlighted that different solid-solid mixture form another solid-solid mixture.

Assessment

- Students' ability to answer 'Test Yourself' questions.
- Students' skills of preparing solid- solid mixtures during the activity.
- Students' communication skills when they share solid-solid mixtures they listed to the whole class.

Reinforcement

Students explore their surroundings for more examples of solid-solid mixture and share them in the class.

3.4. Solid-liquid Mixtures

Time: 80 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define solid-liquid mixture.
- write examples of solid-liquid mixture.

Key Competencies

During the activity, students interpret and analyse information to make informed decisions to conclude about solid-liquid mixture. When they do their activities in groups, they establish positive relationships among them, and learn from each other. During the activity, they get first-hand experience to prepare the solid-liquid mixture.

New terms

Solid-liquid mixture

Activity A

- This activity introduces the solid-liquid mixture to the students. Teacher may provide opportunities for students to prepare different types of solid-liquid mixtures. They discover that rice does not dissolve in water but forms solid-liquid mixture. They define solid-liquid mixture as a mixture that consist of solid and liquid.

Activity B

- In this activity, students discover that ammonium chloride completely dissolves in water and forms solid-liquid mixture. They may put excess ammonium chloride in water and it may not dissolve completely. However, it still forms solid-liquid mixture. They understand that some solids are soluble and some solids are insoluble in the water but they ultimately form solid-liquid mixture.

Assessment:

- Students' manipulative skills like preparing, observing, recording, comparing, measuring, and inferring when they prepare solid-liquid mixtures.
- Students' communication skills in answering activity questions posed by teacher or peers.
- Students' knowledge on solid-liquid mixtures by asking questions given in 'Check your progress'.

Reinforcement

Students list four different types of solid-liquid mixtures that they use at home.

3.5. Liquid–liquid Mixtures

Time: 160 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define liquid-liquid mixture
- give examples of liquid-liquid mixtures.

Key Competencies

The students reflect on their previous experience of preparation of solid-liquid mixture, make a connection with the current activity, and enhance their learning. In the group work, they are engaged in exchanging their views and ideas, listen to others view and voice out their opinions. As they carry out the activities, they are actively engaged in inquiry process.

New terms

Liquid-liquid mixture

Activity A

- Students understand that some liquids are soluble and others are insoluble in the water but they form liquid-liquid mixture. They prepare liquid-liquid mixture of ink and water. They state more examples of liquid-liquid mixture, such as milk and water, alcohol and water, glycerine and water, ink and water, vinegar and water, limejuice and water, etc.

Activity B

- Students design their own method of preparing mixture of oil and water. It may be noted that some liquids like honey partially dissolves in water. They discover that some liquids are soluble and some are insoluble or partially soluble in water to form liquid-liquid mixture.

Assessment

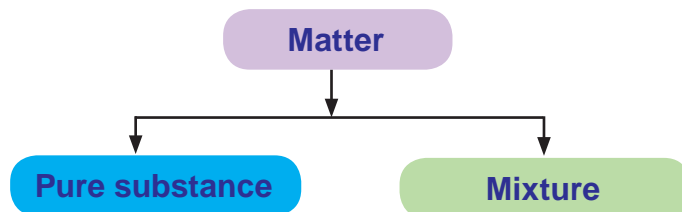
- Students' manipulative skills in handling the laboratory apparatus like test tubes, beakers, glass rod, dropper, etc. while preparing the mixtures.
- Students' skills like preparing, observing, comparing and inferring during the activity.

Reinforcement

Students list four different types of liquid-liquid mixtures that they use at home.

Content Summary

Matter consists of pure substances and mixtures.



Substances without impurities are pure substance and substances containing impurities are generally impure substances or mixtures. Mixtures are available everywhere as natural or human-made.

Substances may or may not be soluble in liquid. Substances which dissolve in liquid are soluble substances and those which do not dissolve are insoluble substances.

A mixture is a substance that contains two or more pure substances. If a mixture consists of two or more solids, it is called solid-solid mixture. Solid-liquid mixture is a mixture of solid and liquid. If a mixture consists of two or more liquids, it is called liquid-liquid mixture.

Chapter 4

Separating Mixtures

All the way back to ancient history, human beings have separated mixture to get the substances that they need. This chapter deals with various separating methods commonly practised. Different separating methods may be used to separate mixture into their individual components. Students understand that many substances that we use every day occur in the form of mixture. For example, fresh water may contain impurities like sand and dust particles, therefore it is not drinkable. To purify the water we may use separating methods, such as sedimentation, decantation, and filtration. Separating mixtures is an important process at home and in industries to obtain the products for the specific use.

Learning Outcomes

By the end of the chapter, students should be able to:

- explain various methods of mixture separation and relate them to local practices.
- describe the methods to separate insoluble solids dissolved in liquids.

4.1. Sedimentation and Decantation

Time: 80 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define sedimentation and decantation.
- separate insoluble substances by sedimentation and decantation.

Key Competencies

Students learn the method of sedimentation and decantation and successfully separate sediments from the solid-liquid mixture. They follow instruction and demonstrate their manipulative skills.

New terms

Sedimentation, decantation, sediments

Activity A

- This activity can be conducted in the classroom or laboratory. Students learn the processes of sedimentation and decantation to separate insoluble solid (sediments) from water. Students will also learn that the volume and mass of a solid are factors which affect the rate of sedimentation. For instance, settling of mud particles might take little longer time to settle than other heavier particles like gravels and pebbles. Students must ensure that the mixture is left undisturbed during the sedimentation process and very carefully decant the water such that no mud particles pour out of container along with water.

Assessment

- Students' manipulative skills while they perform the experiment on sedimentation and decantation of muddy water.
- Precautions students take during sedimentation and decantation.

Reinforcement

Students explore on sedimentation and decantation processes applied at home. They write three examples and share them to the whole class.

4.2. Separating Insoluble Substances by Sedimentation and Decantation

Time: 120 Minutes

Learning Objectives

By the end of the lesson, students should be able to:

- separate insoluble substances by sedimentation and decantation.
- identify mixture that cannot be separated by sedimentation and decantation.

Key Competencies

Students actively collaborate and share their understanding with teacher and each other during group works. They interact with each other, learn to inquire, clarify differences and exchange ideas among themselves. Students solve meaningful, real-life, complex problems and relate the processes to real-world settings.

Activity A

- This activity provides hands on experience to students to prepare solid-liquid mixture of rice and water. Students use sedimentation and decantation processes to separate the mixture into their individual components, i.e, water and rice. To reinforce the understanding of sediment, students may be asked to point out the sediments after the sedimentation process.

Activity B

- Students prepare several solid-liquid mixture and carry out sedimentation and decantation processes to investigate and confirm the mixture that can be separated by these processes. Students find out that all the solid-liquid mixture cannot be separated by decantation and sedimentation, such as sugar and water from sugar solution.

Assessment

- Scientific skills of students when students prepare solid-liquid mixture.
- Students' manipulative skill and dexterity in the separation of mixture by sedimentation and decantation.
- Students' conceptual knowledge by answering the questions given in 'Check Your Progress'.

Reinforcement:

Students explore and list down some of the real life examples where sedimentation and decantation processes are used to separate mixture. Some examples include separating tea leaves from tea (without the use of sieve), washing rice in water and draining, separating water from oil, separating juice from fruit pulps, etc.

4.3. Separating Insoluble Substances by Filtration

Time: 120 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define filtration, filtrate and residue.
- carry out filtration using filter paper.
- identify the mixtures that can be separated by filtration.

Key Competencies

During the activity, teacher demonstrates the process of filtration and the students observe the scientific skills and the correct way to set up and carry out experiment. The students observe, record information and knowledge that are useful in separating mixture by filtration. Students correctly fold the filter paper and separate filtrate and the residue.

New terms

Filtration, filtrate, residue

Activity A

- Teacher demonstrates the process of filtration and students observe the basic skills of folding the filter paper and setting up of apparatus. They learn to record and identify all the apparatus and materials used during the demonstration. Students enhance their observation skill and correctly identify filtrate and residue during the filtration of muddy water. Students observe the colour of filtrate and compare it with colour of muddy water to confirm that filtration is an effective method of separation.

Activity B

- Students arrange their own filtration setup to separate the mixture of chalk powder and water. Students recollect the process and skills observed during the demonstration and apply them to filter. They should clearly identify drained water as filtrate and chalk powder on filter paper as residue.

Assessment:

- Students' ability to answer 'Test Yourself' questions verbally.
- Students' manipulative skills like observation, handling of apparatus and mixtures during the activity.
- Student's collaborative skills while students work in groups during the separation of insoluble substances by filtration.

Reinforcement

- Students design a simple model to obtain clean water from muddy water, which can be use in their community.
- Students find out the reason why oil filter and air filter in vehicles are replaced regularly and share their finding to the class.

4.4. Making Water Safe for Drinking

Time: 200 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- design a simple water filter.
- explain the process of SODIS.
- make water safe for drinking

Key Competencies

Students identify the causes of water contamination and learn the process of SODIS. Students learn to work in groups efficiently and follow the steps to successfully construct a water filter. They analyse the purposes of charcoal, gravel and sand in making of the water filter.

New terms

SODIS, contamination

Activity A

- Teacher may start lesson with the question “Why we should not throw garbage or trash in rivers and streams?”
- Students discuss in groups and identify how contamination of water occurs at the source of water or as it flows. They may list that river, streams and water sources are contaminated usually by animals, home and industrial wastes, soil erosions, etc. Students recollect whether they have devices at home or seen one that purify water for drinking. They list down the importance of making water safe for drinking.

Activity B

- Students learn that sunlight can kill germs and therefore can be used to kill germs in water too. Students follow the procedure of SODIS in school using glass bottles to treat water.

- Teacher must inform students to use only glass bottle for this activity.
After the activity, teacher may ask students to answer questions, such as :
 - How is water treated by SODIS?
 - Name one method to make drinking water safe.
 - Why is glass bottle used for SODIS?

Activity C

- Students design water filter using locally available materials, such as charcoal, sand, gravels, cloth piece, empty container, etc. Teacher guides students in planning and designing and during the construction of the filter. Charcoal is used in the filter to remove unpleasant odour present in dirty water. Students should use clean cloth piece or cotton. This activity develops psychomotor skills of the students and encourages improvisation and innovation.

Assessment

- Students' cognitive and collaborative skills during the group works.
- Students' manipulative skills while they follow the processes of SODIS and construct a water filter.
- Students answer the questions given in 'Check Your Progress'.

Reinforcement

Students organise exhibition to display water filters designed and constructed by them.

Content Summary

Sedimentation and decantation is one of the processes of separating insoluble substance from solid-liquid mixture. When insoluble solids like sand, rice, mud, chalk powder mix with water, they can be separated by the process of sedimentation and decantation. Sedimentation is the process of settling down of the insoluble solids as sediment. The process of decantation can separate liquid from sediments.

Sedimentation and decantation can separate insoluble solid from a liquid but it cannot separate soluble solids from liquids. However, if the solid is lighter than the liquid, sedimentation and decantation processes are generally not effective separation methods. For example, in husk-water mixture, husk is lighter than water and the process of sedimentation and decantation cannot separate them.

Filtration is considered a better method of separating insoluble solid-liquid mixtures compared to sedimentation and decantation. The principle of filtration can separate the solid-liquid mixtures irrespective of the weight and size of the solid in the mixture. However, filtration cannot separate mixture of the substances that dissolve in liquid.

SODIS and filtration make water relatively safe for drinking. In SODIS, only transparent glass bottles should be used. Avoid the use of plastic or PET bottles because the chemicals used for making the PET or plastic bottles will leach out in water, which may be toxic.

Chapter 5

Forces

Students discover that an object at rest can be moved by applying force and the object in motion can be stopped by applying force. The children at this stage can describe force as a push or a pull that changes the shape and state of an object. Force is intangible but we can realise its presence by its effect. The common effects of the forces depend on motion and speed.

Students identify the force by looking at its impact and its application in their daily activities. Majority of activities in our daily lives involve contact force where one body applies force and the other experiences the impact of force.

Students carry out the investigations to discover non-contact forces or experiment to confirm the existence of these forces. Students explore the magnetic force and gravitational force as dominant non-contact forces that are essential for carrying out our daily activities.

Learning outcomes

By the end of the chapter, students should be able to:

- investigate the nature of contact force and non-contact force.
- explain the effects of forces in everyday life.

5.1. Let Us Look at Forces

Time:120 minutes.

Learning Objectives

By the end of the lesson, students should be able to:

- define force as a push or a pull.
- identify push or pull as force involved in different situations.

Key Competencies

When children look around, they see leaves falling from trees, prayer flags fluttering in the wind, people moving things etc., and children wonder why objects move. While students work in groups to identify existence of force as push or pull, they discuss and share their findings among themselves in trying to understand the presence of force in our daily lives. Students then define force in their own words.

New terms

Force

Activity A

- In this activity, students use the pictures in the textbook, or teacher may substitute them with pictures depicting situations where push and pull can be easily identified. Students may be asked to demonstrate the actions given in Figure 5.1 and confirm these action as push or pull.

Provide opportunity to the child to justify their thoughts clearly on various situations where push or pull are involved to carry out a specific action.

Activity B

- Conduct this activity either inside or outside the classroom (before activity B in the textbook). To explore the situations and movements, ask the students to play, walk, write, etc., and identify the force involved in their actions. Teacher may guide the students in understanding the concept of force by asking two basic questions on every action they observed:

1. Which body is moving or coming to a stop?
 2. What is causing it to do so?
- Now carry out activity B as given in the textbook.

Assessment









- Students' prior knowledge and experiences on force.
- Students' collaborative skills while working in groups in terms of identifying the pull or push in situations presented and co-constructing knowledge and meaning of force.
- Demonstration of actions and identification of push or pull in those actions.

Reinforcement

- Students can solve Worksheet 3.

Worksheet 3

Instruction: Write push or pull below each picture.

			
a. _____	b. _____	c. _____	d. _____
			
e. _____	f. _____	g. _____	h. _____

- Students state more examples of push or pull force to enhance their understanding of force. Students can also draw them in their notebook or chart paper.

5.2. What a Force can Do

Time: 80 Minutes

Learning Objectives

By the end of the lesson, students should be able to:

- identify the effects of force on the state of a body.
- identify situations in our daily lives where effects of force play a role.

Key Competencies

When students observe an event or engage in an activity to identify the force that has brought about changes, they develop information processing and decision-making skills. While working in groups students learn to collaborate and develop team spirit while recognizing the effects of force. They share their observation and findings to the class and encourage others to question further on their findings.

New terms

Moving object, object at rest, speed

Activity A

- In this activity teacher plans out the lucky draw game. On pieces of papers, the teacher writes one action each a student is supposed to carry out. Provide every student with a piece of paper containing one action. For example, ‘Push the door.’ The student who gets this action will demonstrate the action of pushing the door. Other students will observe carefully and note down the change brought about by the force. Other paper pieces may include actions that bring about the following changes:
 - stop moving,
 - change the shape of an object
 - speed up
 - start moving
 - slow down

Make sure to include the actions, which are doable by all gender and ability groups. Teacher must arrange the materials and setting required for demonstration by students prior to learning.

- Students can be engaged in playing a paper football game to reinforce the understanding of the effects of force. Pair students in the class and provide each pair with a sheet of paper (A4). On the paper, students draw a football pitch large enough to play football made of paper with the outline of players placed haphazardly on the pitch. Let the pair of students sit facing each other and play a football match by blowing air from their mouth. The air from the mouth controls the movement of the paper ball. As they play, students should observe carefully and note the effect of force applied by blowing air on the paper ball.

Activity B

- Teachers may share examples for specific effect of force, which may provide clues that lead students to discuss and come up with more examples.

Students in groups discuss the effects of forces and come up with several ideas and examples that they experienced or observed.

Students complete Table 5.3 given in the textbook and present their work to the class.

Assessment

- Students' ability to answer questions correctly.
- Students' ability to relate the effects of force to their daily activities, where push or pull bring about change in the motion of object, speed and change in shape of the object.
- Students' manipulative skills while arranging the set up and handling objects during investigation and preparing for the game.
- Students' collaborative skills while working in groups to identify the effects of force on the object.

Reinforcement

- Students watch the video from the given web link and ask them to list down the force and its effect.

<https://www.youtube.com/watch?v=hNPjB9xDTrc>

- Student identify a situation where force is not involved but still there is motion of an object. Also a situation where there are no effects of force on an object.

5.3. Contact Force

Time: 80 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define contact force.
- state examples of contact force.

Key Competencies

When children are engaged in group or pair work, they share ideas, views and ultimately improve the skills of scientific reasoning and communication skills. Students acquire information through different processes and sources, interpret and analyse the information to construct new knowledge on the concepts of contact forces.

New terms

Contact force

Activity A

- In this activity, students learn the fundamental concept that contact force exists only when there is contact between two bodies. We apply contact force when we push, pull or lift things in doing work.
- Students can carry out the following tasks:
 - push a switch
 - open a window
 - squeeze a lemon
 - kick a ball
 - close a door
 - lift your bag
 - clean the chalkboard
 - move a table

Students observe carefully while carrying out the above tasks and answer the following questions for each task carried out.

- What is moving?
 - What is applying the force?
 - Where is the contact point?
 - Can the objects move without being touched?
- Ask students to push a wall. Here, the emphasis is on whether the body that is pushing comes in contact with the wall. Force is being exerted even though the wall does not move. Therefore, the misconception that forces exist only when the state of a body is changed should be avoided.

Activity B

- Students, either inside or outside the classroom, can observe the activities that are occurring due to application of force. Students generalise the information in answering the following questions in each case:
 - What is moving?
 - What is applying the force?
 - Where is the contact point?
 - Can the objects move without being touched?
- Students may reflect and list down the experiences where contact forces are applied, or draw the picture of their experiences. In either case, students identify the point of application of contact force. Students share their work to the class through presentation.

Assessment

- Students' ability to provide correct answer to the questions.
- Students' ability to present situations they have observed, where contact force is prominent.
- Students' responses in writing 3 things they learned, 2 things they found interesting and 1 question about contact forces.
- Accuracy of information while students present their experiences of contact force.

Reinforcement

Students watch video from the given web link. They write about the three forces explained in video and justify why each of them is a contact force.

<https://www.youtube.com/watch?v=v-BPYONLh18>

The lesson on contact force may be more effective if students learn both contact force and non-contact force simultaneously.

5.4. Non-contact Force

Time: 120 minutes

Learning objectives

By the end of the lesson, students should be able to:

- define non-contact force.
- give examples of non-contact force.

Key competencies

Students carrying out the investigations are fully engaged in an inquiry process to solve problems. Students reflect on experiences to enhance learning by constructing an understanding of the concepts and generating knowledge through the behaviour of objects under the influence of non-contact force.

New terms

Non-contact force, gravitational force, magnetic force

Activity A

- Teacher arranges the following materials before carrying out the activity:
Magnets, paper clip, thread and sello tape. Make sure the magnet is strong enough to attract paper clips at least from 2 to 3 cm distance. The paper clips should be made of magnetic materials. The thread must be light enough such that the combined weight of the clip and thread should be within the strength of magnet to pull them up.

In this activity, students should carefully take the magnet close to the clips without touching them. The other way could be to lift the clip (tied to thread and fixed at one end) attached on the magnet to a vertical position. Slowly try to detach the magnet away from clip to the position such that there remains a gap between the magnet and the clip. The clip should be still attracted to magnet and vertically standing. Teacher may ask why the paper clip got lifted.
- Students can take two bar magnets and slowly bring them close without touching each other (See Figure 5.2). The magnets will attract or repel

each other. Students can give reasons for the attraction and repulsion of magnets. The non-contact arrangement needs to be focussed during push and pull of the magnets. Students should identify push or pull as a force that exists between the magnets without even coming in contact. This should build the concept of non-contact force.

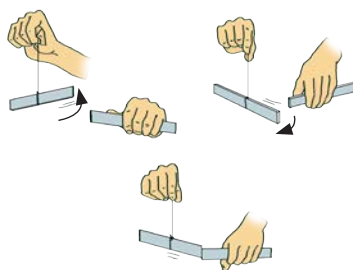


Figure 5.2. Non-contact forces between magnets

Definition of magnetic force may be limited to as:

- Magnetic force is a non-contact force with which a magnet pulls another magnetic body, or
- Magnetic force is a non-contact force with which a magnet pulls or pushes another magnet.

Activity B

- Teachers arrange the following materials before carrying out the activity:

Materials which are soft, small and light (not very light that floats in air) could also be used to demonstrate the falling of objects.

Through this activity, students realise that the Earth pulls everything towards it; this force is the gravitational force of the Earth. Therefore, students understand that they are under the constant influence of gravitational force of the Earth.

Misconceptions that only heavy objects fall, may be avoided by demonstrating the falling of feathers.

The definition of gravitational force may be limited to as:

- Gravitational force is a non-contact force with which the Earth pulls the body towards the ground.

Assessment

- Students' manipulative skills while arranging the set up and handling the magnets.
- Students' collaborative skills while working in pairs in constructing knowledge of non-contact force and establishing positive relationships.

Reinforcement

- Facilitate students to explore further on contact and non-contact forces from the given web links.

<http://physics.tutorvista.com/forces/non-contact-force.html>

<https://science.howstuffworks.com/transport/engines-equipment/maglev-train1.htm>

- Students draw a concept map on types of forces and their effects.
- Students to present another scenario where non-contact force exists, using experimental set-up or applications based on magnetic and gravitational force.

Content Summary

Forces exist while pushing or pulling an object. Push and pull are actions that may not define the force perfectly. Strictly, force is not action but the cause for the action. However, children can realize that force exists when actions are carried out physically. Therefore, the force is defined as push or pull at this stage.

Although force is invisible, the effects caused by it are visible. The effect of force controls and makes everyday activities function. One must understand that force is required not only to move a body but also to bring a body to rest.

The forces we use when we press a switch, open a window, squeeze a lemon and kick a ball are contact forces as our hands or feet are in contact with the objects. Similarly, contact forces act when we pluck an apple or break a branch of a tree. On the contrary, non-contact forces such as magnetic and gravitational forces act on the object through a distance. Examples include falling of apples, attraction of pins by magnets, flowing of rivers downstream, etc.

The main criterion to distinguish between forces is the existence of distance during the impact of the forces between the bodies. (Forces are measurable- to be dealt in higher classes.)

Chapter 6

Light and Sound

We interact with the world through the sense of touch, sight, hearing, taste and smell. Among these, sight and hearing are probably the most useful senses. This chapter introduces students to different sources of light and deals with how light travels and forms shadows. These are investigated through experiment that builds foundational understanding regarding the properties and nature of light. The indispensability of light for forming shadows is demonstrated.

This chapter also allows students to develop conceptual understanding of how different sounds are produced in our surrounding. Many living and non-living things around us may be recognized through the sound they produce. Students investigate and find out that sound is produced only when an object vibrates. They also investigate to find out that loudness of the sound depends on the distance between the source and ear.

Students can compare the propagation of light and sound and identify that light travels in a straight line whereas sound can travel in a straight line as well as around the corner.

Learning Outcomes

By the end of the chapter, students should be able to:

- identify sources of light in a local community.
- verify that light travels in a straight line and forms shadows.
- investigate how sound is produced.
- relate loudness of sound with distance.

6.1. Sources of Light

Time: 80 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- name the sources of light.
- explain the importance of light in everyday life.
- list down the different sources of light at home and in community.

Key Competencies

This topic entails the students to visit the nearby locality to identify various sources of light. This helps students to develop the social skills and strong community vitality relationships. By conducting a survey to identify different sources of light in the community, students learn to gather data, analyse the data, interpret the findings, and draw evidence based conclusions.

The activities also requires students to work in collaboration with other team members and therefore helps them to develop team spirit and interpersonal relationship.

New terms

Source of light

Activity A






- Students may begin this activity by identifying five objects that emit light. Use Worksheet 4 while carrying out the activity.

Worksheet 4

Name: _____ Date: _____

Things that make light

Can you think of five objects that make light? Write and draw them below:

1. _____	
2. _____	
3. _____	
4. _____	
5. _____	

- Show the picture of different objects given in the textbook in Figure 6.1 and ask the students to classify the ones that emit light and the ones that do not. Students may be given real objects in place of pictures. An object may or may not be the source of light depending on certain conditions. For example, a candle is not a source of light but become source of light when it is lit. Misconception can be avoided by emphasising on how a torch and a bulb become source of light only when the switch is put on. Tree in the activity given in Figure 6.1 is considered not a source of light, however glowing trees such as bioluminescent trees created by scientists are source of light.

Student can also explore other bioluminescent organisms found in nature, such as, foxfire fungus, glow-worm, lanternfish, etc.



Fungus

Glow-worm

Lanternfish

Another misconception is detected when students claim the light coming from reflector is considered as a source of light. For example, moon is not a source of light but a reflector of light. Similarly, a mirror is not a source of light although it reflects light and appears to be so.

Activity B

- This activity provides students the basic skills of carrying out survey in the community. Students may design their own forms and tables to list down different sources of light found in the community. Students should be briefed on how to carry out the survey effectively by sharing tips and clues if possible. Suggest students to carry out the survey during the weekends with prior permission from parents. Make them visit the houses during daytime and interview around five people in a proper manner.

This activity will not only improve students' ability to identify light sources but also offers the potential to learn how, why, and where they are used.

Assessment

- Students ability to differentiate the light sources from the object that do not produce light.
- Students' interviewing skills, data collection and analysis skills while carrying the survey.
- Students' ability to infer evidence based conclusions after conducting the survey.

Reinforcement

Teacher may also let the students find out three sources of light used in the olden days.

6.2. How Light Travels

Time: 120 minutes

Learning Objectives

By the end of the lesson, students must be able to:

- investigate how light travels.
- demonstrate that light travels in straight line.

Key Competencies

While investigating the propagation of light through experiments, students are involved in conducting experiment, analysing data, interpreting results, synthesising knowledge, and simultaneously taking up responsibility for their own learning. Working in groups or in pairs promotes the importance of sharing and accepting other's ideas to solve problems.

Activity A

- A drinking straw and a candle are provided to each pair. A chart paper or newspaper may be used to make tube or pipe if there is no straw. Help the students to light the candle and ensure that a distance of at least 15 cm is maintained between the source of light and the straw. This instruction must be repeated as and when required. Students set up the experiment in groups, therefore enhancing their collaborative and manipulative skills.

Teacher needs to be attentive and vigilant and must keep a fire extinguisher ready, in case fire breaks out.

Students may follow the POE structure in carrying out the activity

1. Predict: students guess what they would observe through the straight straw and the bent straw.
2. Observe: students describe their observation regarding the visibility of the flame on both the scenario.
3. Explain: students explain the reason for not being able to see the flame

through the bent straw. (reconcile any conflict between their predictions and observations)

Teacher needs to remind students not to play with the burning candle or poke their eyes with the drinking straw.

Activity B

- This activity follows structured inquiry process. Students are provided with a question, materials and procedure for the experiment. Through the experiment students conclude that light travels in straight line.

Students make small holes at the centre of three cardboards (same size) or card boards with small holes at the centre is provided to students. Teacher may help the groups to light the candle.

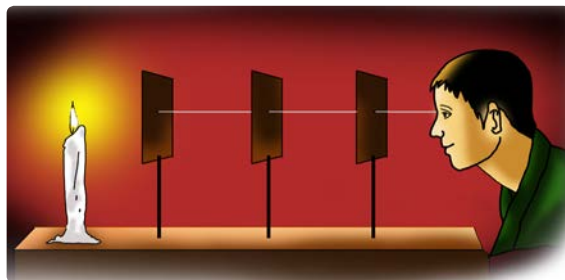


Figure 6.3. Path of light

Make sure groups have ample of working space. They should be extra-careful while working with the flames. The whole set up should be very stable. Students should align the cardboard as instructed in the activity and look for the flame of the candle. They will find that flame is visible only if all the holes are perfectly aligned in straight line. In case of slight misalignment of any hole due to the displacement of one or two card boards, the light is not visible proving that light travels in straight line.

- Each group should be provided with a roll of ribbon or twine thread, two mirrors, a flashlight and a target (cardboard). Students must place the target and arrange the mirrors in such a way that when flashlight is focused at one of the mirrors, light hits the target (Figure 6.4). Students should then trace the path travelled by the light from the flashlight to the target. They then draw the sketch in their notebook and describe the path travelled by the light.

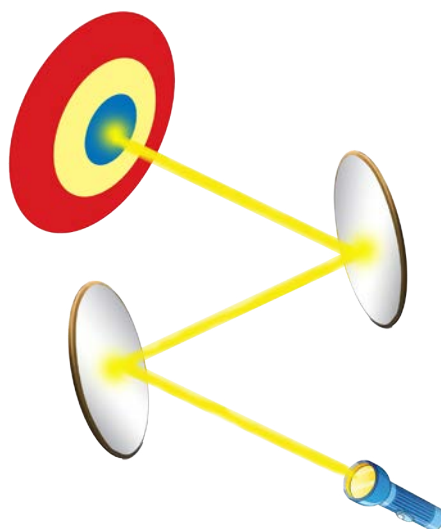


Figure 6.4: Rectilinear propagation of light

Assessment:

- Students' ability to explain the path travelled by light.
- Students' ability to apply the scientific process skills while carrying out the investigation.

Reinforcement

- Students explore steps to carry out the experiment given in activity B using the given web link:

<https://byjus.com/physics/rectilinear-propagation-reflection-of-light/>

- Students to explore about the rectilinear propagation of light using the given web link:

<https://www.youtube.com/watch?v=4tV4HUDM1B0>

6.3. Lights and Shadow

Time: 120 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- conduct an experiment to show formation of a shadow.
- investigate how the shape and size of a shadow is affected by the change in the position of the light source.
- explain that shadows are formed only in presence of light.

Key Competencies

While carrying out the experiment on formation of shadow, students are engaged in the process of thinking and analysing which promotes the skills of inquiry and critical thinking. Students also acquire the skills of collecting, processing and analysing data and interpretation of results when they investigate the formation of shadow at different position of the light source. Students will also learn to plot graphs and analyse the data points to come to a conclusion.

New term

Shadow

Activity A

- Students are provided with a new set of battery to produce bright light. This activity must be done in a dark room to avoid the formation of multiple shadows. The cardboard tree should be thick enough to block the light. Use white curtain or a white wall as a screen. Students must switch off and switch on the flashlight to confirm that shadows are formed only in presence of light. Students define shadow in their own words.

Students come to know that number of shadows for same object is equal to the number of sources of light; however, a shadow will not be visible if there is light coming from different sources in different directions.

- Students may play a game using flashlight to make shadows of different animals with hands and fingers in a dark room. Focus the flashlight on the wall or screen. Some group members can place their hands in between the flashlight and the wall to produce shadows of different shapes as shown in Figure 6.5.

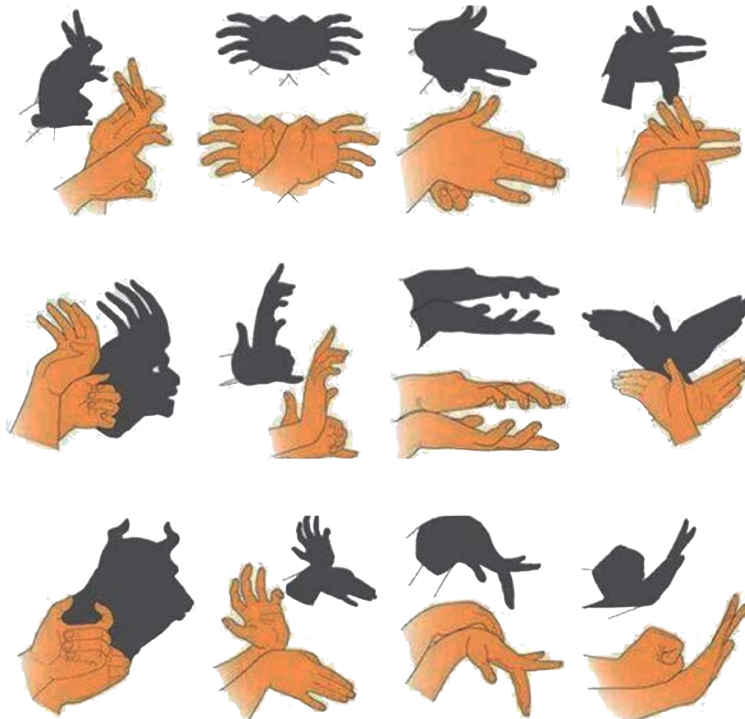


Figure 6.5. Making different shadows with hands and fingers

Students may shift their hands closer or further away from the flashlight or screen to see the variation in the shape and size of the shadow.

Ask following questions to students to promote better understanding of the concept.

- When are shadows formed?
- What happens to the size and shape of the shadow when the position of the hands are changed?

Activity B

- This activity requires children to use a measuring tape, a clock and stick or crowbar. Before the activity, teacher must ensure that students know how to handle and take correct readings using the measuring tape and the clock.

Students should select an open place where the set up is not disturbed. The activity must be carried out on a sunny day. Instruct students not to stay in the intense heat for too long.

Mark a spot on the ground and place a crowbar or stick. All the group members will measure the length of the shadow of stick or crowbar formed, at least six times in a day.

Students plot a graph and obtain similar to graph as shown below.

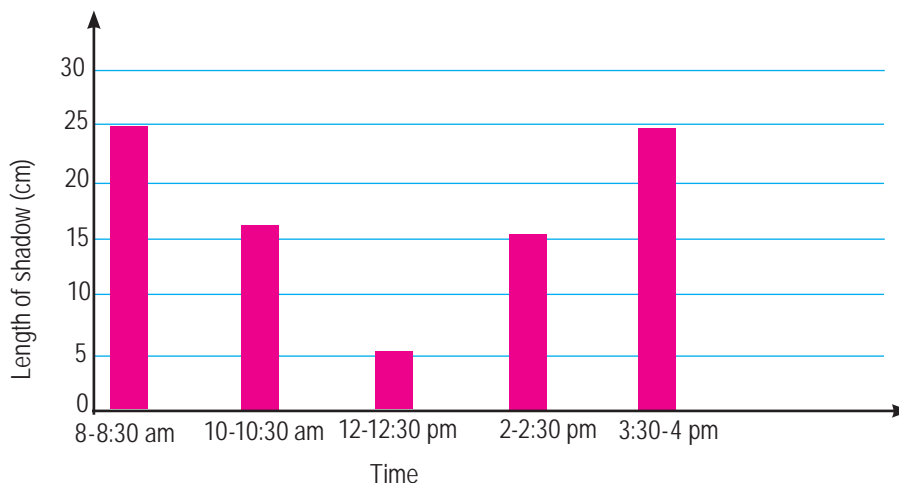


Figure 6.6. Variation of shadows at different time.

Students interpret the graph and present their findings. Encourage students to reflect on the following questions to probe their scientific reasoning skills.

- Why does the length of a shadow vary?
- What does a long shadow indicate?
- How can we predict time by looking at the length of a shadow?

Assessment

- Students' ability collect data with precision, analyse the data, interpret the results and generalize their findings from the graphs drawn.
- Students' ability to use a measuring tape and a clock to measure length and time accurately.

Reinforcement

- Students construct a sundial to measure time using the given web links:
<http://www.sundials.co.uk/projects.htm>
<http://www.skyandtelescope.com/astronomy-resources/how-to-make-a-sundial/>
- Students investigate how people in olden days inferred time by looking at the length of the shadow.

6.4. Making a Sound

Time: 120 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define vibration.
- demonstrate that sounds are produced due to vibration.

Key Competencies

In this chapter, students carry out the investigation and engage in the process of inquiry to find out how the sound is produced. Students also learn to observe, communicate and relate vibration with the production of sounds.

New terms

Vocal cord, vibration

Activity A

- Students go out of classroom and listen to different sounds. They must be guided to listen and record the different sounds carefully.

The sound or singing of students in this activity may disturb the other classes. Therefore, it is advisable for students to go into an open ground. They need not shout out too loud. The focus here is to observe or feel the vibration of vocal cords while making sound. The function of vocal cords can be illustrated through the vibration of a thin rubber membrane.

Activity B

- This activity allows the students to understand the process of vibration by observing the flickering movement (up and down) of ruler. The flickering movement of the ruler is considered as vibration and students should carefully listen to the sound produced. Students are able to relate the sounds produced by the ruler to its vibration and conclude that sounds are generally produced when objects vibrate.

- Students can flip a sheet of paper near the ear, observe how paper sheet vibrates and produces sound.

Students need to be provided with materials to carry out the following activities:

- Stretch and pluck a rubber band.
- Holding a thread at two ends and pluck it.
- Stretch rubber band over a container and pluck it.
- Flip thin metal strips.
- Hit a drum.

Students must observe carefully while carrying out these activities and answer the following questions:

- What happens to an object when it is hit, plucked or flipped?
- What do you hear when the object is hit, plucked or flipped?
- How is sound related to vibration of the objects?

Assessment

- Students' ability to answer 'Test Yourself' and 'Check Your Progress' questions.
- Student's manipulative skills while carrying out activities with different objects to produce different types of sounds.
- Student's collaborative skills while working in groups in terms of constructing concepts that vibration produces sound.

Reinforcement

- Students explore how different materials using the given web produce different sounds using the given web link:
<https://www.youtube.com/watch?v=gdGyvGPZ1G0>
- Students strike a tuning fork on a hard rubber pad and place one of its prongs near the ping-pong ball and discuss the following questions:
 - What happens to the tuning fork when it strikes against hard rubber pad?
 - What happens to the ping-pong ball when tuning fork is placed near it?
 - Why did the ping-pong ball behave in that manner?

6.5. Fading Sound

Time: 80 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- investigate how the distance affects the loudness of the sound.

Key Competencies

In this chapter, students carry out the investigation and engage in the process of inquiry to find out how loudness of the sound is affected by the distance. While carrying out the activity, students learn to follow the steps accurately, observe carefully and take precise measurements that lead to the development of scientific skills.

New terms

Loudness

Activity A

- Play music in the centre of football field at a fixed volume. Provide each group with a measuring tape. Students move away from the music player and record the observations in Table 6.4 given in the textbook, until they stop hearing the sound.

Students listen to the sound carefully and answer the following questions:

- What are the variables in the experiment?
- What is kept constant throughout the experiment?
- At what distance did you stop hearing the music?

Students conclude that loudness of the sound decreases with increase in distance.

- Students plot a graph of between distance and loudness of sound. Students interpret that loudness of the sound decreases with the increase in the distance.

Students obtain graph that similar to the one shown below:

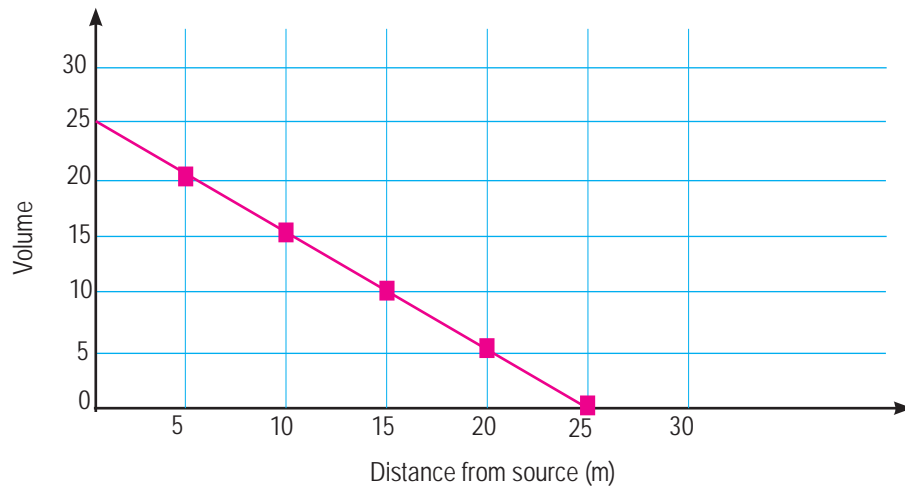


Figure 6.7: Variation of loudness of sound with distance.

Assessment

- Students' manipulative skills while carrying out activities on how sound fades as you move away from the source.
- Students' collaborative skills while working in groups.
- Students' answer the question given in 'Check Your Progress.'

Reinforcement

Students explore on how sound gets fainter as you move away from the source using the given web link.

<https://www.twinkl.co.uk/resources/keystage2-ks2>

Content Summary

When light from an object enters our eyes, we see the object. If an object emits light of its own, then it is a source of light. (Do not introduce the term 'luminous' body at this stage). The examples of sources of light are the Sun, fire, stars, lightning, firefly, etc. Mirror, Moon, snow, diamond, glass, etc., are not sources of light but they reflect the light that falls on them. The Moon does not emit light of its own, but reflects the sunlight falling on it. Thus, the Moon is not the source of light. During the day, the Sun is our primary source of light. The flame of a candle, the filament of an electric bulb and a fluorescent tube light are some other sources of light used at night.

Light travels in straight line and the formation of shadow is possible in the presence of light only. Darkness of the shadow depends on the intensity or brightness of light. If an opaque object is placed in the path of the light, light cannot pass through it. The space behind the object does not receive any light from the source. This dark area, which generally takes the shape of the object is called a shadow.

Sound is produced only when the source or object vibrates. Different objects produce unique sound when they vibrate. Animals produce variety of sounds to communicate among themselves. When we move away from the source of the sound it becomes fainter. Sound is a form of energy. We are able to hear the sound though we cannot see it.

The loudness of the sound can be measured with the help of a sound meter. It is measured in units called decibels (dB). The device used and the units for measurement of sound are to be dealt in higher classes.

Chapter 7

Electricity and Magnetism

Through this chapter, students are familiarised with various sources of electricity. Electricity generated from hydroelectricity, chemical cells, solar cells, fossil fuel power generators and nuclear power generators are used for transportation, factories and various purposes at home. Electricity is a form of energy and is transported from one place to another through electrical circuits. Electrical circuit is made of conductors connected to electrical appliances like bulbs, motors, heaters, coolers, etc., to the source of electricity.

In this chapter, students learn to connect circuit by themselves using cells or batteries, bulbs, and conductors like copper wires. Electric current that flows through the circuit without blockage is a complete circuit. The simplest complete circuit may be demonstrated by connecting a piece of wire from one end of a battery to the other. If electrical appliances are not connected to the battery, the wire just gets hot and the battery is exhausted. Therefore, to make use of electricity, electrical appliances must be connected to the electrical circuit. To avoid electrical shock and short circuit, all the electrical connection must be tight and coated with insulators. A short circuit is an unwanted or unintentional path that current can take which bypasses the routes you actually want it to take.

Students explore, investigate and discover that magnets attract only certain materials available on the Earth. This investigation will help them to locate the usage of magnets in their day-to-day life. They also discover many electrical appliances that work using magnets.

Learning outcomes

By the end of the chapter, students should be able to:

- identify the sources of electricity.
- show that electricity flows through a complete circuit.
- identify electrical appliances where magnets are used.
- differentiate magnetic and non-magnetic materials.

7.1. Sources of electricity

Time: 120 minutes

Learning Objectives

By the end of the lesson, student should be able to:

- identify different sources of electricity.
- explain how electricity is generated in their own words.
- name at least two sources of electricity in Bhutan.

Key Competencies

Students learn the various sources of electricity and demonstrate that electrical energy is used in various appliances at home, school and factories. They will also learn about generation of electricity in Bhutan and compare with the generation of electricity throughout the world.

New terms

Electricity, source of electricity, electrical energy, power stations

Activity A

In this activity, students will demonstrate that electrical energy is necessary to make a torch bulb glow. Students conclude that battery is the source of electrical energy. Ensure that a fresh battery is used for the activity. Students may follow

the POE strategy in conducting the activity

- Predict: students guess whether the torch light will glow in absence or presence of battery in it.
- Observe: students describe their observation regarding the glow of torch light in both the conditions.
- Explain: students explain the reason for glow of torch light.

Activity B

Students must study Figure 7.1 in the textbook carefully and discuss the role of each component observed in the figure. Provide an opportunity for students to explain the components present in the generation of electricity. To understand the role of all the components given in the figure, they should be able to answer the following questions during the activity.

- Why is water necessary to generate electricity?
- What is the purpose of the dam?
- What is the role of the generator and the turbine?

Activity C

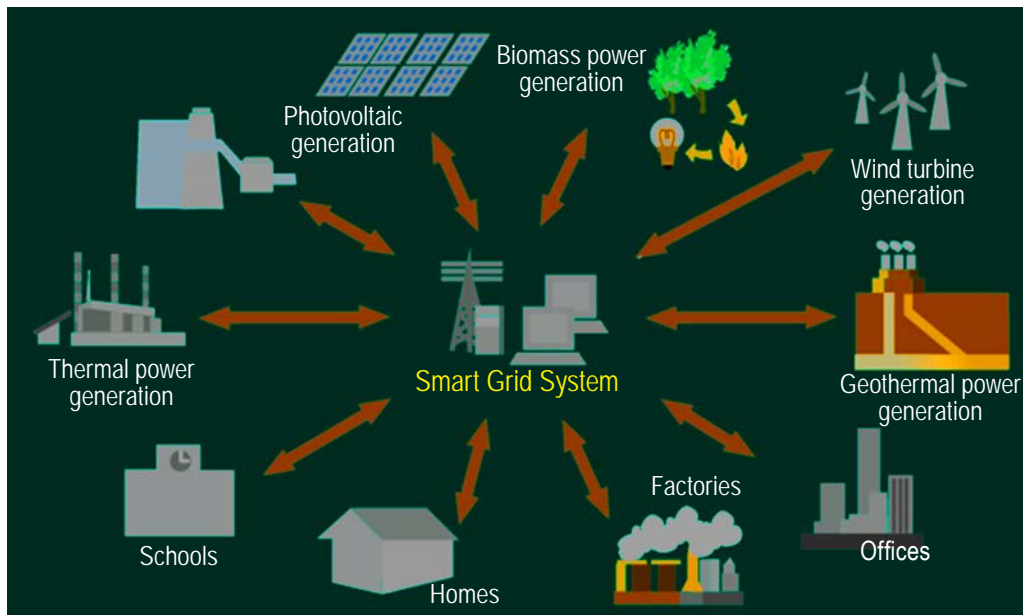


Figure 7.1. Different sources of electricity.

- Teacher assist students to identify different sources of electricity. Introduce students to the sources of electricity like battery, solar cells and wind turbine. They may either explore further on different sources of electricity from the library or browse the internet to find that fossil fuel, nuclear, thermal and tidal energy are also known sources of electrical energy. Provide them Figure 7.1 to students to identify different sources of electricity.
- Each pair select one method of generating electricity and explore how electricity is produced. The pair presents their work to the whole class.
- Teacher and students watch a video from the given web links showing the methods of generating electricity. While watching video teacher may explain the process of generating electricity and ensure that every student take notes.

<https://www.youtube.com/watch?v=NsQiVIPy6CA>

<https://www.youtube.com/watch?v=wMOpmKa6PJI>

Assessment

- Students' ability to list electrical appliances and the corresponding source of electrical energy.
- Student's description on the process of generation of electricity.
- Students' ability to gather information from the library or the internet and consolidate the information into a coherent piece for the presentation.

Reinforcement

- Students explore the role of components in hydroelectric power, visit the website: http://www.wvic.com/content/how_hydropower_works.cfm
- Students watch a video that demonstrates how hydropower station work.
<https://www.youtube.com/watch?v=W0axSL4tQYA>

7.2. Where Electricity is Used

Time: 80 minutes

Learning objectives

By the end of the lesson student should be able to:

- name different devices that use electricity.
- name places where electricity is used.
- write an essay about life without electricity

Key Competencies

Students will identify devices that require electricity to operate. They will also learn electricity is used as a source of energy. This topic offers the potential to make them think outside the box about how their life would be without electricity and write about it, which fosters creative writing. Besides fun in solving the word puzzles, their spatial reasoning skills are enhanced.

Activity A

- Ensure that students know each of the device given in the book before they start the activity. Teacher may substitute it with other devices, which are familiar to the students. Teachers can also bring the real objects to the class and show them how they operate.
- Students solve the provided worksheet to identify which devices use electricity.

Worksheet

Instruction: Tick the devices that use electricity to operate.





Activity B

- Students print or make a copy of the word puzzle and solve it. Do not let them write on the textbook.
- Students compare their findings with their friends to verify their own work. Home, school, office, airport, etc., are the places that they might be able to locate from the puzzle.
- Students may use different worksheets developed by teacher to identify more places where electricity issued.

Assessment

- Students' ability to correctly identify devices and places that use electricity from the given pictures and word puzzle.
- Students' ability to identify and classify things that use electricity amidst of other.
- Test the students' knowledge on electricity from the given web link.
https://www.edplace.com/worksheet_info/science/keystage2/year4/topic/691/2404/electrical-appliances-2

Reinforcement

- Students visit the website to improve knowledge on where and what uses electricity. <http://grist.org/climate-energy/how-do-we-use-electricity/>
- Students go out of the class and find out about different things that uses electricity in the school campus.

7.3. Making Connections

Time: 160 minutes

Learning objectives

By the end of the lesson, students should be able to:

- make electrical connection on their own using materials provided.
- investigate faulty circuit and take corrective measures.

Key Competencies

This topic enhances inquiry skills. As students struggle to carry out their experiment, many obstacles will obstruct the progress of their task. They will have to look for alternative solutions, thus persevering to overcome the challenges. While they carry out their task, a lot of attention to detail (observation skills) and scientific reasoning skills are required to make the correct choices in their answers.

New terms

Circuit, electrical connections

Activity A

- Provide a torch bulb attached to a bulb holder, insulated connecting wires (flexible) and a fresh pair of battery to the students. Physical circuit diagram may provided to guide the students to construct the circuits correctly. Teachers may conduct this activity in the form of guided inquiry.

The whole focus of the activity is to identify the source of electricity and the electrical appliance using it. Do not allow students to use electricity from main electrical source or car battery for carrying out their experiments.

- Students visit the given web link and construct the electric circuit in the virtual lab.

<http://www.sciencekids.co.nz/gamesactivities/electricitycircuits.html>

<https://www.kongregate.com/games/dmurph24/complete-the-circuit>

Activity B

- Provide a torch bulb attached to a bulb holder, insulated connecting wires (flexible and colour coded) and a fresh pair of battery to the students.
- In this activity, students physically make the electrical connections by referring to the different connections given in Figure 7.4 and verify whether the bulb glows. They identify whether the circuit is complete in each case. Through this activity, they shall conclude that the bulb glows only when the circuit is complete.

Activity C

- Provide the following electrical materials to all the groups:
 1. A good insulated wire (Wire 1)
 2. An insulated wire broken within the insulation (Wire 2 - wire breakage should not be visible)
 3. Batteries-one exhausted (Battery 1) and two fresh ones (Battery 2 and Battery 3)
 4. Bulbs- one damaged (Bulb 1) and other working (Bulb 2)

Students may try to connect different circuit using different set of wire, battery and bulbs. For example:

Set 1: Wire 1, Battery 2, Bulb 1

Set 2: Wire 1, Battery 1, Bulb 1

Set3: Wire 1, Battery 1, Bulb 2

Set 4: Wire 2, Battery 2, Bulb 2

Set 5: Wire 1, Battery 2, Bulb 2

Set 6: Wire 1, Battery 2&3, Bulb 2

Students investigate and discuss to eventually discover the following:

1. An electric circuit may not work even if it appears complete since wire, bulb or battery or all are faulty.
2. The bulb will glow brighter if more batteries are connected in the circuit.

Assessment

- Students' conceptual understanding of the topic through writing answers or answering verbally to the questions under, 'Test Yourself' in textbook or any other test item designed and developed by the teacher.
- Students' manipulative skills through arrangement and operation of set ups for experimentations.
- Students' collaborative skills while working in pairs and groups in terms of constructing knowledge, meaning, and content on making connections and participating in pairs/groups, establishing positive relationships.
- Assess students' analytical and observational skills to find out the faults in the circuit.

Reinforcement

- Students make their own torches using the materials provided for experiments and display in the science corner.
- Students play the Circuit Game from the given web link.
<https://www.coolmath-games.com/0-electro-appliances>

7.4. Things that are Magnetic

Time: 80 minutes

Learning objectives

By the end of the lesson, students should be able to:

- define magnetic and non-magnetic materials.
- sort out the magnetic materials from non-magnetic materials.
- name at least three magnetic materials found around them.

Key Competencies

When students sort out materials provided to them using a magnet, they develop investigative skills and eventually understand that magnets do not attract all metals. In groups, they discuss, verify, and through concerted effort, synthesize the justifications why and how magnets are used in devices and present their findings to the whole class.

New terms

Magnetic force, magnetic materials, non-magnetic materials

Activity A

- Provide all the materials in a plastic tray including a strong magnet. Teacher may show students the correct way to store the magnets after use. Students sort the given objects into magnetic and non-magnetic materials by using a magnet. Instruct students not to drop nor hammer the magnets.

Teacher asks students to define the magnetic materials in their own words. For example, students may define the magnetic materials as:

- Pin, paper clips, compass and iron nail are magnetic materials because magnets attract them.
- Paper, plastic tray, eraser, stone, pencil and pen (plastic) are non-magnetic materials because magnets do not attract them.

Activity B

- Students explore their surrounding in groups and identify magnetic materials. They may draw the conclusion that some metals are magnetic while some metals are non-magnetic. Students then discuss their findings thoroughly in the class to avoid misconceptions. Please note that in this case the words ‘objects’ and ‘materials’ are used synonymously.

Instruct students not to touch the meter box or any electrical outlets with the magnet. Bringing any strong magnets near an appliance that has magnet in it may damage the appliance.

Assessment

- Students’ conceptual understanding of the topic through test items designed and developed by the teacher.
- Students’ collaborative skills while working in pairs and groups in terms of constructing knowledge, meaning, and content on making connections and participating in pairs/groups, establishing positive relationships.
- Students’ observation and classifying skills.

Reinforcement

- Students visit the given web links.
<http://www.learnernext.com/class6/science/Magnetic-and-Non-magnetic-materials>

<http://www.zephyrus.co.uk/magneticmaterials.html>

Students then compare the materials mentioned in the websites and their findings of Activity A. Students discuss the similarities and differences among themselves or with whole class.

7.5. Magnets at Home

Time: 120 minutes

Learning objectives

By the end of the lesson, students should be able to:

- list down things that use magnets in them.

Key Competencies

Students observe different objects and devices to accomplish expected results and interact with others appropriately. They discuss to enhance learning while filling up the worksheet in identifying and comparing. They design and construct a magnetic toy.

New terms

Electrical, non-electrical








Activity A

- Students may not be able to identify the magnet by simply looking at the pictures. Therefore, they may collect the discarded electrical appliances and objects where they can practically see and locate the magnets in the appliances and objects. A circus of objects that is already opened (screws taken off so that they can look at internal features) is arranged.

A circus comprises a number of different exercises that run alongside each other. Individuals or groups of students work on the different exercises and as they complete each exercise, they move on to the next. These are a means by which limited resources can be used effectively.

The circus arrangement may be more difficult for the teacher to manage, as not all students are doing the same activity. This puts more pressure on the teacher as they have to cope with advising and answering questions from a variety of investigations. Teacher must plan properly so that he or she can take part in each group and maintain a safe environment.

Provide table given below to the students and ask them to write down which object and devices use magnet.

 Tape recorder	
 Fan	
 Mobile	
 Geometry box	
 Drawer	
 Handbag	
 Door	

Students conclude that magnets are used for various purposes and are used not only in electrical devices but also in non-electrical objects.

- Design and make a simple magnetic game or toy. Teacher may provide the magnets or students can collect magnets from discarded electrical appliances. A simple toy can be a fishing rod with small magnet at the tip of the string and a few paper fishes to which paper clips are attached. Other examples include magnetic robot, cars, boat, cranes, etc. Exhibit the toys along the corridors and inside classroom.

Student may visit the given website which provides ideas on how to build magnetic toys.

<https://www.hellowonderful.co/post/7-FUN-MAGNETIC-TOYS-AND-GAMES-TO-MAKE>

Assessment

- Students' scientific skill of observing while determining devices that use magnets.
- Students' collaborative skills while working in groups in constructing knowledge on magnets and while designing the activity.
- Assess students' creativity and innovation through magnetic toy making.

Reinforcement

Students explore that magnets exist in different shapes and sizes from the given websites.

http://www.ehow.com/list_7476962_household-appliances-contain-magnets.html

<https://www.alibaba.com/photo/magnetic-materials-photo.html>

Content Summary

Electricity is not visible but its effects can be seen, felt and heard in our day-to-day life. Electricity requires medium like wires (term conductor to be introduced in higher classes) to flow from one place to another place. For any electrical appliance to work smoothly and safely, electrical connection should be secure and tight. At home, we use electricity to brighten rooms during night, cook rice in rice cooker, cool rooms using air conditioner, refrigerator to store food, power the television (TV) to watch movies, etc. Beside home, we also use electricity in factories, schools, playground, construction site, trains, cars, etc.

We get electricity from different sources like the Sun, wind, water and chemicals. In some places, people use Sun's energy (solar) and wind's energy to produce electricity. In Bhutan, the main source of electricity is water because we have many rivers that have potential to generate electricity. We do not have other reliable sources from which we can produce electricity.

A magnet usually attracts substances that are made of iron. There are some materials made up of cobalt, nickel, gadolinium, dysprosium and their alloys, such as steel (iron and carbon), alnico (iron, nickel, cobalt, and aluminium), and perm alloy (iron and nickel) which are attracted by magnet.

Magnets are used in common things found in our homes, such as head phones, stereo speakers, computer speakers, telephone receivers, phone ringers, microwave ovens, refrigerators, etc. In most of the cases, magnets used are placed inside the appliances.

Chapter 8

Living Things and their Environment

Our world consists of varieties of physical conditions that create diversities of environment where living things are found. We find varieties of living things with diverse feeding habits and relationships around us. This great variety in living organisms is mainly due to varieties of habitats that exist as a result of diversities in the environment.

Through this chapter, students learn that living things and the environment do not exist and function independently but the organisms in the environment are interdependent on each other and the environment and it is this interdependence that sustains life.

Learning outcomes

By the end of the chapter, students should be able to:

- name plants and animals found in their local habitat.
- explain how animals and plants in different habitats have adapted to their environment.
- describe simple food chains.
- describe the three feeding habits of animals (herbivore, carnivore, and omnivore).

8.1. Living Things and Non-Living Things

Time: 120 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define living and non-living things.
- sort things into living and non-living things.
- compare the characteristics of living and non-living things.

Key Competencies

While defining living and non-living things, students must understand the characteristics of living and non-living things. They compare and contrast the things around to sort them as living and non-living thing based on their characteristics. They are encouraged to share their views and feelings to the class and their families.

New terms

Living things, non-living things

Activity A

- In this activity, students identify living and non-living things based on the concepts that living things have life and non-living things do not have life. To sort out living and non-living things, they go around the school campus and list down the things. While visiting the school campus, ask students to make a list without touching anything.

In case it is not feasible to go out of classroom, then students are to be provided with handouts including a list of both living and non-living things to every group in the class to sort them.

Stone, plant, pencil, geometry box, ant, house, bird, stick, soil, earthworm

Activity B

In this activity, students make a comparison between their friend and a book by listing the characteristics of both in terms of what each can do or need. The characteristics of friend may include, can walk, can eat, can talk, can breathe, and can write. Similarly, the characteristics of book include, cannot move, cannot talk, cannot eat, and cannot breathe.

After completing Table 8.1 in the activity, students can compare the characteristics of living and non-living things. Eventually, they learn the basic characteristics of living and non-living things by the end of this activity.

Assessment

- Student's understanding on characteristics of living and non-living things.
- Student's ability to sort things as living and non-living things.
- Students reasoning abilities for sorting the things as living and non-livings.

Reinforcement:

Students watch video and learn the characteristics of living and non-living things by visiting the following website:

https://www.youtube.com/watch?v=p51FiPO2_kQ

8.2. Plants and Animals in their Habitat

Time: 120 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- list down some of the plants and animals found in their locality.
- define habitat.
- state the habitat of some of the plants and animals.

Key Competencies

Learning of this topic requires students to explore their surroundings and list down the names of plants and animals they find. To identify plants and animals and their habitats students discuss in groups. They learn to value the relationship between living and non-living things in their environment.

New terms

Hand lens, blunt forceps, habitat

Activity A

This activity begins by eliciting the prior knowledge of common plants and animals found in their locality. Students visit plant and animal habitats mentioned in the Table 8.3 in the textbook to observe and list down the names of plants and animals found in those habitats. While identifying plants and animals, students can use names in any language.

Through this activity, students understand that different plants and animals are found in different habitats and also some plants and animals are common to different habitats. For example, flowers such as rose, sunflower, dahlia, marigold, china rose are found in flower garden, while animals such as earthworm, beetles, caterpillars, birds are found in the soil, on the trees, rocks and in the forests.

Activity B

Students in groups discuss about the plants and animals listed in the Table 8.4 in the text book. With their prior knowledge and experiences, they identify the habitats of the plants and animals to complete the table. Pictorial diagrams may be provided or video may be shown, if they have difficulty in identifying the habitats because they may not have observed or seen these plants and animals in their environment.

This activity facilitates the students in defining the term 'habitat' in their own words and discover that plants and animals live in places which provide basic necessities such as food, shelter, air and water for survival and growth.

Assessment

- Student's behaviour in the group activity in terms of participation, collaboration and acceptance of other's views.
- Student's ability to identify habitats for plants and animals provided in Table 8.4 and more.
- Correctness of definition of habitat.

Reinforcement

- Students list down the names and habitat of plants and animals found in their locality.
- Students watch video following the link given below to discover different habitats found around the world.

<http://www.thunderboltkids.co.za/Grade4/01-life-and-living/chapter4.html>

8.3. How Plants Adapt in their Habitat

Time: 120 minutes

Learning Objectives:

By the end of the lesson, students should be able to:

- define adaptation
- list down at least three adaptive characteristics of plants.

Key Competencies

Students browse the internet or any other reference materials for information on adaptive features of plants which engage them in information searching and processing skills. They develop presentation skills when sharing their ideas to the class.

New terms

Adaptation

Activity A

Prior to the commencement of the lesson, teacher should inform the librarian or the ICT assistant in helping students to find information related to the topic. Teacher can also prepare a list of websites or books where students can find the information on adaptive features of plants.

Teacher creates a forum for students to share their information on voluntary basis to the whole class. This process helps them develop their communication skill particularly their oration and articulation of points.

Activity B

Students go around the school campus and observe plants in different habitats. They must be instructed not to touch unfamiliar plants as some may be poisonous or allergic. They record the description of habitat and the characteristics of plants (focus on the shape, size, colour of leaves, flower, branches of plants). They also

discuss how different characteristics of plants help them to survive in different habitats. Students can generalise that different plants have different characteristics to adapt in a particular habitat. For example, orchids have aerial roots that may help them to absorb moisture from the air.

Assessment:

- Student's understanding of the concept of adaptation and presentation skills while sharing their collected information from the library and internet during the presentation.
- Student's ability to locate plants in their habitat, observe significant characteristics of plant and record them correctly.
- Students' ability to reason and present ideas and thoughts backed by scientific evidences in justifying the purpose of adaptive features.

Reinforcement

- Display pictures of plants in the class with brief description of distinct adaptive features.
- Students visit website following the link given below and discover more plants with special adaptive features in various habitats.

<http://mocomi.com/adaptations-in-plants/>

8.4. How Animals Adapt in their Habitat

Time: 120 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- describe a few adaptive characteristics of animals.
- explain why adaptive characteristics are important for animals.
- investigate camouflage in animals.
- state the importance of camouflage for animals.

Key Competencies

In this topic, students learn about different adaptive features and reason out the importance of these features that help animals to survive in their habitats. Students investigate, record and generalise findings the importance of camouflage in animals. In groups, they make effective presentation of their findings to the class.

New terms

Proboscis, predator, camouflage, prey, antenna

Activity A

Teacher can prepare a chart containing animals with distinctly visible adaptive features along with the descriptions and questions similar to Table 8.6.

Activity B

This activity may be conducted outside the classroom in a lawn or a playground. Students in groups prepare the materials and mark grassy area of one metre square for the activity. The activity involves them to compare the time taken to find the four batches of 10 coloured matchsticks. Comparing the time taken to locate the match sticks of different colours, students understand camouflaging and conclude that camouflage is a form of adaptation by which animals blend in their surroundings that save them from predators and helps them to find food.

Activity C

This activity helps students to relate the concepts of habitat and adaptive features in understanding how different animals survive. In doing so, they complete the Table 8.8 by providing the missing information, so as to draw the relationship of animals with their corresponding habitat and adaptive features.

From this topic, students identify that different adaptive features are present in animals to survive in specific type of habitat. For example, tigers have stripes on their bodies to help them camouflage while looking for food. Similarly, honey bees have yellow stripes on their bodies which blend in with the colours of the flowers to protect themselves from predators; stinkbugs have foul smell to ward off predators; and bedbugs have flat bodies to squeeze and slip through small spaces.

Assessment:

- Student's ability to recognise special characteristics of animals to adapt to their habitat to survive.
- Performance of students by using the checklist given below while carrying out the activity B to generalise the findings.

Sample checklist

Objectives/key competencies	Performance	
	√	X
Students relate animals to their adaptive features.		
Students work together to complete the assigned task on time.		
Students state the importance of adaptive features.		
Students explain camouflage in different animals.		

Reinforcement

- Students display pictures of animals in the class with brief description of their distinct adaptive features.
- Students visit website following the link given below and learn more on adaptation

<http://www.primaryhomeworkhelp.co.uk/adaptation.htm>

8.5. Living Together

Time: 160 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- draw a food chain.
- explain food chain with an example.
- differentiate predator and prey.
- state the importance of each organism in the food chain.

Key Competencies

This topic focuses students' learning on understanding the concept of food chain and how every organism is linked to the other in the given environment. To construct food chain, students reflect on the types of food that different organisms consume to survive, and make connections among them based on the food they feed on. Students create diagrammatic representations of this relationship in the form of food chain.

New term

Food chain

Activity A

- All living things depend on each other for food and shelter. In order to understand this concept, students study the food chain provided in Figure 8.3 given in the text book. To complete the task they must answer the questions given in the text book.

The food chain illustration helps students to understand that the food chain begins with plant as it can prepare its own food, and animals directly or indirectly depend on it. They realise every living thing are important in maintaining balance in nature.

Activity B

- Students construct a food chain from the list of organisms provided in the textbook to identify animals' prey and predator.

At the end of the activity, students conclude that all animals depend on each other for food. If an organism is removed from the food chain, the survival of organisms that depend on it is at risk. For example, if trees are cut down, organisms lose their habitat and may either migrate or die. Consequently, these events lead to breakdown of food chains in the environment and make it unstable.

Assessment:

- Student's understanding of the concept of food chain.
- Identification of prey and predator in the food chain.

Reinforcement

- Students construct food chains using the names of plants and animals in their locality and present to the class.
- Students explore for more examples of food chain in the internet following the web link given below.

<http://www.sheppardsoftware.com/content/animals/kidscorner/foodchain/foodchain.htm>

8.6. Feeding Habits

Time: 120 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- explain the terms herbivore, carnivore, omnivore, producer and consumer with examples.
- identify producer, herbivore, carnivore and omnivore from the given food chain.
- explain different types of feeding habits.

Key Competencies

Students appreciate the diversity of feeding habits of living organism in ecosystem using a food chain. Animals depend on plants directly or indirectly for their survival. Students discover that plants are the producers as it prepares its own food and animals are the consumer.

New terms

Producer, consumer, herbivore, carnivore and omnivore

Activity A

- Students categorise organisms as herbivore, carnivore and omnivore based on their feeding habits. For example, goat is a herbivore because it eats only plants. Similarly, leopard is a carnivore as it feeds only on meat while a human is an omnivore since it feeds on both plant and meat. To carry out the activity students must complete Table 8.9. Teacher may provide the information food eaten by different animals and then students classify animals into groups based on the food they eat.
- The teacher can vary the activity by explaining the concepts of three different feeding habits of organisms. In the following activity, teacher may provide the list of living organisms. Students carry out this activity by analysing the type

of food each organism eats and classify them under different feeding habits.

Horse, Tiger, Bear, Rat, Cat, People, Goat, Jackal, Crow

Herbivores: Those living organisms that eat plants.

Examples:.....
.....
.....

Omnivores: Those living organisms that feed on both plants and animals.

Examples:.....
.....
.....

Carnivores: Those living organisms that feed on other animals.

Examples:.....
.....
.....

Activity B



During this activity, students learn the concepts of producer and consumer through a simple food chain. They learn that producers are organisms that prepare their own food while consumers are organisms, which directly or indirectly depends on producers for food. They further categorise consumers into herbivore, carnivore and omnivore.

Assessment

- Student’s ability to trace food chains and identify producer and consumer.
- Reasons forwarded by students to justify the role played by organisms in the food chain.

Reinforcement

- Students discover and learn more on eating habits of animals through the internet following the web link given below.
<http://mocomi.com/eating-habits-of-animals/>
- Divide the class into groups and instruct them to make their own food chain. Let students fill in the following table first and then construct a food chain.

Producer	Herbivores		Omnivores		Carnivores	
	Examples		Examples		Examples	
	Food they eat		Food they eat		Food they eat	

Content Summary

Our environment consists of both living and non-living things. Unlike non-living things, living things are characterised by the ability to grow, move, reproduce, breathe and the need for food. Non-living things like buses, trains, aeroplanes, etc., also move by consuming fuel but cannot reproduce, grow, breath, etc., like living things. Nevertheless, there exists strong interdependence between living and non-living things. Non-living things constitute parts of the habitats where living things live, grow and reproduce.

Habitats can be of different types depending on physical and geographical conditions such as temperature, light, space, soil and moisture. Depending on these conditions, different habitats have different plants and animals.

All living things bear different characteristics such as body structure, feeding habits and behaviour to suit and adapt to their immediate environment. The varied adaptive features borne by living things are either designed for protection or to obtain for food. Therefore, the ability of the organisms to adjust and survive in the environment is called adaptation.

Every organism in the environment is a source of food for the other organisms. The feeding relationship existing between certain organisms is called food chain. If one organism is removed, the survival of other organisms in the higher levels for food chain is affected. Therefore, maintaining food chain balances the environment.

A food chain usually consists of producers and consumers. Food chains always begin with producers. Consumers depend on producers for food either directly or indirectly. Consumers are of different types depending on the nature of their feeding habits. They are herbivore, carnivore and omnivore. Herbivores and carnivores feed on plants and animals respectively, while omnivores feed on both plants and animals.

Chapter 9

Green plants

Green plants are the source of food for other organisms. It also provides air for the animals to breath. Like animals, plants also require light, air, water, temperature and nutrients to grow. This chapter provides opportunity to students to investigate, observe and infer the necessity of sunlight, air, water and temperature for the proper growth of plants. Flowers are the reproductive parts of the plants.

Learning Outcomes

By the end of the chapter, students should be able to:

- investigate the effect of light, air, water and temperature on the growth of plants.
- explain the effect of light, air, water and temperature on the growth of plants.
- draw and label the parts of a flower

9.1. Effect of Light on the Growth of Plant

Time: 160 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- investigate the effect of light on the growth of plants.
- explain the plants seek sunlight for its growth.

Key Competencies

In this topic students determine the necessity of sunlight for the growth of plants. They work in groups and investigate the effect of sunlight on the growth of the plants. As a result, they acquire the skills of interpersonal relationship, collaboration, observation and the scientific inquiry. Moreover, they discuss and share their findings to the whole class that provides them an avenue to improve their proficiency in communication.

Activity A

- This activity may take a minimum period of two weeks to see the visible results. Teacher must explain the procedures and engage students to prepare both experimental and control setup as shown in the textbook in Figure 9.1. Let students note their weekly observation as per the format given in the observation Table 9.1. They are provided with metre scale to measure the height of the plant. They may note the lateral growth, i.e, the number of branches, size and number of leaves, number of buds, etc. In this activity, students will compare the growth of potted plants and conclude that sunlight is necessary for proper growth of the plants.

Table 9.1. Effect of light on the growth of plants

Observation Timing	Colour of leaves		Height (cm)	
	Plant A	Plant B	Plant A	Plant B
Week I				
Week II				

Activity B

- This activity supplements students' conceptual knowledge gained from their previous activity. Students must follow the procedures given in the text book to set up the experiment as shown in Figure 9.2. The activity may take a month to have the noticeable results. Therefore, students must observe the plants every week and note the changes as per the format given in the observation Table 9.2. During their observations, they compare and record the visible changes of the two potted plants in terms of growth of the parts of the plant that faces the window sill. The bending of the plant kept on the window sill further confirms that sunlight is necessary for the proper growth of the plant.

Table 9.2. Response of plants towards sunlight

Observation Timing	Observations	
	Plant kept in the direct sun shine	Plant kept on the window sill
Week I		
Week II		
Week III		
Week IV		

Assessment

- Students' ability to generalise the concepts from activity A and B.
- Students' answers to the questions given for each activity.

Reinforcement

- Students to explore more information on effects of sunlight on plants from the web link:
<http://www.actforlibraries.org/how-sunlight-affects-a-plants-growth/>
- Students observe the same type of plants growing under the stones and thick canopy forest and on the open space with enough sunlight.

9.2. Effect of Air on the Growth of plant

Time: 80 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- investigate the effect of air on the growth of plants.

Key Competencies

In this topic students learn the effect of air on the growth of plants. Students carry out the investigation in groups and are engaged themselves in the process of observation and the scientific inquiry. They also discuss in groups and compare their findings to the whole class. This enable them to develop their interpersonal relationship, spirit of collaboration and the communication skills.

New term

Carbon dioxide, oxygen

Activity A

- In this activity, students investigate and confirm that air is necessary for the proper growth of plants. This activity might require more than a week to observe and keep record of the entire process as per the format given in the observation Table 9.3. Before the experiment is carried out, teacher needs to ensure that students are aware of the objectives and procedures.

To have the fair test, there should be both experimental and control is setup arranged. In the two setups, equal amount of water and same number of seeds are spread over the soaked cotton kept in the inner bottom of the jars. However, one jar is made air tight while the other is left open. Students can record the visible changes in Table 9.3. They observe that the plant kept in air tight jar becomes pale, slender, weak and stunted whereas the plant kept in other jar becomes greener, thicker, healthier and taller. With this, they conclude that air is necessary for the proper growth of plants.

Table 9.3. Effect of air on the growth of plants.

Plant in	Observations
Jar A	
Jar B	

Assessment

- Students' ability to generalise the necessity of air for the growth of plants by asking them to interpret the data obtained in activity A.
- Students' answers to "Check Your Progress" questions.

Reinforcement

Students watch video to enhance their conceptual understanding on importance of air on the proper growth of the plants from the given web link and answer questions by the teacher:

<https://www.youtube.com/watch?v=T94hwhYCFsY>

9.3. Effect of Temperature on the Growth of Plant

Time: 120 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- investigate the effect of temperature on the growth of plants.
- record the temperature using thermometer.

Key Competencies

In this topic, students investigate the effect of temperature on the growth of plants through an experiment. This provides them an avenue to acquire the skills of scientific inquiry as well as the skills of handling and reading the calibration of thermometer. Moreover, they engage in group discussion and share their findings to the whole class. This develops spirit of collaboration and the proficiency of delivery in them.

New Term

Temperature, thermometer, degree Celsius, germination, greenhouse

Activity A

- This activity helps students to understand the basic concept of temperature and the method to read temperature using thermometer. Each group is provided with a thermometer, container and water to record the room temperature and the temperature of tap water. While calibrating the temperature, students take the reading of upper meniscus as shown in the textbook in Figure 9.3. Teacher must remind them not to touch the bulb of thermometer as their body heat may lead to rise in temperature reading and give faulty reading. They will also discover that room temperature and the temperature of tap water are not same.

Activity B

- This activity demonstrates the effect of temperature on the growth of plants. The activity may take more than a week to see better results.

Teacher must remind students to follow the procedure given in the textbook and complete their activity by recording their observation in Table 9.2. During the observation, students notice that growth of plant in Tray 2 is faster than plant in Tray 1 due to the suitable temperature maintained by the plastic sheet. With this finding, students realise that temperature is one of the necessary factors that regulates the growth of plants. They also relate this concept with the values of growing plants and vegetables in the green house in cold regions or during cold seasons. With the idea of suitable temperature, they conceptualise that plants do not grow well either at high or low temperature. However, teacher must generate discussion on whether green house is a suitable method in hot places.

Assessment:

- Students' ability to handle and read the temperature accurately using thermometer.
- Students' explanation on the effect of temperature on the growth of plants.

Reinforcement

- Students to explore more information from the given web link:
<https://www.gardeningknowhow.com/plant-problems/environmental/temperature-on-plants.htm>
- Students go for a field trip to the nearby farms to gather information about the utility of green house.

9.4. Effect of Water on the Growth of Plant

Time: 80 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- investigate the effect of water on the growth of plants.
- explain the effect of water on the growth of plants.
- tell why plants are called autotrophs.

Key Competencies

This topic helps students to learn the necessity of water for the growth of plants. In groups, they set up their experiment, observe and record the findings. This gives them a platform to learn through the skills of scientific inquiry and observation. They discuss, analyse and share their inferences to the whole class. This helps them to develop team spirit, interpersonal relationship and the communication skills. They also learn that plants are autotrophs as they can prepare their own food and animals are called heterotrophs as depends on plants for food.

New Term

Autotrophs, heterotrophs

Activity A

- This activity shows the necessity of water for the growth of plants. Students carry out the experiment using two potted plants as shown in the textbook in Figure 9.6. To ensure fair test, ensure that two plants are of same type with same height or number of leaves and branches. Make sure that the plant in setup A is watered regularly for a week leaving the one in the setup B without watering. Students observe the setups for about two weeks regularly and record the observations using Table 9.4.

During their observations, students confirm that plant, which is watered regularly, grows better than the one that is not watered. Through this

experiment, they conclude that water is necessary for the proper growth of the plants.

Table 9.4. Effect of water on the growth of plants.

Potted plants	Observations
A	
B	

Activity B

- This activity facilitates students to work in groups to find out the importance of water for both plants and animals. Teacher may suggest to them to explore information from either library or the internet and share their findings to the whole class.

At the end of the activity, students realise that plants prepare their own food using sunlight, air, water at suitable temperature and animals depend on plants for food.

Assessment

- Students' ability to carry out the investigations in groups.
- Students' ability to explore information in the internet and library.

Reinforcement

Teacher may provide the platform to explore more information using the web link and ask students to note down the important points:

<https://www.youtube.com/watch?v=jEzNUVMHjJ8>

9.5. Flower

Time: 120 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- draw a flower showing all the whorls.
- label all the floral whorls.
- mount the floral whorls in the scrapbook.

Key Competencies

In this topic, students learn the different parts of the flowers through observation, identification and the drawing of floral appendages. They also make their learning further enriching by pasting the floral whorls (term 'whorls' should not be introduced) in their respective scrap book. This gives them an opportunity to develop inquiry and artistic skills through real hands-on experiences.

New terms

Stamen, carpel, stigma, style, ovary, anther, filament, petal, sepal, pedicel.

Activity A

- In this activity, students in groups visit the school flower garden and collect a flower each. Instruct them not to pluck the flowers unnecessarily. Teacher will help them to identify and name the flower or students can explore in library or internet. After the collection, they observe the flower carefully and draw a labelled diagram showing all the floral details. Ask the groups to record their findings as per the format shown in Worksheet 5.

Worksheet 5

Name of the group:

Name of the flower:.....

Diagram of the flower:

Sl.No.	Observation	Findings
1	Colour of petal	
2	Number of petal	
3	Colour of sepal	
4	Number of sepal	
5	Number of stamen	
6	Number of carpel	

Activity B

- In this activity, students in groups remove the floral parts with the help of forceps. Teacher guide them to ensure that floral parts are removed carefully with the help of forceps. Students then paste the flower parts in their scrapbook with the labelling details. This activity reinforces their conceptual knowledge of floral leaves. They should correctly identify reproductive parts of the plants that usually contain sepals, petals, stamen(s) and carpel(s).

Assessment

- Students' ability to draw and label the parts of a given flower.
- Students identify the parts of a flower correctly.

Reinforcement

- Students go around the school campus and observe the whorls of the different flowers. They then identify all the parts in them.
- Students explore more about the flowers that are commonly found in Bhutan using the web link:

<http://biodiversity.bt/species/list>

Content Summary

Plants are one of the forms of living things. They need sunlight, air, water and suitable temperature for proper growth and development. With the help of these factors, plants prepare their own food. Hence, plants are called autotrophs. On the other hand, animals depend on plants for food and they are called as heterotrophs.

Different parts of the plants, such as root, stem, leaf and flower have important functions for the growth of a plant. Flowers are the reproductive parts of the plants. They are commonly borne on a stalk called pedicel. Generally, a typical flowers contain sepals, petals, stamen (s) and carpel (s). Stamens and carpel's form the essential parts of the flowers while sepals and carpels just constitute as the accessory whorls.

Chapter 10

Food

Food is a substance consumed by the animals to gain nutritional support. Consuming different types of food is essential as food contains variety of nutrients and vitamins. Food can be categorised as types of food for energy, for growth, to repair and protect the body from diseases.

Learning outcomes

By the end of the chapter, students should be able to:

- list different kinds of food consumed by the people.
- explain the importance of eating energy giving food, body building food and the food that protect body from diseases.
- explain healthy eating habits.

10.1. Different Kinds of Food

Time: 120 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- list name of the foods that they eat.
- classify the food that they eat into pulses, grains, fruits, milk products, meat and vegetables.

Key Competencies

In this topic, students list different kinds of food they consume and classify them into pulses, grains, fruits, milk products, meat and vegetables. This facilitates students to develop the skills of classification and realise the value of consuming different types of food to keep their body healthy.

New Terms

Pulses, grains

Activity A

In this activity, students work in groups and classify the list of foods they eat as pulses, grains, fruits, milk products, meat, and vegetables. Teacher may help students to name and classify foods into different categories and record in Table 10.1. Through this activity, students conclude that the foods that they consume are of different kinds.

Assessment:

- Students' ability to list and classify foods they eat into different categories.

Reinforcement

- Students visit school's mess and ask them to categorise the available food in the store as pulses, grains, fruits, milk powder, meat, and vegetables.
- Students watch video from the given web link to enhance their knowledge on different types of food:

<https://www.youtube.com/watch?v=9YiJj10yqp0>

10.2. Food for Activity

Time: 120 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define energy giving food with at least five examples.
- explain the importance of eating energy giving food.

Key Competencies

This topic enhances students' conceptual understanding of energy giving food. Students interpret the data from the graph and generalise the concepts. This enables students to develop their skills of comparison, analysis and interpretation. Students draw the diagram of their favourite energy giving food and thereby enhance their artistic skills.

New terms

Energy giving food

Activity A

- This activity requires students to interpret the graph given in the textbook and identify the foods that generally give more amount of energy. In the process of interpretation, they realise that not all foods they eat produce equal amount of energy. Students also conceptualise that every individual requires varying amount of energy depending on the type of work they do. To make the idea clear, teacher may articulate in the context of farmers, teachers, drivers and athletes who need varying degree of energy. For example, farmers usually need to eat more amount of energy giving food than teachers do as they are engaged in carrying out physical works.

Activity B

- This activity entails students to draw their favourite food that they eat to play, work, and ask them to display them in the “Food for Activity” corner in the classroom identified by the teacher. However, teacher must ensure that students draw and display only the food that provides energy. Students then present their display to the whole class and state why it is their favourite energy giving food.

Assessment

- Student's graph interpretation skills
- Student's drawing skills

Reinforcement

- Students list down the foods that they consume at home and identify the energy giving foods from the list.
- Students explore information from the given web link and identify energy giving food:

<http://apjcn.nhri.org.tw/SERVER/info/books-phds/books/foodfacts/html/data/data2a.html>

10.3. Food for Growth

Time: 80 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define body-building food with at least five examples.
- explain the importance of eating body-building food.

Key Competencies

This topic facilitates students to learn about the food that helps in growth. Students interpret the data from the graph and generalise the concepts. This enables students to develop their skills of comparison, analysis and interpretation. Students draw the diagram of their favourite body-building food and that enhance their artistic skills.

New Term

Body-building food, protein

Activity A

- In this activity, students interpret the data given in the graph and identify foods that contain more amount of protein for growth and development. In the process of interpretation and analysis, students conceive that not all foods contain same amount of proteins. For example, the graph shows that food like lentils contain high amount of protein than others.
- Overall, students actualise the importance of taking right amount of food for proper growth and development. They also realise that amount of protein required by the body depends on individual's need and circumstances. Teacher may compare an adult to a growing baby who needs more body-building foods for proper growth and development.

Activity B

- This activity asks students to draw their favourite food and display them in the “Food for Growth” corner in the classroom identified by the teacher. However, teacher must ensure that students draw and display only the food that helps in body growth.

Assessment

- Students’ ability to identify of energy giving food
- Students’ ability to answer “Check Your Progress” questions.

Reinforcement

Students explore information on body-building foods by browsing the given web link:

https://www.onhealth.com/content/1/nutrients_for_growing_children

10.4. Food for Protection

Time: 80 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- define protective food with at least five examples.
- explain the importance of eating protective food.

Key Competencies

This topic leads the students to have the conceptual understanding of the food that protect our body from diseases. They learn that food that contain vitamins and minerals keep our body healthy and strong. As a result, they develop the values of consuming fruits, vegetables, animal products and other stuffs with nutrients that keep our body healthy. Students draw the diagram of their favourite fruit and vegetables and this provides them a platform to enhance their artistic skills.

Activity A

- In this activity, students sort out foods for protection from the list of food given in the textbook. With this activity, students realise that food such as fruits, vegetables, animal products with vitamins and minerals form the essential part of the diet that protect body from diseases. To name more foods that protect our body, students may refer Annexure B given at the end of the textbook.

Activity B

- This activity entails students to draw their favourite fruit, vegetable, and display in the “Food for Protection” corner in the classroom identified by the teacher. However, teacher must ensure that students draw and display only fruits and vegetables.

Assessment

- Students' ability sort out protective foods from the list of food items
- Students' ability to recognize variety protective foods

Reinforcement

- Students explore more information regarding the protective food using the web link:
<https://www.betterhealth.vic.gov.au/health/healthyliving/fruit-and-vegetables>
- Students list down foods they eat at home and check if protective foods are included in their diet or not.

10.5. Eat all Types of Food

Time: 120 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- explain the importance of having energy giving food, body-building food and protective food in a meal.
- identify the right sets of food that would keep the body healthy

Key competencies

Students understand the value of eating balanced diet. Students prepare the menu for a daily meal to keep the body healthy and strong.

Activity A

- Students study the sets of food given in the textbook in Figure 10.5 and identify the kinds of foods present in each set. Students compare and conclude that meals containing all kinds of food are best for the body.

Activity B

- Students apply their knowledge about food in preparing a menu that contains balanced diet. Students list out food items for each menu for three days using Table 10.2. Students realise that it is important to consume different kinds of food in a meal for good health and proper growth.

Assessment

- Students' ability to explain the importance of consuming all types of food in a daily meal.
- Students' ability to prepare food menu containing different kinds of food.

Reinforcement

- Students explore information on importance of all types of food through the web links given below to deepen their conceptual knowledge.

<https://health.gov/dietaryguidelines/dga95/variety.htm>

<https://www.ahealthiermichigan.org/2015/04/28/why-all-5-food-groups-are-essential-to-maximizing-your-health/>

Students answer the following follow up questions:

1. Why is it important to eat meal containing each type of food?
2. How do energy giving food, body-building food and protective food help our body?

Content summary

Food is generally classified into pulses, grains, fruits, milk products, meat and vegetables. Pulses are edible seeds found in a pod while grains are small, hard, dry seeds, with or without fruit cover. Vegetable are the edible plants or parts of the plants other than fruits or seeds. However, foods are categorised as energy giving food, body-building food and protective food based on their nutritional value and the nature of their needs.

Foods that provide energy are called energy giving foods, while others that help in body growth called body-building food. Foods derived from cereal like rice, maize, potatoes, etc. that contain carbohydrate and fat are examples of energy giving food, while meat, eggs, milk, fishes, fruits, vegetables, etc. that contain protein are the body-building food. Foods that protect body from diseases are called protective food. Fresh fruits, vegetables and animal products are examples of protective food. They are rich in vitamins and minerals that keep our body healthy.

Everyday meal should have all types of food in right proportion to keep our body healthy.

Chapter 11

Our Earth

Our Earth is one of the planets that moves around the Sun on its own axis. This chapter lets the students learn about the structure of Earth, its movements and the cause of day and night and different seasons.

Learning outcomes

By the end of the chapter, students should be able to:

- define rotation and revolution in their own words.
- explain the formation of day and night in their own words.
- explain the effects of rotation and revolution.

11.1. Shape of the Earth

Time: 80 minutes

Learning objectives

By the end of the lesson, student should be able to:

- define Solar System.
- describe the shape of the Earth
- make model of the Earth using clay.

Key Competencies

In this topic, students to learn the details of Earth through drawing and building models. This enables them to develop the spirits of learning through hands-on experiences, psychomotor skills and artistic skills.

New terms

Solar System, planet, oblate spheroid

Activity A

- In this activity, students draw and label two shapes as shown in figure 9.1. The reason for the shape of the Earth is beyond the scope of class 4 science.



	
Name of the object: Earth Shape: Oblate Spheroid	Name of the object: Football Shape: Sphere

Figure 9.1. Oblate spheroid and sphere

- Students then build three-dimensional model of Earth using modelling clay and display in the classroom.
- Divide the class into two groups and let one group find evidences about ‘Flat Earth Society’ and the other about ‘Oblate Spheroid Earth Society’ from either internet or library. Start the debate between two groups asserting their claims with evidences.

Assessment

- Students’ debating skills.
- Students’ ability to build 3-D model of earth using modelling clay.

Reinforcement

Students explore more information on the shape of the Earth from the website:

<http://www.geography.hunter.cuny.edu/~jochen/GTECH361/lectures/lecture04/concepts/Datums/The%20Earths%20shape%20is%20a%20spheroid.htm>

11.2. Rotation of the Earth

Time: 80 minutes

Learning Objectives

By the end of the lesson, student should be able to:

- define rotation in their own words
- carry out the activity to demonstrate rotation of earth.

Key Competencies

In this topic, students in groups build a model of Earth with its axis using modelling clay and stick or straw and demonstrate rotation. This provides students an avenue to develop the skills of collaboration, interpersonal relationship and the spirits of learning via hands-on activities. Moreover, using the model, students demonstrate rotation.

New terms

Rotation, axis

Activity A

- In this activity, teacher uses a ball of cotton thread with a knitting needle placed through it as an analogy of Earth and its axis as given in the textbook in Figure 11.2. Teacher also demonstrates the rotation of the Earth using a globe. Students note the direction of the rotation and then draw the Earth, its axis and an arrow indicating the direction of the rotation. (The reason for counter clockwise direction of rotation of the Earth is beyond the scope of class 4)

Activity B

- In this activity, students in groups build the model of the earth using modelling clay. A straight piece of drinking straw or a small straight twig may be used to represent the axis of the Earth. Each group of students explains and demonstrates rotation of the Earth using their model. Students draw a labelled

diagram of the Earth on a chart paper and display their work. The teacher organizes gallery walk for students to observe the display to generalise and bring about coherence in the concept.

Assessment

- Students' skills to make models.
- Demonstration of rotation of the earth.
- Students' ability to explain the concept of rotation.

Reinforcement

Students explore more information on rotation of the Earth from the websites:

http://www.polaris.iastate.edu/NorthStar/Unit3/unit3_sub1.htm

<https://www.youtube.com/watch?v=EXasopxAFoM>

11.3. Day and Night

Time: 80 minutes

Learning Objectives

By the end of the lesson students should be able to:

- describe how day and night is caused.
- demonstrate the cause of day and night.

Key competencies

In this topic, students in groups investigate how day and night is caused using globe and flash light. This provides them an opportunity to develop the skills of scientific inquiry, collaboration, and the proficiency of communication.

New terms

Ante meridiem, post meridiem.

Activity A

- Carry out the activity in a dark room. Demonstrate the cause of day and night by focussing a flash light over the rotating globe. Ensure that children do not move around in the dark room. A flash light and a globe can also be provided to each group to experiment the cause of day and night. During their activity, teacher may ask the questions given the textbook below Figure 11.4 to help children draw inferences regarding the occurrence of day and night.

Assessment

- Students' ability to justify the formation of day and night
- Students' ability to demonstrate the cause of day and night.

11.4. Revolution of Earth

Time: 120 minutes

Learning Objectives

By the end of the lesson, student should be able to:

- define revolution.
- demonstrate revolution of the Earth.

Key competencies

This topic enables students in groups to learn about the revolution of the Earth through investigation. They share their findings with reasons to peers after the investigation. This provides them an avenue to develop the skills of scientific inquiry, reasoning, collaboration and communication.

New terms

Revolution, orbit.

Activity A

- Each group of students are provided a globe and a candle. The globe represents Earth and the burning candle the Sun. Make sure that students do not play with the burning candle. Move around the candle carrying the rotating globe in counter clockwise direction and observe. When the demonstration is complete, students draw the diagram of the Earth revolving around the Sun showing:
 - axis
 - orbit
 - direction of rotation of the Earth
 - direction of revolution of the Earth
- Teacher may also initiate to carry out an alternative activity in groups using the following materials:
 1. two paper plates

2. a cardboard
3. two nails
4. scissors
5. crayons or poster colours
6. brushes

Prepare a model as given in Figure 9.2. Colour the bigger paper plate yellow to represent the Sun and the other in blue as the earth.



Figure 9.2. Sun and the Earth.

Before the activity is carried out, make sure that students are provided with clear direction and description of the component represented by the model. Make sure that students hold the paper plate that represent Sun firmly when the plate that represent the Earth is rotated. Students must be told that orbit is actually oval, not circular as shown by the model.

Assessment

- Students' skills to make model.
- Students' participation in the group activity.
- Students' drawing skill to represent revolution of Earth.

Reinforcement

Students explore for information on revolution of the Earth using the web links:

<http://peter-mulroy.squarespace.com/Earths-motions-revolution-and-rotation/>

<https://www.youtube.com/watch?v=9n04SEzuvXo>

11.5. Seasons in a Year

Time: 160 minutes

Learning Objectives

By the end of the lesson, students should be able to:

- state the four seasons.
- explain the reasons that cause seasons.

Key Competencies

In this topic, students learn about seasons through multi-media and poster competition. This enables them to develop the spirit of learning through media technologies. Moreover, the topic also helps them develop the critical thinking skills, creativity and the artistic skills.

New terms

Spring, summer, autumn, winter

Activity A

- Explain the cause of seasons using pictures or show the following video to describe how seasons are caused by the revolution of the earth.

<https://www.youtube.com/watch?v=Pgg0LThW7QA>

<https://www.youtube.com/watch?v=igCmW5jLF7k>

- Make sure students have the understanding that seasons are caused by:
 - i. tilt of the Earth's axis and
 - ii. revolution of the Earth around the Sun.

Activity B

- Conduct a poster completion amongst the groups to depict different seasons. Students can come up with their own ideas on how to represent different seasons. Let the students display their works along the corridors or in the class room.

Assessment

- Students' skills to make posters using predefined criteria.
- Students' ability to explain the cause of different seasons.

Reinforcement

Teacher may also ask the students find out more information on seasons from the web links:

https://www.youtube.com/watch?v=q4_-R1vnJyw

https://www.youtube.com/watch?v=WgHmqv_-UbQ

<https://www.nationalgeographic.org/encyclopedia/season/>

Content summary

Our Earth is one of the planets that moves around the Sun. It is oblate spheroid in shape. It rotates on its own axis in counter clock wise direction. One complete rotation of the Earth takes about 24 hours. This movement of the Earth causes day and night. It also moves around the Sun simultaneously along its fixed orbit. This movement is called revolution. Seasons are caused due to the revolution of the Earth around the Sun.

ANNEXURE

Chapter 1

Materials in our surrounding

1.1. Everyday Materials

Test Yourself

1. Name two things that you use while brushing your teeth.
Answer: Toothpaste, tooth brush, etc.
2. Name five different things that we use every day.
Answer: Table, chairs, books, clothes, pen, pencil, shoes, bags, etc.
3. What are the uses of five things you have listed?
Answer: We use these things for sitting, sleeping, writing, reading, clothing, carrying, etc.
4. Name two things that we get from animals.
Answer: Milk, meat, wool, etc.
5. What is a chair made of?
Answer: Wood, steel, iron, plastic, bamboo, etc.

Activity A

Classify them into different groups as given in the Table 1.1. Present your work to the class.

Table 1.1.

Plant	Animal	Metal	Plastic	Rock	Glass
<i>Chair; match box, stick.</i>	<i>Feather; hair</i>	<i>can, lock and key</i>	<i>Chair, bag, bottle.</i>	<i>Chorten.</i>	<i>Mirror, bottle</i>

Which material is used to make a mirror?

Answer: Glass is used to make a mirror.

Name two things which are made of metal.

Answer: can and key, or can and lock, or lock and key.

Activity B

Look around your classroom. Make a list of five things that you see. Name the materials they are made up of. Share your findings with other pairs.

Answer:

Things	Materials
Table	Wood
Blackboard	Slate and wood
Chair	Wood
Window	Wood and glass
Dustbin	Plastic, metal or wood

Check Your Progress

i. List ten things that you find at home.

Answer: Plastic bucket, pot, cups and plates (plastic/metal), tray, comb, bed, curry cooker. (Other things can also be listed).

ii. Write down their uses.

*Answer: Plastic bucket – storing water and grains, washing, garbage bins, etc.,
Pot – cooking,
Cups and plates – drinking and eating,
Tray – serving,
Comb – combing,
Bed – sleeping,
Curry cooker – cooking curry,
Chair – sitting,
Knife – cutting.*

1.2. Sorting Materials

Test Yourself

1. What is a bottle made of?

Answer: Bottle is made of either glass, plastic, metals, bamboo or wood.

2. Name some materials used to build houses.

Answer: Materials used to build houses are wood, cement, mud, stone, metal, bricks, plastic, glass, etc.

3. Name five things made of wood.

Answer: The five things made of wood are cupboard, chair, desk, table, door and window sill.

4. Give two examples of materials that we can see through.

Answer: The two examples of materials that we can see through are glasses and plastics.

5. Why are plastic bags easily blown away by wind?

Answer: Plastic bags are easily blown away by wind because they are light.

Activity A:

List down objects that you see in your classroom. Sort them under the following headings in Table 1.2.

Materials	Wood	Glass	Plastic	Cloth	Paper	Metal
Classroom objects	Table and pencil, bench, door	Windowpane, Beaker and Test tube	Pen, Chair, and Pet bottle.	Duster, Gho, Kira, Tego, and Lagay.	Book and Chart	Nail and Hammer

(The above listed items are just the examples. Children can write any example according to the availability in their locality)

Which material is mostly used in making the classroom objects?

Answer: The material mostly used for making classroom objects is cloth. (Answer

for this question may differ from school to school or classroom to classroom depending upon the prevalence of the objects).

What materials are used other than the ones given in Table 1.2?

Answer: The materials used other than the ones given in table 1.2 are stones, cement, bamboo, etc. (Answer for this question may differ from school to school or classroom to classroom depending upon the prevalence of the objects).

Activity B

Table 1.3.

Classroom objects from the above table in A	Heavy	Light	Transparent	Opaque	Soft	Hard	Elastic
	Wood, Metal, Glass, Rubber, Leather, Slate, Stones, Soil and Cement.	Paper, Plastic, and Clothe.	Plastic and Glass	Wood, Metal, Rubber, Leather, Slate, Stones, Soil, and Cement	Paper, Rubber, Leather, and Clothe	Metal, Rubber, Leather, Slate, Stones, Soil, and Cement	Rubber

(Characteristics, such as soft, hard, and elastic are some of the examples. Children may come up with any characteristic that is plausible and intelligible.)

What do you mean by characteristic of materials?

Answer: Characteristic of material means feature of the materials that makes the objects different from other.

Write the characteristics of a feather.

Answer: The characteristics of a feather are soft, light, flexible, etc.

Check Your Progress

i. Define the terms transparent and opaque in your own words.

Answer: Transparent is the characteristic of materials through which we can see or light can pass through. Opaque are the characteristic of materials through which we cannot see or light cannot pass through.

- ii. Sort the above objects given below. Copy and complete the table 1.4.
(Cotton, log, spade, crowbar, plastic bottle, wool, leaf, hammer, axe, stones, paper, feather)

Answer:

Heavy objects	Light objects
<i>Spade, crowbar, hammer, axe, stones, log.</i>	<i>Cotton, plastic bottle, wool, leaf, paper, feather.</i>

1.3. Floating and Sinking

Test Yourself

- Which is heavier, a pencil or a book?
Answer: A book is heavier than a pencil.
- Name three objects we use every day that float in water.
Answer: The three objects we use every day that float in water are ball, plastic bottle, and pencil.
- Make a paper boat and place it in a bucket of water. What do you observe?
Answer: The paper boat floats in water.
- Put a small stone in a beaker of water. What do you observe?
Answer: The stone sinks in water.
- Why do you think some objects float while others sink in water?
Answer: Some objects float because they are light and have larger surface area while some objects sink because they are heavier and have smaller surface area.

Activity A

Table 1.5. Floating or sinking objects

Objects	Prediction	Observation
<i>Leaf</i>	<i>Float</i>	<i>Floating</i>
<i>Stone</i>	<i>Sink</i>	<i>Sinking</i>
<i>Eraser</i>	<i>Float</i>	<i>Floating</i>
<i>Pencil Sharpener</i>	<i>Float</i>	<i>Floating</i>
<i>Chalks</i>	<i>Float</i>	<i>Floating</i>
<i>Scissors</i>	<i>Sink</i>	<i>Sinking</i>
<i>Pencil</i>	<i>Float</i>	<i>Floating</i>
<i>Paper clips</i>	<i>Sink</i>	<i>Sinking</i>
<i>Crayon</i>	<i>Sink</i>	<i>Sinking</i>

Why do some objects float?

Answer: Some objects float as they are light.

Why do some objects sink?

Answer: Some objects sink as they are heavy.

Activity B

What you needed:

- *Bucket, water, balloon, stone and string.*

What you did:

- *Filled the bucket with water.*
- *Placed the deflated balloon tied with the stone in the bucket and carried out the observation.*
- *Then placed the inflated balloon tied with the stone in the bucket and carried out the observation.*

What happened:

- *The deflated balloon tied with the stone sank.*
- *The inflated balloon tied with the stone floated.*

What you observed:

- *It was found that the objects with air inside it floats in water easily.*

Check Your Progress

- Why does a football float in water?

Answer: Football float in water as it contains air inside.

1.4. Natural and Human-made Things

Test Yourself

- Write the names of a few things heavier than your science textbook.

Answer: Table, desk, chair, bench, cupboard, chalkboard, etc.

- Name the materials these things are made of.

Answer: Wood, plastic, metals, paper, etc.

- Name one natural thing.

Answer: Stone.

- Name a few things made by human beings.

Answer: Plastic bottle, computer, pencil, chalk, clothes, etc.

Activity A

List five natural things and five human-made things that you see in your school campus.

Table 1.6. Natural and human-made things

Natural things	Human-made things
<i>Stone</i>	<i>Car</i>
<i>Water</i>	<i>Can</i>
<i>Plants</i>	<i>Plastic</i>
<i>Animal</i>	<i>Book</i>
<i>Soil</i>	<i>Building</i>

Write one difference between natural things and human-made things.

Answer:

Natural things	Human-made things
<i>Not made by human</i>	<i>Made by human</i>

Name the raw materials used to make the following things:

Things	Raw materials
<i>Paper</i>	<i>Wood</i>
<i>Pen</i>	<i>Metal and/or Plastic</i>
<i>Gho and Kira</i>	<i>Thread</i>
<i>Table</i>	<i>Wood and/or Metal</i>
<i>Brick</i>	<i>Soil</i>

Check Your Progress

- i. What are natural things? Give two examples.

*Answer: The things that are found in the nature are called natural things.
Example, tree and stone.*

- ii. What are human-made things? Give two examples.

*Answer: The things that are made by human are called human-made things.
Example, chalkboard and table.*

- iii. List the raw materials you get from the forest to build a house.

Answer: The raw materials we get from the forest to build house are wood, bamboo, fibre, leaves, etc.

- iv. What are the raw materials made by human, which are used to build a house?

Answer: The raw materials made by human, that are used in building a house are metal rod, cement, glass, window, door, etc.

1.5. Degradable and Non- degradable Things

Test Yourself

1. What is paper made from?

Answer: Paper is made from wood.

2. Is paper a natural thing or a human-made thing?

Answer: Paper is human-made thing.

3. What will happen to the food kept open for a long period?

Answer: The food kept in open for a long period will decay or rot.

4. Which one do you think will decay faster, a plastic or a paper?

Answer: Paper will decay faster than the plastic.

5. Why is it important to dispose waste properly?

Answer: It is important to dispose waste properly because some materials like plastics take longer time to decay and pollute the environment.

Activity A

What do you see on the bread?

Answer: A white substance which will slowly turn into greyish black. Use microscope or hand lens to observe its body structure closely.

What happens to the bread?

Answer: The bread gets decayed.

Activity B

Which of the following substances do you think are degradable and non-degradable?

Glass, paper, iron nail, leather shoe, plastic bottle, newspaper, cow dung, vegetable waste

Degradable substances	Non –biodegradable substances
Paper	Glass

<i>Vegetable waste</i>	<i>Iron nail</i>
<i>Leather shoe</i>	<i>Plastic bottle</i>
<i>Newspaper</i>	
<i>Cow dung</i>	

Activity C

Materials required: Spade, garden hoe, safety gloves, waste materials.

Students need to be instructed not to play with garden tools that are used for digging pits.

They also need to be reminded to be very careful when they collect materials like bottles, glasses, and metal pieces.

Copy Table 1.7 and fill it in.

Table 1.7. Observing decay

<i>Pits</i>	<i>Waste Materials</i>	<i>Changes Observed</i>			
		<i>Day 1</i>	<i>After 2 Weeks</i>	<i>After 4 Weeks</i>	<i>After 6 Weeks</i>
<i>Pit 1</i>	<i>Leaves, flowers, fruits, Cow dung, etc.</i>				
<i>Pit 2</i>	<i>Plastic bottle, plastic bag and pieces of metal</i>	<i>No changes</i>	<i>No changes</i>	<i>No changes</i>	<i>No changes</i>

(Students will record the changes observed in the two pits periodically as mentioned in the table)

In which pit did the materials decay?

Answer: In pit 1.

Which ones are degradable materials?

Answer: Leaves, flowers, fruits, cow dung, etc.

Which ones are non-degradable materials?

Answer: Plastic bottle, plastic bag and pieces of metal.

Where can we use the decayed wastes?

Answer: We can use decayed wastes in garden to make the soil fertile.

Why should we have separate pits for degradable and non-degradable wastes?

Answer: We should have separate pits for degradable and non-degradable wastes because degradable waste materials get decayed by micro-organism and this can be used as manure. While, non-degradable wastes materials do not get decayed and can be collected for recycling.

Check Your Progress

i. Define degradable things and non-degradable things.

Answer: Things that decay are called degradable things, while things that do not decay are called non-degradable things.

ii. What causes decay?

Answer: Micro-organisms causes decay.

Think Again

1. Fill in the blanks

- Things which are made by human are called human-made things.
- Small organisms which we cannot see with our naked eyes are called micro-organisms.
- An example of a non-degradable thing is nail
- Materials from which other things can be made are called raw materials.
- Stone and iron nail sink in water because they are heavy.

2. Write one difference between degradable things and non-degradable things.

Answer: Degradable things decay and non-degradable things do not decay.

3. Why is glass a good material for windows?

Answer: Glass is transparent and allows light to pass through.

4. Why are plants and animals natural things?

Answer: They are found in nature. They cannot be made by humans.

5. Plastic is a handy material, but using plastic is bad for the environment. Why?

Answer: Plastic is a non-degradable material. Burning plastics releases harmful gases in the air.

6. Why do people use rubber tubes while swimming?

Answer: People use rubber tube while swimming to prevent themselves from drowning as they help people remain on the surface of the water as it has air in them.

Chapter 2

Matter

2.1. What is matter?

Test Yourself

1. Differentiate degradable and non-degradable things.

Answer: Degradable things are those that decay while non-degradable things are those that do not decay.

2. Name two objects which sink in water.

Answer: Stone and knife sink in water.

3. What is a human-made change?

Answer: A human-made change is a change brought about by human activities.

4. Name two objects that occupy space.

Answer: Stone and book occupy space.

5. Do these objects have mass?

Answer: Yes, they have mass.

Activity A

Give five more examples of matter.

Answer: Stone, plate, cat, geometry box and clothes.

Activity B

Materials required: Pan balance (reading in grams), lock, twine thread, pencil, paper, nail, plastic bottle, eraser, compass and sharpener.

What does the movement of the needle show?

Answer: The movement of the needle shows that lock has mass.

Does it occupy any space?

Answer: Yes, it occupies space.

Is key a matter? Give reasons.

Answer: Key is a matter because it has mass and occupies space.

Now your teacher will provide you a set of objects (like pencil, paper, nail, plastic bottle, eraser, compass, sharpener, etc.)

Find whether they are matter

Answer: All the materials provided above are matter.

Check Your Progress

i. Is shadow a matter? Why?

Answer: Shadow is not a matter because it does not have mass.

i. Give two characteristics of matter.

Answer: a. Matter has mass.

b. Matter occupies space.

2.2. Solid as Matter

Test Yourself

1. What is matter?

Answer: Matter is anything that has mass and occupies space.

2. What is the use of a pan balance?

Answer: Pan balance is used to measure mass of an object.

3. How do we determine that an object is a matter?

Answer: By finding its mass and the space it occupies.

4. Give three examples of solids that have mass and occupy space.

Answer: Table, chair, and pencil.

5. Can we call paper a matter?

Answer: Yes, paper is a matter because it has mass and occupies space

Activity A

Why does the level of water in the cylinder change?

Answer: The level of the water in the cylinder changes because the stone occupies space and pushes up the water.

Activity B

Is stone a solid?

Answer: Yes, stone is a solid.

Is stone a matter? Why?

Answer: Stone is a matter because it has mass and occupies space.

Check Your Progress

i. Define meniscus.

Answer: The curve upper surface of a liquid in a container is called meniscus.

ii. Are all solids matter? Why?

Answer: All the solids are matter because they have mass and occupy space.

2.3. Liquid as Matter

Test Yourself

1. Give three examples of liquid that you use at home.

Answer: Milk, water, and oil.

2. Why is solid a matter?

Answer: Solid is a matter because it has mass and occupies space.

3. What is mass?

Answer: Mass is the quantity of matter of an object.

4. Is liquid a matter?

Answer: Yes, liquid is a matter.

Activity A

Table 2.1. Mass of liquid

Bottle	Mass
Empty bottle	
Bottle filled with water	

(Mass would depend on the type and the capacity of the bottle)

What is the mass of the water?

Answer: Mass of water = mass of water and bottle – mass of the empty bottle.

Activity B

What you needed:

- *Measuring cylinder, empty containers of various shapes and sizes, and a bucket of water.*

What you did:

- *Place all the containers on a flat surface.*
- *Pour water into each container.*
- *Observed the shape of the water in different containers.*

What you observed:

- *Water occupies space taking the shape of the containers.*
- *Note: Use transparent containers*

Is water a matter? Why?

Answer: Yes, water is a matter because it has mass and occupies space.

Check Your Progress

- i. Name four liquids that you use other than water.

Answer: Fruit juices, tea, milk and butter milk.

- i. Are all the liquids matter? Why?

Answer: All the liquids are matter because they have mass and occupy space.

2.4. Gas as Matter

Test Yourself

1. How do we determine that the liquid is a matter?

Answer: By finding its mass and the space occupied.

2. Write two similarities between a solid and a liquid.

Answer:

Solid	Liquid
<i>Has mass</i>	<i>Has mass</i>
<i>Occupy space</i>	<i>Occupy space</i>

3. What is present inside the inflated balloon?

Answer: Air or mixture of gases is present inside the inflated balloon.

4. Give two examples of gas.

Answer: Oxygen and carbon dioxide.

Activity A

1. Does gas have mass?

Answer: Yes, gas have mass.

2. Write what you did during the activity.

Answer: (a) Took two balloons and inflated them to a similar size.

(b) Hung the balloons at the two ends of the metre stick.

(c) Balanced the metre stick with two inflated balloons tied to it by holding a string tied around it and observed the set up.

(d) Punctured one of the balloons and observed the set up.

3. What did you find out from the activity?

Answer: We found out that gas has mass.

Activity B

Materials required: Beaker, bucket, and paper.

1. What happens to the paper? Give reasons.

Answer: The paper remains dry inside the beaker even after pushing it into the water because the beaker contains air inside that occupies space.

Check Your Progress

- i. Why is gas a matter?

Answer: Gas is a matter because it has mass and occupies space.

- ii. Are empty bottles really empty?

Answer: No, empty bottles are not really empty as they contain air inside.

2.5. Heating and Cooling of Substances

Test Yourself

1. Is ice cream solid, liquid or gas?

Answer: Ice cream is a solid.

2. What happens to the ice cream when it is kept in the sunlight?

Answer: The ice cream melts when it is kept in the sunlight.

3. If we keep on heating water, what do we see?

Answer: We see the water vapour rising.

4. What will happen to water when it is kept in a freezer?

Answer: When water is kept inside the freezer, it will change into ice.

5. Name any everyday material which changes on heating.

Answer: Butter.

Activity A

Materials required: Butter, long test tube, test tube holder, spatula, spirit lamp, matchbox and balloon.

Alternative teaching aid. In place of butter, use candle wax.

Copy and fill in the table given below. Table 2.2.

Characteristics	Before heating	After heating
1. Colour	Yellow	White
2. Form(solid, liquid or gas)	Solid	Liquid

What happens to the butter on cooling?

Answer: It becomes solid.

Activity B

List the materials used by the teacher in the demonstration.

Answer: Beaker, water, spirit lamp, wire gauze and tripod stand.

Write the steps involved in the demonstration.

Answer: Take some amount of water in a beaker and heat it over the flame till it boils.

What happens to the liquid when heated?

Answer: It changes to vapour.

Activity C

Materials required: Balloon, beaker, hot water, and test tube.

Fix a balloon on the mouth of a test tube tightly. Now place the test tube into a

beaker containing hot water. Keep it for some time.

What happens to the size of the balloon?

Answer: The size of the balloon becomes bigger.

Why does the size of the balloon change?

Answer: Size of the balloon changes because of the expansion of gas inside it.

Now remove test tube from the beaker and cool it.

What do you observe?

Answer: Balloon becomes smaller or inflated.

What happens to the gas inside the balloon?

Answer: The gas inside the balloon gets contracted.

Check Your Progress

i. What will happen when ice is heated?

Answer: It will change into water.

ii. What will happen when a gas is heated?

Answer: It will expand.

Think Again

1. State whether the following statements are TRUE or FALSE.

i. Matter has mass and occupies space.

Answer: True.

ii. Gas expands on heating.

Answer: True.

iii. The level of water in a beaker decreases when a stone is immersed into it.

Answer: False.

iv. Milk is a solid form of matter.

Answer: False

v. Pan balance is used for measuring weight.

Answer: False

2. Classify the following as solid, liquid, and gas.

Book, water, pencil, smoke, air and kerosene

Answer: Solid- book and pencil.

Liquid- water and kerosene.

Gas- smoke and air.

3. Give two examples of non-matter.

Answer: Sound and shadow.

4. Give two properties that are common in all the matter.

Answer: The two properties common in all the matters are mass and the space occupied.

5. What is meniscus?

Answer: The curve upper surface of the liquid in a container is called meniscus.

6. How will you measure the volume of a liquid correctly in a measuring cylinder?

Answer: We can measure the volume of a liquid correctly in a measuring cylinder by reading the bottom of the meniscus.

Chapter 3

Materials in Mixtures

3.1. Pure Substances and Mixtures

Test Yourself

1. What are three forms of matter?
Answer: Solid, liquid, and gas are the three forms of matter.
2. Give an example each for different forms of matter.
Answer: Solid- stone, liquid- milk, and gas- smoke.
3. Name an object made of different materials. List the materials.
Answer: Bricks- made from clay, water, sand, and cement.
4. What is a mixture?
Answer: Things made of two or more materials.
5. What do you call a substance when it is free from impurities?
Answer: Pure substance.

Activity A

Name two more substances that contain impurities.
Answer: Water and air.

Activity B

Which is a mixture? Why?
Answer: Solution in beaker A is a mixture because it contains the mixture of salt and water which are different substances.

Which is a pure substance? Why?
Answer: Water in beaker A is pure substance because it does not contain any other substance.

Name two more pure substances that you see in your class room.

Answer: Wood and glass.

Activity C

Study the list of substances given below.

(Air, water, soil, cake, gold, ice cream, saw dust, suja, milk, tea leaf)

Copy and complete the table.

Pure substance	Mixtures
<i>Water (pure form), gold, and saw dust</i>	<i>Water (impure form), air, soil, cake, ice cream, suja, milk, and tea leaf.</i>

Check Your Progress

i. Why is ema-datsi not a pure substance?

Answer: It contains substances like chilli, salt, water, cheese, etc.

ii. Differentiate between pure substance and mixture.

Pure substance	Mixture
<i>Contain only one type of substance.</i>	<i>Contain two or more pure substances.</i>

3.2. Soluble and Insoluble Substances

Test Yourself

1. Name three things that are used to make tea.

Answer: Sugar, water and tea leaf.

2. Give two example of pure substance.

Answer: Sugar and salt.

3. Give two example of mixture.

Answer: Tea and curry.

4. Will sugar disappear when it is added to water and stirred?

Answer: Yes, sugar will disappear.

5. Will sand disappear when it is added to water and stirred?

Answer: No, sand will not disappear.

Activity A

Table 3.2. Predicting soluble and insoluble substances

Name of the substance	Soluble	Insoluble
<i>Sugar</i>	<i>Soluble</i>	
<i>Chalk powder</i>		<i>Insoluble</i>
<i>Copper sulphate</i>	<i>Soluble</i>	
<i>Glucose</i>	<i>Soluble</i>	
<i>Flour</i>		<i>Insoluble</i>

Table 3.3. Investigating soluble and insoluble substances

Name of the substance	Soluble	Insoluble
<i>Sugar</i>	<i>Soluble</i>	
<i>Chalk powder</i>		<i>Insoluble</i>
<i>Copper sulphate</i>	<i>Soluble</i>	
<i>Glucose</i>	<i>Soluble</i>	
<i>Flour</i>		<i>Insoluble</i>

How many predictions were correct?

Answer: Depend on students' predictions.

Name two other substances that are insoluble in water.

Answer: Rice and mud.

Check Your Progress

i. Define soluble substance. Give one example.

Answer: Soluble substance is a thing that dissolve in liquid. Example, salt.

ii. Define insoluble substance. Give one example.

Answer: Insoluble substance is a thing that does not dissolve in liquid.

Example, stone.

3.3. Solid-solid Mixtures

Test Yourself

1. What are pure substances?

Answer: Substances which do not contain impurities are called pure substances.

2. Give two examples of insoluble substance.

Answer: Sand and glass.

3. Name one solid which does not dissolve in water.

Answer: Coin.

4. What do we get when we mix two or more substances together?

Answer: We get a mixture.

5. Give an example of a mixture that contains two solids.

Answer: Soil

Activity A

What kind of mixtures are these?

Answer: These are solid-solid mixtures or mixture of solids.

Mix rice, gravel, maize and peas.

What kind of mixture is this?

Answer: Solid-solid mixture.

Give some more examples of such type of mixtures.

Answer: Rice and peas, stones and flour, wheat and stones and rice and husk.

Check your progress

- i. Define solid-solid mixture.

Answer: A mixture that contains two or more solid substances is called solid-solid mixture.

- ii. Give two examples of solid-solid mixtures that you find at home.

Answer: Kharang and rice, and rice and beans.

3.4. Solid-liquid Mixtures

Test Yourself

1. What type of mixture is tea leaves and salt?

Answer: solid-solid mixture

2. Name one soluble substance.

Answer: sugar

3. Is salt in water a mixture?

Answer: Yes. It is a solid-liquid mixture.

4. Give two examples of mixture that contain solid and liquid.

Answer: Sand and water and rice and milk.

5. What do you call a mixture that contains a solid and a liquid?

Answer: It is called solid-liquid mixture.

Activity A

What do you observe?

Answer: The rice settles at the bottom of the beaker.

Is this a mixture? Why?

Answer: Yes, it is a mixture because it contains two substances.

Name some more examples of such mixtures.

Answer: Sand and water, gravels and water and tea leaves and water.

Activity B

What you needed:

- *Beaker, spatula, glass rod, ammonium chloride, water and measuring cylinder.*

What you did:

- *Took some water in a beaker.*
- *Added a spatula of ammonium chloride to it.*
- *Stirred it with the help of a glass rod.*

What you observed:

- *Ammonium chloride disappears in water.*

How is the mixture in this experiment different from the mixture obtained in the previous activity?

Answer: Mixture in this experiment is different from the mixture obtained in the previous activity as ammonium chloride is soluble while rice isn't soluble in water.

Check Your Progress

- i. Define solid-liquid mixtures. Give two examples.

Answer: A mixture that contain solid (s) mixed with liquid (s) is called solid-liquid mixture. Examples, sugar in water and bread in milk.

3.5. Liquid-liquid Mixtures

Test Yourself

1. Give three examples of liquid.

Answer: Milk, ink and kerosene.

2. What is solid-liquid mixture?

Answer: A mixture that contain solid(s) mixed with liquid(s).

3. Does oil dissolve in water?

Answer: No, oil does not dissolve in water.

4. What type of mixture is milk and water?

Answer: Liquid-liquid mixture.

5. Give two examples of mixture containing two or more liquids

Answer: Milk and water, and oil and water.

Activity A

Does ink mix with water?

Answer: Yes, ink mixes with water.

What type of mixture is this?

Answer: It is a liquid-liquid mixture.

Name some more examples of liquid-liquid mixtures.

Answer: Milk and water, oil and water, kerosene and oil and juice and water.

Activity B

What you needed:

- *Water, oil, test tube and dropper.*

What you did:

- *Took some amount of water in the test tube.*
- *Added 5 to 10 drops of oil into test tube with the help of a dropper.*

- *Shook the test tube.*

What you observed:

- *We saw two layers of liquids, i.e. oil over water.*

Does oil mix with water?

Answer: No, oil does not mix with water.

Can it be called a liquid-liquid mixture? Why?

Answer: Yes, it is a liquid-liquid mixture because it is the mixture of two liquids i.e. oil and water.

Check Your Progress

- i. Define liquid-liquid mixture.

Answer: A mixture that contain two or more liquids.

- ii. Give two examples of liquid-liquid mixture that we use in our day to day life.

Answer: Orange squash mixed with water, kerosene and water in the lamp and milk and water in making tea.

Think Again

1. State whether the following statements are TRUE or FALSE.

- i. Chalk powder is a soluble substance.

Answer: False

- ii. Oil and water is a liquid-liquid mixture.

Answer: True

- iii. Sand and sugar is a solid-liquid mixture.

Answer: False

- iv. Dissolving of salt in water is a solid-liquid mixture.

Answer: True

- v. A mixture contains different types of pure substances.

Answer: True

2. Is orange squash a mixture? Why?

Answer: Yes, orange squash is a mixture because it contains sugar, citric acid, flavour and water.

3. What type of mixture is tea that we drink?

Answer: Tea is either solid-liquid mixture or liquid-liquid mixture.

4. What do you observe when you open a bottle of fizzy drink? What type of mixture is it?

Answer: When the bottle of fizzy drink is opened, we observe the rise of gas with fizzy noise. It is gas-liquid mixture.

5. Differentiate between soluble and insoluble substances.

Answer: Soluble substances dissolve in liquid(s).

Insoluble substances do not dissolve in liquid(s).

6. What is a pure substance? Give two examples.

Answer: Pure substance is a thing made of single substance. Example, iron and gold.

7. Pema and Karma went to river bank to collect some pebbles to play “Tiger and Cow game”, their village’s popular game. They collected pebbles of different shapes and colours. On their way back, they saw different types of insects on the cow dung.

- i. What is the type of mixture from which they collected the pebbles?

Answer: Solid-solid mixtures if they have collected from the dry river bank or solid-liquid mixture if they have collected from wet or moist river bank.

- ii. What mixture did they see on the cow dung?

Answer: They did see the mixture of insects.

- iii. Would they be right to say that they saw a mixture of “pebbles and insects”? If not, why?

Answer: No, they would be wrong to say that they saw a mixture of “pebbles and insects” because pebbles and insects were not found together.

Chapter 4

Separating Mixtures

4.1. Sedimentation and Decantation

Test Yourself

1. What are soluble substances?

Answer: Substances that dissolve in liquid (s) are known as soluble substances.

2. Give two examples of liquid-liquid mixture.

Answer: Kerosene and water and oil and water.

3. Give two examples of solid-solid mixture.

Answer: Sand and gravel and sugar and salt.

4. What will happen if you put sand in water?

Answer: Sand will not dissolve or sand will settle down at the bottom of the water.

5. Can you easily separate sand from water?

Answer: Yes, by decantation and filtration.

Activity A

What do you observe?

Answer: The mud settling down at the bottom of the water in the beaker.

Is mud soluble in water?

Answer: No, mud is not soluble in water.

How is water separated from the mixture of sand and water?

Answer: By pouring out the water without disturbing the sand.

What precaution should you take?

Answer: The sediment should not be disturbed.

Why do you use the glass rod?

Answer: To prevent the spillage of liquid while decanting the sediment.

Check Your Progress

i. What is sedimentation?

Answer: Settling of solid at the bottom of the liquid in a container is called sedimentation.

ii. What is decantation?

Answer: Pouring out the liquid without disturbing the sediment is called decantation.

4.2. Separating Insoluble Substances by Sedimentation and Decantation

Test Yourself

1. Give one example of soluble substance.

Answer: Salt

2. Give one example of insoluble substance.

Answer: Coal

3. If a mixture of soil and water is kept undisturbed for some time, what will happen to the soil?

Answer: The soil will settle down at the bottom of the water.

4. What type of mixture is commonly separated by decantation?

Answer: The solid-liquid mixture containing insoluble solid in the liquid.

5. How would you separate insoluble substance?

Answer : Through the process of sedimentation and decantation.

Activity A

What do you observe?

Answer: We observe the settling down of rice at the bottom of the beaker.

How will you separate water from the rice?

Answer: By pouring the water without disturbing the rice settled at the bottom (decantation).

Activity B:

Find out which mixtures can be separated by sedimentation and decantation.

Answer: Mixture of tea leaf and water and the mixture of chalk powder and water.

Check Your Progress

i. Why is it possible to separate cheese from whey?

Answer: Cheese being heavier than whey settle down at the bottom of the container.

ii. Copy Table 4.1 and write the difference between sedimentation and decantation.

Answer:

Sedimentation	Decantation
<i>Settling down of solid at the bottom of the liquid in the container</i>	<i>Pouring out the liquid without disturbing the sediment.</i>

4.3. Separating Insoluble Substances by Filtration

Test Yourself

1. Give two examples of mixture that can be separated by sedimentation and decantation.

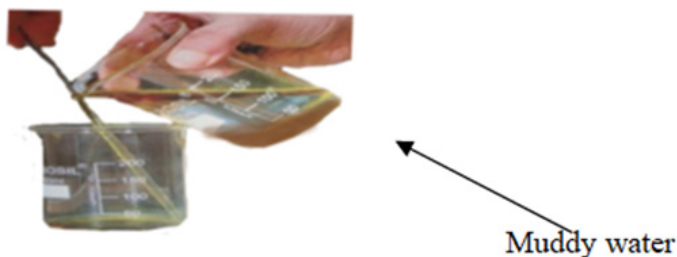
Answer: Rice and water, and pulses and water.

2. What is the difference between sedimentation and decantation?

Answer:

<i>Sedimentation</i>	<i>Decantation</i>
<i>Settling down of solid at the bottom of the liquid in the container</i>	<i>Pouring out the liquid without disturbing the sediment</i>

3. Draw a labelled diagram of decantation process.



4. In summer, drinking water is usually muddy. How would you make it clear and clean?

Answer: Muddy drinking water can be made clear and clean through the process of sedimentation and decantation and filtration.

Activity A

List down materials used by your teacher for filtration.

Answer: Filter paper, funnel, beaker, stand, muddy water and glass rod.

What was collected on the filter paper?

Answer: Mud was collected on the filter paper.

What is the colour of the filtrate?

Answer: The filtrate is colourless.

Activity B

What do you get on the filter paper?

Answer: We get chalk powder on the filter paper.

What is the colour of the filtrate?

Answer: The filtrate is colourless.

Is filtration a better process than sedimentation and decantation? Explain.

Answer: Yes, filtration is a better process than sedimentation and decantation because through it, a liquid can be separated from the solid completely.

Check Your Progress

i. What is a filtrate?

Answer: Filtrate is the clean and clear liquid collected in the container after filtration.

ii. What is a residue?

Answer: Residue is the solid particles left on the filter paper after filtration.

iii. What is the importance of filtration?

Answer: Filtration separates the insoluble solid particles from liquids completely.

4.4. Making Water Safe for Drinking

Test Yourself

1. What is filtration?

Answer: It is the process of separating insoluble solid mixed in a liquid.

2. Give one example of mixture that can be separated by filtration.

Answer: Sand and water.

3. How will you carry out the process of filtration?

Answer: Filtration can be carried out by pouring the mixture into the funnel containing filter paper.

4. Name two methods to make water safe for drinking.

Answer: Boiling and filtration.

5. Name a method used at home to make water safe for drinking.

Answer: Boiling.

Activity A

What are the various ways by which water gets contaminated?

Answer: Improper disposal of household waste materials, human waste and undigested materials and industrial affluent, etc.

How can you make water safe for drinking?

Answer: We can make water safe for drinking by boiling and filtering.

Activity B

What are the materials used in making SODIS?

Answer: Water, water bottles and zinc sheet and poles.

How does SODIS make water safe for drinking?

Answer: SODIS make water safe for drinking as it kills germs through heating.

What are the precautions to be taken?

Answer: Some of the precautions that must be taken while making SODIS are: i) clean the water bottles well before using, ii) close the lid well, and iii) place the bottles in sunlight for at least six hours.

Activity C

Discuss the use of charcoal, sand and gravel in your filter.

Answer: Charcoal is used to absorb gas and dust particles and to make the water colourless.

Gravel is used to block the passage of bigger particles.

Sand is used to block the impurities that filter through the gravels and also to prevent the displacement of charcoal while adding the water.

Is your water safe for drinking? Why?

Expected answer:

No, it is still not safe for drinking because germs do not get killed in the process.

Check Your Progress

i. Why is it unsafe to drink water straight from the tap?

Answer: Because tap water contains germs and dirt.

ii. Why is SODIS used in schools to treat water?

Answer: SODIS used in schools to treat water because it is cheaper and easier method of making the water safe for drinking.

Think Again

1. Match the items of column 'A' with the correct answers in column 'B'

Answer:

Column A	Column B
1. Decantation	c. Separating by pouring out the top liquid
2. Sedimentation	d. Heavy materials settle down

3. Pure substance	e. Same kind of substance
4. Filtration	a. Separates insoluble solid mixed in a liquid
5. Residue	b. Solid left behind after filtration

2. The following are the steps to obtain clear water from a bucket of muddy water. Arrange the steps in the correct order. (Filtration, sedimentation, decantation)

Answer: Sedimentation, decantation and filtration.

3. Explain why decantation cannot be used to separate the mixture of salt and water?

Answer: Decantation cannot be used to separate the mixture of salt and water because the salt is soluble in water.

4. Define the terms:

a. Filtration.

b. Sedimentation.

Answer: Filtration: The process of separating solids mixed with liquids using filter paper or cloths.

Sedimentation: The settling down of solid particles at the bottom of the liquids in a container.

5. Why is it advisable to boil and filter water before drinking?

Answer: It is advisable to boil and filter the water before drinking because boiling kills the germs which cause diseases while filtration helps to remove the dirt.

6. Why is diarrhoea common among children during summer?

Answer: Diarrhoea is common among the children during summer because the water that they drink is generally contaminated by rainwater that contains germs.

7. A teacher provides a student with 150 mL of dirty water containing sand and saw dust. Write the steps that you will use to separate the water, sand and sawdust.

Answer: 1. Let the sand and heavy saw dust to settle down at the bottom.

2. Decant the water and the saw dust without disturbing the sediment.

3. Filter out the saw dust via filtration using filter paper.

Chapter 5

Forces

5.1. Let Us Look at forces

Test Yourself

1. How do you open the door when you enter a house?

Answer: I open the door by either pushing or pulling it.

2. How do you pass a football to your friend?

Answer: I pass a football towards my friend by kicking it.

3. How can you move an object with bare hands?

Answer: I can move an object with bare hands by either pushing or pulling it.

4. What would you do to lift a bucket of water from a tank?

Answer: I would apply force to lift the bucket of water up.

5. Will it be easier to push a log or to pull a log?

Answer: It is always easy to pull a log than to push it.

Activity A

When we look around us, we can see leaves falling from trees, prayer flags fluttering in the wind and people moving lots of things. Why do you think they move?

Answer: They move due to either push or pull (force).

Work in groups

Categories the pictures into Column A and Column B based on pull or push actions. Copy and complete Table 5.1.

Table 5.1. Pushing and pulling objects

Column A	Column B
<i>a. People pulling a rope in a tug of war.</i>	<i>b. A woman pushing a wheel chair.</i>
<i>c. A man pulling a panel of the door.</i>	<i>d. A man pushing a table.</i>
<i>e. A girl pulling a trolley bag.</i>	<i>f. A man pulling a drawer.</i>
<i>g. A man pushing a car.</i>	<i>h. A man pulling a log.</i>
	<i>i. A man pushing a chair.</i>

What is the common action in column A?

Answer: Pulling.

What is the common action in column B?

Answer: Pushing.

Now, define force.

Answer: Force is either push or pull exerted over the body.

Activity B.

In Table 5.2, identify the force applied and write it down in your notebook.

Table 5.2. Forces in action

Sl.No.	Action	Force Applied (Push or Pull)
1	<i>Stretching an elastic band</i>	<i>Pull</i>
2	<i>Throwing a ball</i>	<i>Push</i>
3	<i>Squeezing the toothpaste from the tube</i>	<i>Push and/or Pull</i>
4	<i>Loading logs into a truck</i>	<i>Push and/or Pull</i>
5	<i>Lifting a bucket of water</i>	<i>Pull</i>
6	<i>Kicking a football</i>	<i>Push</i>

Which one of the above activities would require the maximum force?

Answer: Pushing and/or pulling logs into a truck.

What does a body need to produce force?

Answer: Body need energy to produce force.

Check Your Progress

- i. What causes a football to move when it is kicked?

Answer: The movement of football when kicked is caused by the push (force).

- ii. What makes a plough move?

Answer: The movement of plough is caused by the pull.

5.2. What a Force can Do

Test yourself

1. What is force?

Answer: Force is push or pull exerted over the body.

2. What makes a ball move when it is thrown?

Answer: The push applied over the ball makes it move when it is thrown.

3. Push a table. What is making the table move?

Answer: The push exerted over the table makes it move.

4. What happens to a piece of paper when you crumple it?

Answer: The size and shape of the paper changes when it is crumpled.

5. What will happen to an egg if you hit it hard with a spoon?

Answer: An egg will break when it is hit hard with a spoon.

Activity A

Answer: Students' possible answer for the effects of force are:

- i) Force can set the body into motion,*
- ii) Force can bring the body into rest,*
- iii) Force can increase or decrease the speed of the moving body,*
- iv) Force can change the direction of the motion, and*
- v) Force can change the shape of the body.*

Activity B.

Table 5.3. Examples of effects of force.

Effects	Examples
<i>Stop a moving object</i>	<i>Catching the ball which is in the state of motion.</i>
<i>Change the shape of an object</i>	<i>Squeezing the table tennis ball.</i>
<i>Speed up a moving object</i>	<i>Kicking the ball which is in the state of motion.</i>
<i>Start moving an object at rest</i>	<i>Kicking the ball which is in the state of rest.</i>
<i>Slow down a moving object</i>	<i>Rolling the ball on a grassy ground.</i>
<i>Change the direction of a moving object</i>	<i>Kicking the ball moving westward towards eastward.</i>

Check Your Progress

- i. Write the changes a force can bring to objects.

Answer: The force can:

- i) set the objects into the state of motion,*
- ii) bring the objects into the state of rest,*
- iii) increase or decrease the speed of the moving objects,*
- iv) change the direction of the moving objects, and*
- v) change the shape of the objects.*

5.3. Contact Force

Test Yourself

2. What can a force do?

Answer: A force can set the objects into motion, set the moving objects into the state of rest, increase or decrease the speed of the moving objects, change the direction of the moving objects, and change the structure of the objects.

3. What is the effect of force when you make dough?

Answer: The force applied changes the shape of the dough.

4. What is the effect of force when you kick a ball back?

Answer: When a ball is kicked back, it will be set into motion, set into rest, increase or decrease the speed, and/or change the direction of the motion.

5. Is it possible to kick a football without touching it?

Answer: No, it is not possible to kick a ball without touching it.

6. How can you make the football move?

Answer: The football can be made into motion by applying force over it (kicking or pushing).

Activity A.

Can you:

move a table without touching it?

Answer: No

close a door without touching it?

Answer: No

lift your bag without touching it?

Answer: No

clean the chalkboard without touching it?

Answer: No

What should you do to carry out the above activities?

Answer: Things must be touched or kept in contact in order to carry out the above activities.

Activity B.

Think of at least four examples of contact forces that you come across in your daily life. List them down in your notebook.

Answer: i) Dragging the study table, ii) Lifting the bucket of water, iii) Throwing a ball, and iv) Stretching the elastic band (varieties of answers can be expected)

Check Your Progress.

- i. What is contact force?

Answer: It's a force applied when we touch the objects to move.

- ii. Write three more examples of contact force.

Answer: Sweeping the floor, washing dishes, and rubbing hands.

- iii. How is contact force useful in your life?

Answer: Contact force is useful in our life as it allows to carry out any sort of work.

5.4. Non-Contact Force

Test yourself

1. What type of force do you apply when you write?

Answer: When we write, we apply contact force.

2. Can you move an object without contact force?

Answer: Yes. For instance, iron nails can be moved by placing magnet near them.

3. Give one example of contact force.

Answer: Pulling a chair.

4. What can a magnet do?

Answer: Magnet attracts magnetic materials such as iron, steel, cobalt, nickel, etc., and either repels or attracts another magnet.

5. Why do leaves fall from a tree?

Answer: Leaves fall from a tree because the gravitational force pulls them towards the ground.

Activity A.

What happens?

Answer: The magnet attracts the paper clip.

What happens?

Answer: The magnet still attracts (pulls) the paper clip.

Activity B

What happens?

Answer: The eraser falls back to the ground.

Check Your Progress

i. What is non-contact force?

Answer: The force that acts in between the bodies even when they are not in contact.

ii. Write two examples of non-contact force.

Answer: Magnetic force and gravitational force are two examples of non-contact force.

iii. Dechen combs her wet hair and Choki combs her dry hair with same type of comb. Choki is surprised to see her hair stand straight upward as she combs her hair, while Dechen does not experience the same.

a. What type of force exists between comb and Choki's hair?

Answer: Non-contact force, i.e. electro-static force.

b. What condition made it suitable for this type of force to act on Choki's hair?

Answer: Dry condition has made it suitable for this type of force to act on Choki's hair.

c. Why do you think Dechen's hair is not attracted?

Answer: Dechen's hair is not attracted because it is wet.

Think Again

1. Fill in the blanks.
 - i. Push or pull on an object is called force.
 - ii. The force that moves things without touching them is called non-contact force.
 - iii. The gravitational force of the Earth is an example of non-contact force.
 - iv. Closing the door is an example of contact force.
 - v. The change brought about by a force on an object is called effect of force.

2. What are the effects of force?

Answer: The effects of force are: i) set the objects into the state of motion, ii) bring the objects into the state of rest, iii) increase or decrease the speed of the moving objects, iv) change the direction of the moving objects, and v) change the shape of the objects.

3. Compare contact force with non-contact force.

Contact force	Non-contact force
<i>It is a force that is exerted over the objects when we touch them.</i>	<i>It is a force that acts between the objects even when they are not in contact.</i>

4. If you kick a ball in the air, will it stay in the air? Why?

Answer: No, the ball will not stay in the air because the gravitational force will pull it towards the earth.

5. What happens when a ball of cotton is squeezed?

Answer: When a ball of cotton is squeezed, its shape gets changed.

6. A force can make a moving object stop. Give one example.

Answer: Catching a ball.

7. Where can you use the non-contact forces in your life?

Answer: Non-contact force can be used in different ways such as to find a needle in the soil using magnet, to find direction using magnetic compass, for walking, working, and keeping the objects on the ground with the help of gravitational force, etc.

Chapter 6

Light and Sound

6.1. Sources of Light

Test yourself

1. What is the difference between day and night?
Answer: The day is time when there is light from the Sun, and night is the time when there is no light from the Sun.
2. Why are we not able to see in the dark?
Answer: We do not see in the dark because there is no light falling on the objects around us.
3. What do you use to see in the dark?
Answer: To see in the dark, we use kindling sticks (wood and/or bamboo), spirit lamp, battery powered torch, etc.
4. What helps you to see during the day?
Answer: Sunlight helps us to see during the day.
5. What do you use at home to see at night?
Answer: At home, we use kindling sticks (wood and/or bamboo), spirit lamp, battery powered torch, etc., to see at night.

Activity A

Copy and complete the table 6.1 given below:

Table 6.1. Identifying sources of light

Objects which give light	Objects which do not give light
<i>Sun</i>	<i>Wall</i>
<i>Lighted torch</i>	<i>Table</i>
<i>Glowing car's headlight</i>	<i>Stone</i>
<i>Burning candle</i>	<i>Book</i>
<i>Lighted bulb</i>	<i>tree</i>

Which sources of light do you use at home?

Answer: Lighted candle, lighted kerosene lamp, lighted torch, burning resins (mapche), petromax lamp, fire, etc.

Activity B

Carry out a survey. Find different sources of light used in your locality. Copy and use Table 6.2 given below to record your information.

Table 6.2. Different sources of light used in the locality

House number	Light source used
1 Kha--6- 233	a. fire b. burning candle c. lighted torch d. lighted bulb, etc.
2	
3	
4	
5	

(The nature of the activity is open and finding may depend on the context the survey is carried)

Which is the most common source of light used in your locality? Why?

Answer: The most common source of light used in my locality is lighted bulb because it is cheap and readily available (This could be the most probable answer students might find across according to the present scenario)

Check your progress

i. Name two sources of light that are used outside your home.

Answer: Street lamp, torch and car headlights.

ii. What is the main source of light on the Earth?

Answer: Sun is the main source of light on the Earth.

6.2. How Light Travels

Test yourself

1. Name two uses of light.

Answer: Two uses of light are to see everything around us and to make photographs.

2. Name some sources of light that you use at home.

Answer: Fire, burning candle, and lighted bulb, etc.

3. What source of light is used in your school?

Answer: Lighted bulb by electricity or solar energy.

4. What is a shadow?

Answer: The dark shape formed behind the opaque object is called a shadow.

5. Why do you feel cool when you sit under a shade?

Answer: Heat rays of the Sun are blocked by the shade.

Activity A

Materials required: Straw, candle and match box.

Alternative: Rolled chart paper or newspaper to make tube or pipe if there is no straw.

Can you see the flame of the candle?

Answer: Yes.

Can you see the flame now? Why?

Answer: No, because the light coming from the flame is blocked.

Activity B

Take three cardboards A, B, C each with fine hole at the centre. Arrange them such that each cardboard is behind the other. Place a lighted candle behind cardboard A as shown in Figure 6.3.

Now, look through the hole in cardboard C.

Can you see the flame of the candle?

Answer: No, the flame of the candle is not visible.

Now slightly move cardboard B and C such that the flame is visible through the hole in cardboard C. Move cardboard B slightly and look again through cardboard C.

Can you see the flame now? Why?

Answer: No, the flame is not visible because light coming from the flame is blocked as the holes of cardboard B and C are not in straight line.

What do you conclude on the path travelled by light?

Answer: Light always travels in straight path.

Check your progress

- i. Why are you not able to see light through a bent rubber tube?

Answer: It is not possible to see light through a bent straw because light always travels in straight path.

6.3. Light and Shadow

Test yourself

1. How does the light travel?

Answer: Light travels in a straight path.

2. When do you see your shadow?

Answer: We see our body's shadow when the light is blocked by our body.

3. Why are you not able to see the Sun on a cloudy day?

Answer: We do not see sun on a cloudy day because the light coming from the Sun is blocked by the clouds.

4. What is the shape of a shadow?

Answer: The shape of the shadow is the shape of the object blocking the light.

Activity A

Can you see the light on the wall?

Answer: Yes.

What do you see on the wall?

Answer: Black or dark shape of the tree.

Put off the light. Can you see the shadow now? Why?

Answer: No, because there is no light to form the shadow.

What can you say from this investigation?

Answer: This investigation proves that shadow is formed only in presence of light.

Activity B

Observation time	Recorded time	My guess (length of shadow in cm)	Observed length (of my shadow in cm)
08:00-08:30a.m.			
10:00-10:30a.m.			
12:00- 12:30p.m.			
02:00-02:30p.m.			
03:30-04:00 pm			

Plot a bar graph for the above measurements with observation time on X-axis and observed length of the shadow on Y-axis.

Answer: (The bar graph may depend on students' observed length of the shadow)

At what time interval of the day is your shadow the longest? Why?

Answer: The longest shadow formed is in the morning (8:00-8:30am) and in the evening (3:30-4:00pm) because at these hours the Sun is the furthest and remains in slanting direction from the Earth.

At what time interval of the day is your shadow the shortest? Why?

Answer: The shortest shadow formed is at noon (12:00) because the Sun is near and appears directly above the Earth.

Check your progress

i. Why does the length of the shadow change?

Answer: Length of the shadow changes as the angle of sunlight falling on the Earth changes at different times in a day.

ii. How is shadow formed?

Answer: Shadow is formed when the light coming from the source is blocked by the bodies.

6.4. Making a Sound

Test yourself

1. What is music?

Answer: Music is a sound produced by the musical instruments.

2. What is produced when the teacher taps on the board?

Answer: Sound is produced.

3. Which sense organ is used for hearing?

Answer: Ears are used for hearing.

4. How can you make a sound?

Answer: By letting or making the object move or vibrate.

5. Is whispering a sound?

Answer: Yes, whispering is a sound.

Activity A

Go outside the classroom.

Listen carefully for 2 minutes.

Write all the sounds that you hear

(Answer may depend on different types of sounds students may hear while listening)

Are all the sounds same?

Answer: No, not all the sounds are same.

Place your fingertips gently on your throat. Now speak or sing for about ten to twenty seconds.

What do you feel?

Answer: I feel the vibration (movement) of vocal cords.

Activity B

What do you see?

Answer: Vibration of the metre ruler.

What do you hear?

Answer: Sound of the metre ruler vibrating.

Construct one simple instrument for producing sound by vibrations.

(Students may construct any instrument that produce sound through vibration)

Check your progress

- i. What produces sound when you flick a metre ruler?

Answer: When a metre ruler is flicked, the vibration produces sound.

- ii. List five sources of sound.

Answer: birds chirping, vehicles moving, rivers, dogs barking, people singing, children shouting, etc.

- iii. How is sound useful in our life?

Answer: Sound is useful in our life as it is a means of communication.

6.5. Fading Sound

Test Yourself

1. What is vibration?

Answer: The back and forth motion of a body is called vibration.

2. How can you produce sound?

Answer: By letting an object vibrate or move.

3. What vibrates when you boil a kettle of water?

Answer: Lid and boiling water vibrates when a kettle of water is boiled.

4. How do you communicate with your friend standing far away from you?

Answer: I shout when my friend is far away from me so that I am heard.

5. Why do you talk very softly with your friends sitting close to you?

Answer: Its important to talk in soft manner when friends are sitting close to us because loud sound can damage their ears.

Activity A

Table 6.4. Change in loudness of sound

Distance (m)	Sound			
	Loudest	Loud	Faint	Faintest
5 m	√			
10 m		√		
15 m			√	
20 m			√	
25 m				√

(This may depend on students' hearing ability)

As you move away from the source of sound, what happens to the loudness of the sound?

Answer: When moved away from the source of the sound, loudness of the sound decreases.

Check your Progress

- i. Why can you not hear the music from a certain distance?

Answer: Music cannot be heard from certain distance because as distance increases, the sound becomes faint.

- ii. What can you do to hear a song from a farther distance?

Answer: To hear a song from the farther distance, the volume should be increased, the spot where there is least disturbance is selected, and the sound should be listened carefully.

Think Again

1. Fill in the blanks.

- Sound is produced by vibration.
- Light travels in straight line.
- The main source of light is Sun
- Sound made close to us is loud.
- Sound is a form of energy.

2. Name one source of light which your grandparents might have used for lighting homes.

Answer: Fire

3. How can we make shadow bigger?

Answer: By moving the object near the source of light or by moving the source of light near the object.

4. Distance can make sound fainter. What else can make sound fainter?

Answer: Sound can be made fainter through external disturbances, noise, and covering the source of sound, etc.

5. If light travels around the corner, how will it affect the life on the Earth?

Answer: If light travels around the corner, then living organisms living in every nook and corner of the earth will receive light for growth and development. The routine of day and night would change completely.

6. You can hear a television programme in the other room but cannot see it. Why?

Answer: We can hear the sound coming from the television because sound travels around the corner, but cannot see the pictures as the light travels in the straight path and cannot reach our eyes.

7. Compare the shadows of transparent and translucent glasses.

Answer: Shadows are never formed by transparent glasses while the shadows formed by the translucent glasses are always faint.

Chapter 7

Electricity and Magnetism

7.1. Sources of Electricity

Test Yourself

1. Where do we get light from?

Answer: We get light from electric power station, candle, torch, Sun, etc.

2. Do you use electricity at home?

Answer: Yes or No.

3. What are the things in your house that use electricity?

Answer: Things in my house that use electricity are radio, television, refrigerator, tape recorder, mobile, rice cooker, etc.

4. Where do you think we get electricity from?

Answer: We get electricity from hydropower stations, solar panel and windmill.

5. What do people use to make electricity?

Answer: People use water, wind, sunlight, chemicals, etc., to generate electricity.

Activity A

What do you observe?

Answer: Nothing happens. Torch bulb does not glow.

What do you observe?

Answer: Torch bulb glows.

In which step did you see the torch bulb glowing?

Answer: In the second step.

Why do you think the torch bulb was glowing?

Answer: The torch bulb was glowing because of the current generated by the batteries.

Name the source of electricity used in this experiment.

Answer: Batteries.

Activity B

Find out the main source of electricity from Figure 7.1.

Answer: Water.

Write a paragraph on generation of electricity.

Answer: The water from the river is stored in a dam which then flows through a tunnel. This running water turns the turbine and generates electricity. The electricity produced is carried through transmission lines.

Activity C

Discuss and write different sources of electricity.

Answer: Water, wind, solar, chemical and nuclear.

List all the sources of electricity shared in the class in your notebook.

Answer: (Students note all the sources of electricity shared in the classroom).

Write three sources of electricity that are commonly used.

Answer: Water, wind, solar, chemical, nuclear, etc.

Check Your Progress

i. Name the main source of electricity in our country.

Answer: Water.

ii. Why do you think your answer in (i) is the main source of electricity in our country?

Answer: Water is the main source of electricity in our country because of the continuous flow of rivers.

7.2. Where Electricity is Used

Test Yourself

1. Name two power stations in Bhutan.

Answer: Chukha hydropower station and Kurichu hydropower station.

2. Name some sources of electricity.

Answer: Hydropower station, battery, Sun, wind, chemical and nuclear.

3. Name five places where electricity is used.

Answer: School, house, hospital, factory and office.

4. How is electricity important in our life?

Answer: Electricity makes our life easy and comfortable. We use electricity to light our homes, cook food and operate television, computer, washing machine, refrigerator, and mobile phone.

5. The devices that use electricity is called _____.

Answer: electronic devices.

Activity A

Some of the pictures given in figure 7.2 use electricity. Name them.

Answer: Iron machine, television, laptop, and mobile phone.

Name ten things which use electricity.

Answer: Refrigerator, washing machine, camera, computer, television, mobile phone, rice cooker, water boiler, iron machine, and fan.

Activity B

Search the places where electricity is used in the word maze given below. Write them in your book. One is done for you. Do not mark in the text book

Answer: Home, Plane, Port, etc.

Share your list with your friends.

Check Your Progress

- i. List three more things that use electricity.

Answer: Traffics, mines, and mills.

- ii. Explain how your life will be without electricity.

Answer: Without electricity, life will be difficult live as the machines that make life easy won't work.

7.3. Making Connections

Test Yourself

1. Name two things which use electricity.

Answer: Computer and rice cooker.

2. What is the source of electricity at your home?

Answer: The source of electricity at home if from hydropower station, solar panel, wind mill, battery, etc.

3. Do you know how electricity is brought to our house?

Answer: Yes, it is brought to our house through electric cables or transmission lines.

4. Name three places where electrical connections are made.

Answer: Homes, factories and industries, transportations, railways, etc.

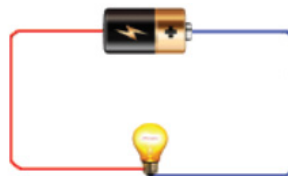
5. What are the things that you use to light a bulb in your house?

Answer: Wires and switches are used to light a bulb in our house.

Activity A

Make the bulb glow using the above things.

Answer: Connect the circuit as shown in the diagram .



Name the source of electricity.

Answer: Battery

Name the electrical appliance used.

Answer: Bulb.

Activity B

Copy and fill the table 7.1.

Diagram No.	Will the bulb glow?	Is the circuit Complete?
1	No	No
2	No	No
3	Yes	Yes
4	No	No
5	No	No
6	No	No

Activity C

Why is the bulb not glowing?

Answer: The bulb is not glowing because the battery may be exhausted, or the wire may not be connected well, or the filament inside the bulb must be burnt out.

What can you do to make it glow?

Answer: To make the bulb glow, replace the battery with new one, make sure a filament inside the bulb is not burnt out, and the circuit is complete.

How can you make the bulb glow brighter?

Answer: To make the bulb glow brighter, the number of batteries can be increased or new batteries can be used.

Check Your Progress

i. Write the uses of wire, bulb and battery in a circuit.

Answer: Wire: It used to let the current flow in the circuit.

Bulb: It is used to indicate the flow of the current by glowing.

Battery: It is used to supply electricity or power or current to glow the bulb.

- ii. Electricity may not flow even if the circuit is complete. Why?

Answer: Electricity may not flow even if the circuit is complete because it is also affected by the condition of the battery life. If the battery is exhausted, there will not be enough power to push the current around the circuit.

7.4. Things that are Magnetic

Test Yourself

1. What is magnetic force?

Answer: Magnetic force is the force exerted by magnet in its surrounding.

2. Is magnetic force a contact or non contact force? Why?

Answer: Magnetic force is non-contact force because it exerts force over the metallic bodies without touching.

3. When do we use magnetic force?

Answer: We use magnetic force when we have to separate magnetic materials from the mixture.

4. What materials does a magnet attract?

Answer: A magnet attracts magnetic materials made of iron and steel.

5. Why is a pencil not attracted by magnet?

Answer: Pencil is not attracted by magnet because it is not a magnetic material.

Activity A

Copy and record your observation in the Table 7.2 given below:

Table 7.2. Things attracted and not attracted by magnet.

SL. No.	Things attracted by magnet	Things not attracted by magnets
1	<i>Pin</i>	<i>Pieces of paper</i>
2	<i>Iron nail</i>	<i>Plastic tray</i>
3	<i>Paper clips</i>	<i>Stone</i>
4	<i>Compass</i>	<i>Eraser</i>
5		<i>Pencil</i>
6		<i>Pen</i>

Activity B

List the objects which are magnetic in your notebook.

Answer: Window latches (iron or steel), door latches, geometry box, etc. (There can be other options also).

Check Your Progress

- i. Why is your notebook not attracted by a magnet?

Answer: Notebook is not attracted by a magnet because it is made of non-magnetic materials.

- ii. Name two metals which are not attracted by magnet.

Answer: Aluminium and copper.

7.5. Magnets at Home

Test Yourself

1. Give two examples of magnetic materials.

Answer: Iron nail and steel door latches.

2. Name two non-magnetic materials.

Answer: Paper and stone.

3. Name two magnetic materials in your class.

Answer: Steel window latches and green board.

4. Name five things in your home that have magnet inside them.

Answer: Radio, TV, water boiler, speakers, etc.

Activity A

What is the main purpose of magnet in the non-electrical things?

Answer: The main purpose of magnet in the non-electrical things is to lock (in wallets, purse, bags, mobile covers, etc.) or to attach one object to another (in toys, glass panes, shutters, etc.)

Design and make a simple magnetic game or toy.

(students may be asked to design a game or toy using magnet)

Check Your Progress

- i. Name some more things that use magnets

Answer: Wallet, fan, electric bell, speakers, microphone, etc.

Think Again

1. Choose the correct answer.

i. *The main source of electricity in Bhutan is*

- a. *battery.*
- b. *sun.*
- c. *water.*
- d. *wind.*

Answer: water.

ii. *Which one of the following is attracted by magnet?*

- a. *Copper wire*
- b. *Iron nail*
- c. *Pencil*
- d. *Stone*

Answer: Iron nail.

iii. *Which set of things use electricity?*

- a. *TV, magnet and pin.*
- b. *Pressure cooker, rice cooker and radio.*
- c. *Electric bulb, spoon and electric kettle.*
- d. *Computer, fans and radio.*

Answer: Computer, fans and radio.

iv. *Which one of the following supply electricity in a circuit?*

- a. *Bulb*
- b. *Wire*
- c. *Fan*
- d. *Battery*

Answer: Battery

v. *Electricity is used in*

- a. *digital watch.*
- b. *pencil.*
- c. *kerosene lamp.*
- d. *bhukari.*

Answer: digital watch.

2. Write three things that use electricity from battery.

Answer: Torch, radio, and toys.

3. What is an electric current?

Answer: The flow of electricity in the circuit is called an electric current.

4. Why are some utensils not attracted by a magnet?

Answer: Some utensils are not attracted by a magnet because they are made of non-magnetic materials.

5. Will a magnet wrapped in a cloth attract pins? Why?

Answer: Yes, magnet wrapped in cloth will attract pins because magnetic force still exists around the magnet which does not get blocked by the cloth.

6. If water had not been the main source of the electricity in our country, what would be the other source?

Answer: If water had not been the main source of electricity in our country, then the other source of electricity could have been either wind or solar energy.

Chapter 8

Living Things and their Environment

8.1. Living Things and Non-Living Things

Test Yourself

1. Name two things that you get from your kitchen garden.

Answer: Two things that we get from our kitchen garden are potatoes and chillies.

2. What are they called?

Answer: They are called vegetables.

3. Why are pen, pencil and plastic called artificial things?

Answer: Pen, pencil, and plastic are called artificial things because they are made by human.

4. What are three things you do but a stone does not?

Answer: The three things that I do and stone does not are breathing, talking, and walking.

5. Can a stone move on its own? Why?

Answer: No, not stone cannot move on its own because stone is a non-living thing.

Activity A

List the names of things that you see around.

Answer: Birds, flowers, stones, dogs, cars, bottles, plastics, wood, and trees.

Sort them out into living things and non-living things.

Answer:

Living thing	Non-living things
<i>Birds, flowers, dogs, and trees.</i>	<i>Stones, bottles, cars, plastic, and wood.</i>

Find the smallest living thing from your list.

Answer: *Flowers*

Which is the biggest non-living thing in your list?

Answer *Cars*.

Activity B

Write as many characteristics as possible of your friend and your book.

Friend	Book
<i>1.Can grow</i>	<i>1.Cannot grow</i>
<i>2.Can walk</i>	<i>2.Cannot walk</i>
<i>3.Can breathe</i>	<i>3.Cannot breathe</i>
<i>4.Can feel</i>	<i>4.Cannot feel</i>
<i>5.Can eat</i>	<i>5.Cannot eat</i>

Now, compare the characteristics of living things and non-living things. Copy and fill up Table 8.1.

Table 8.1. Characteristics of living and non-living things

Sl.No	Characteristics	Living	Non-living
<i>1</i>	<i>Can grow.</i>	<i>Yes</i>	<i>No</i>
<i>2</i>	<i>Can breathe.</i>	<i>Yes</i>	<i>No</i>
<i>3</i>	<i>Can feel.</i>	<i>Yes</i>	<i>No</i>
<i>4</i>	<i>Need food and water</i>	<i>Yes</i>	<i>No</i>
<i>5</i>	<i>Can move on their own</i>	<i>Yes</i>	<i>No</i>

Write other difference between living things and non-living things.

Living things	Non-living things
<i>Have life</i>	<i>Do not have life</i>
<i>Reproduce young ones</i>	<i>Do not reproduce young ones</i>
<i>Respond to stimuli</i>	<i>Do not respond to stimuli</i>
<i>Excrete waste materials</i>	<i>Do not excrete waste materials</i>

Check Your Progress

- i. What are living things? Give five examples of living things.

Answer: Living things are the organisms that have life. For example, plants, birds, snakes, insects, and other animals are living things.

- ii. What are non-living things? Name five non-living things.

Answer: Non-living things are the objects which do not have life. For example, stone, water, soil, metal, and plastic are non-living things.

8.2. Plants and Animals in their Habitat

Test Yourself

1. Give four examples of living things.

Answer: Plants, insects, lizards, and birds.

2. Give four examples of non-living things.

Answer: Stones, soil, water, and plastics.

3. Write one difference between living and non-living things.

Answer: Living things have life while non-living things do not have life.

4. Where do birds live?

Answer: Birds live in trees, rocks, river banks, buildings, etc.

5. A fish lives in water. Why?

Answer: A fish lives in water because it's their habitat where they get food, air to breath and shelter to live in.

Activity A

List down all the plants you observe in Table 8.2 and all the animals in Table 8.3.

Table 8.2. Habitats for plants

Plant habitats			
Flower garden	Eco-pond	Agriculture garden	Forest
<i>Lily</i>	<i>Moss</i>	<i>Maize</i>	<i>Cypress</i>
<i>Sun flower</i>	<i>Algae</i>	<i>Paddy</i>	<i>Oak</i>
<i>Marigold, etc.</i>	<i>Horse tail, etc.</i>	<i>Wheat, etc.</i>	<i>Artemisia, etc.</i>

Table 8.3. Habitats for animals

Animal habitats				
Flower garden	Tree	Eco-pond	Agriculture garden	Forest
<i>Butterfly</i>	<i>Rat</i>	<i>Prawn</i>	<i>Dog,</i>	<i>Elephant</i>
<i>Bee</i>	<i>squirrel</i>	<i>Crab</i>	<i>Boar</i>	<i>Tiger</i>
<i>Bug, etc.</i>	<i>Monkey, etc.</i>	<i>Fish, etc.</i>	<i>Deer, etc.</i>	<i>Leopard, etc.</i>

What kind of plant do you usually find in a flower garden?

Answer: Flowering plants.

Which habitat has more number of plants and animals? Why?

Answer: Forest has more number of plants and animals because of the abundance of food, space, shelter, and water to live.

Activity B

Discuss habitats for the following plants and animals. Copy and complete Table 8.4.

Table 8.4. Habitats for plants and animals

Plants	Habitat	Animals	Habitat
<i>Orchids</i>	<i>Trees</i>	<i>Fish</i>	<i>Pond</i>
<i>Ferns</i>	<i>Forest</i>	<i>Frogs</i>	<i>Pond</i>
<i>Rose</i>	<i>Garden</i>	<i>Ants</i>	<i>Underground</i>
<i>Pine trees</i>	<i>Forest</i>	<i>Dung beetle</i>	<i>Underground</i>
<i>Beans</i>	<i>Garden</i>	<i>Butterflies</i>	<i>Garden</i>

Define habitat in your own words.

Answer: Habitat is a place where plants and animals live.

Check Your Progress

- i. Name a wild animal and describe its habitats.

Answer: Tiger. It lives in a wide range of places. It lives in forest canopy, bushes, swampy jungle and grassy plains that bear plenty of food.

- ii. Name three plants that are found in the same habitat.

Answer: Algae, moss, and horse tail (example may vary).

8.3. How Plants Adapt in their Habitat

Test Yourself

1. Define habitat.

Answer: Habitat is a place where plants and animals live.

2. Name some plants which grow in your locality.

Answer: Maize, paddy, beans, potato, chilly, tomato, etc.

3. State a few characteristics of plants that grow in your locality.

Answer: They have long roots, broad or long leaves, and flexible stem.

4. Are the plants in your locality surviving well? Why?

Answer: Yes, plants growing in my locality are surviving well because they are well adapted or adjusted to live in our locality.

Activity A

Go to the library or browse internet and write a few adaptive features of plants.

(Students visit school library and collect a few adaptive features of plants)

Share your information with the whole class.

(Students share their findings to the whole class)

Activity B

Go around the school campus. Locate plants in different habitats.

Copy Table 8.5 and fill it in.

Table 8.5. Adaptive characteristics of plants

Plants	Habitat	Adaptive characteristics
<i>Cactus</i>	<i>Rocky, sandy, and dry land</i>	<i>Thick and fleshy stem, leaves reduced to spines, and long roots</i>
<i>Bamboo</i>	<i>Dry and rocky hill</i>	<i>Large number of roots, tall in height, and flexible stem.</i>
<i>Pine tree</i>	<i>Rocky, dry, and arid land</i>	<i>Needle shaped leaves, thick waxy layer around the leaves, and thick bark.</i>

How does adaptive characteristics of an organism help it survive in its habitat?

Answer: Adaptive characteristics help the organism to survive in its habitat through protection, ability to access food and other resources, and ability to adjust to its changing environment.

Check Your Progress

- i. What is the habitat of the plant in Figure 8.2?

Answer: Tree

- ii. What are the adaptive features of this plant?

Answer: Adaptive features of this plant are clinging roots, moisture absorbing roots, and thick waxy layer around the leaves.

8.4. How Animals Adapt in their Habitat

Test Yourself

1. Name some plants that are found in your school.

Answer: Lily, chrysanthemum, rose, hedge, begonia, etc.

2. Why do some plants have thorns?

Answers: Some plants have thorns to protect themselves from herbivores that feed on them.

3. Why do different animals live in different habitats?

Answer: Animals live in different habits because they have different needs and living habits.

4. Yak is usually found in cold places in Bhutan. Why?

Answer: Yak is found in cold places in Bhutan. Yak has thick and long fur that make it well adapted to survive in cold places.

5. Birds find it difficult to locate a green grasshopper among green leaves. Why?

Answer: Birds find difficult to locate a green grasshopper among green leaves because grasshopper has green body colour that blends it with green leaves.

Activity B

Table 8.7. Finding matchsticks

Colour of the match sticks	Time take to collect all the match sticks
<i>Red</i>	
<i>Green</i>	<i>Probably the longest duration</i>
<i>Blue</i>	
<i>Uncoloured</i>	

Which coloured matchsticks were the most difficult to find in the grass?

Answer: Green coloured match sticks were the most difficult ones to be found in the grass.

What can you conclude from the above activity?

Answer: From the above activity, one can conclude that colours play very important role in hiding the organism from predators or preys into immediate surrounding environment.

Name some other animals which can camouflage.

Answer: Animals which can camouflage are tigers, snakes, leaf insects, octopus, locus, etc.

Copy and complete Table 8.8.

Table 8.8. Adaptive characteristics of animals

Animal	Habitat	Adaptive Characteristics
<i>Sparrow</i>	<i>Small spaces found under the roof or gaps in and around the building</i>	<i>Small size body</i>
<i>Yak</i>	<i>High cold mountains</i>	<i>Thick furry body</i>
<i>Monkey</i>	<i>Rocks and trees</i>	<i>Well-developed arms and legs and prehensile tail</i>
<i>Fish</i>	<i>Water</i>	<i>Fins and streamlined body</i>

Check Your Progress

- i. Why do tigers have stripes?

Answer: Tigers have striped to keep themselves hidden from their preys in the surrounding environment.

- ii. What adaptive characteristics do the following insects have?

- a. Bees

Answer: Bees have stripe body to protect themselves from the predators.

- b. Shield bug [stinkbug]

Answer: They have the ability to defend by producing unpleasant or stinking smell

- c. Bed bug

Answer: They have well developed tube to suck the blood.

8.5. Living Together

Test Yourself

1. Why do fishes have streamlined bodies?

Answer: Fishes have streamlined bodies to reduce friction while moving in water.

2. Do you think rabbits can live in water? Why?

Answer: No, because rabbits do not have features like gills and fins to breathe and move in water.

3. Name the habitat of the following animals.

Answer:

a) *Yak - cold place.*

b) *Monkey - forest.*

c) *Sparrow - trees.*

4. Why do we see snakes in the places where rats and frogs live?

Answer: We see snakes in the places where rats and frogs live because rats and frogs form the main source of food for snakes living around.

5. Can you name an animal which can eat snakes?

Answer: Eagle, hawk, or mongoose.

Activity A

What is the source of food for the caterpillar?

Answer: Plant is the source of food for the caterpillar.

What is the source of food for the small bird?

Answer: Caterpillar is the source of food for the small bird.

What is the source of food for the large bird?

Answer: Small bird is the source of food for the large bird.

Where does the food chain begin? Why?

Answer: The food chain begins from plants because they are the only organism that can prepare their own food.

Activity B

Make a food chain using the following living organisms.

Grasshopper, grass, eagle, frog, snake

Answer: Grass → grasshopper → frog → snake → eagle

Can you name the prey and predators in the above food chain?

Answer:

Prey	Predator
Grasshopper, frog, and snake	Frog, snake, and eagle

What will happen if we kill all the snakes?

Answer: *If we kill all the snakes, eagle will not have food to eat. The population of frog will rise and ultimately, there will be imbalance in the ecosystem.*

Check Your Progress

i. What is a food chain?

Answer: *The feeding relationship of living organisms represented by a chain is called food chain.*

ii. You should not kill plants and animals. Why?

Answer: *We should not kill plants and animals to keep the food chain(s) balanced or healthy relationship between organisms.*

iii. If we cut down too many trees, all the other living things will suffer. Explain.

Answer: *If we cut down too many trees, all other living things will suffer since trees serve as the ultimate source of food and home for many animals.*

8.6. Feeding Habits

Test Yourself

1. What is a food chain?

Answer: *The feeding relationship in which organisms depend on each other for food is called food chain.*

2. Do humans eat both plants and animals?

Answer: *Yes, most humans eat both plants and animals.*

3. Name three animals which eat only plants.

Answer: *Cow, horse, and goat.*

4. Name three animals which eat other animals.

Answer: Tiger, cat and lion.

5. Why does a food chain always start with a plant?

Answer: Food chain always starts with a plant because plant is the only organism that can prepare its own food.

Activity A

Copy and complete the Table 8.9.

Table 8.9. Classification of animals as per feeding habit

Animals	What do they eat?
<i>Herbivore</i> <i>Examples: Cow, deer.</i>	<i>They eat only plant.</i>
<i>Carnivore</i> <i>Examples: Tiger, lion.</i>	<i>They eat only flesh.</i>
<i>Omnivore</i> <i>Examples: Human, monkey, crow, bear.</i>	<i>They eat both plant and flesh.</i>

What is an herbivore? Give two examples.

Answer: Herbivore is an animal that eats only plants. For example, cow and deer.

What is the difference between herbivore and carnivore?

Herbivore	Carnivore
<i>Eats only plants</i>	<i>Eats only flesh</i>

Is cat an omnivore? Give reasons.

Answer: No, cat is not an omnivore because its main food is meat.

Activity B

Study Figure 8.4 carefully and answer the following questions.

Trace out as many food chains as possible. Identify the producer and consumer in each food chain.

Answer:

Plants → Caterpillar → Bird

Plants → Deer → Bear

Plants → Deer → Tiger

Plants → Deer → Bear → Tiger

Plants → Caterpillar → Bird → Tiger

Grass is a Producer

Caterpillar, bird, deer, bear, and tiger are consumers.

Identify the following:

i. Producer.

Answer: Plants

ii. Herbivore.

Answer: Caterpillar and deer.

iii. Carnivore.

Answer: Tiger.

iv. Omnivore.

Answer: Bear and bird.

Check Your Progress

i. Why plants are called producers?

Answer: Plants are called producers because they can prepare their own food.

ii. Why human beings are called omnivores?

Answer: Human beings are called omnivores because we eat both plants and animals.

Think Again

1. Match the following.

Column I	Column II
a. Herbivore	i. Eagle
b. Carnivore	ii. Plant
c. Predator	iii. Eats only Plants
d. Omnivore	iv. Eats only animals
e. Producer	v. Eats both plants and animals

Answer:

Column I	Column II
a. Herbivore	iii. Eats only Plants
b. Carnivore	iv. Eats only animals
c. Predator	i. Eagle
d. Omnivore	v. Eats both plants and animals
e. Producer	ii. Plants

2. Why are animals known as consumers?

Answer: Animals are known as consumers because they depend on other organism for their food.

3. Represent each list in the form of a food chain:

a. Caterpillar, cabbage, hawk, sparrow

Answer: Cabbage → Caterpillar → Sparrow → Hawk

b. Grass, eagle, rabbit

Answer: Grass → Rabbit → Eagle

c. Paddy, snake, peacock, rat

Answer: Paddy → Rat → Snake → Peacock

4. Why are grasshoppers normally green?

Answer: Grasshopper are normally green to camouflage to escape from the predators.

5. Can a prey also be a predator? Give reasons.

Answer: Yes, prey can also become a predator. This happens when they derive their food source from other organisms that occupy the lower level of the food chain. For instance, frogs are they prey of snakes, however, they become predator when they feed upon insects.

6. A bus can move, but it is not a living thing. Why?

Answer: Although, bus can move but it's not a living thing because it does not have the characteristics of living things like respiration, reproduction, response towards stimuli, growth, aging and death, digestion, etc.

7. Organism A depends only on deer and boar for food. Organism B depends only on C for food as it is the producer in the habitat. The organism D depends on B and C. Identify the feeding habit of each of the organism - A, B, C and D.

Answer: A- Carnivore, B- Herbivore, C- Producer, D- Omnivore.

Chapter 9

Green plants

9.1. Effect of Light on the Growth of Plant

Test Yourself

1. Give two differences between plants and animals.

Answer:

Plants	Animals
<i>Plants can make their own food</i>	<i>Animals cannot make their own food</i>
<i>Plants cannot move from place to place</i>	<i>Animals can move from place to place</i>

2. What are the different parts of a plant?

Answer: The parts of plants are root, flower, leaf, stem, bud, etc.

3. Can plants grow without light? Why?

Answer: No, the plants cannot grow without light because they cannot prepare their own food without sunlight which would affect their growth ultimately.

4. Why is the Sun important for living beings?

Answer: Sunlight is important for living beings because it is the ultimate source of energy for all the living beings.

5. Why do plants need sunlight?

Answer: Plants need sunlight because they can prepare their own food only in presence of sunlight.

Activity A

What is the main difference between the two setups?

Answer: Setup A is kept in the sun light while Setup B is kept in a dark place.

List down the changes that you have observed in the two plants

Set up A	Set up B
1. Leaves are green	1. Leaves are yellow
2. Bigger in size	2. Smaller in size
3. Taller in height	3. Short/stunted growth

Which plant showed proper growth?

Answer: The plant in Setup A showed proper growth.

What can you conclude from this experiment?

Answer: This experiment says that sunlight is necessary for the growth and development of plants.

Activity B

What is same about the two plants?

Answer: The two plants are of same type and have same height.

What is different about the two plants?

Answer: One plant is kept in the direct sunlight, while the other is kept in the dark room that receives sunlight from only one direction.

What do you observe?

Answer: The plant kept on the window sill bends towards the direction of the sunlight coming from the window, while the plant kept in the direct sunlight does not bend but shows healthy growth.

Give reasons for your observation.

Answer: The plant kept on the window sill bends towards the direction of sunlight as light is necessary for its proper growth and development, while the plant kept in the direct sunlight does not bend because it receives sufficient amount of sunlight from all directions.

Check Your Progress

i. Why is light important for plants?

Answer: Sunlight is important for plants because they can prepare their own food only in the presence of sunlight.

- ii. Why do we need to take same type of potted plants in the activity A and activity B?

Answer: We need to take same type of potted plants in activity A and activity B to have fair test.

9.2. Effect of Air on the Growth of Plant

Test Yourself

1. What will happen to the plant if we keep it in a dark place?

Answer: If we keep the plant in a dark place, its leaves will become yellow and it will finally die.

2. Why is air important to us?

Answer: Air is important to us because air contains oxygen which is important for breathing.

3. What do you think will happen if there is no air?

Answer: There will be no life on the Earth if there is no air.

4. How is air important to plants?

Answer: Air is important to plants with which plants can respire and make their own food.

Activity A

How are the two setups similar?

Answer: Two setups contain a jar with cotton, equal amount of water, equal number of seeds, and both are kept on the window sill.

How are the two setups different?

Answer: Jar A is made airtight while jar B is left open.

Observe the plants for about one week. What happens to the plant in jar A?

Answer: The plant in jar A becomes greener, thicker, healthier, and taller.

What happens to the plant in jar B?

Answer: The plant in jar B becomes pale, slender, weak, and stunted.

What does the experiment prove?

Answer: The experiment proves that air is necessary for the growth of plants.

Check Your Progress

v. What will happen if plants do not get carbon dioxide?

Answer: If plants do not get carbon dioxide, they will not be able to make their own food.

vi. Which air is used by the plants to break down the food?

Answer: Oxygen is used by plants to break down the food.

9.3. Effects of Temperature on the Growth of Plants

Test Yourself

1. What will happen to the plants if there is no sunlight?

Answer: If there is no sunlight, plants will not be able to prepare food.

2. What will happen to the plants if there is no air?

Answer: If there is no air, plants will die as air is required to make food and to break down the food.

3. What is temperature?

Answer: Temperature is the degree of hotness or coldness of a body or the environment.

4. If you play outside on a very hot day, what happens to your body?

Answer: If we play outside on a very hot day, our body gets heated up and starts sweating.

5. Why do you think heat is important for plants?

Answer: Heat is important for plants because it is required for proper germination, growth, and development.

Activity A

Table 9.1. Reading temperature

Room temperature (degree Celsius)	Tape water temperature (degree Celsius)

(The room temperature and tape water temperature may vary from place to place)

Which reading is high?

Answer: The reading of room temperature is high.

Activity B

Copy Table 9.2 and record the initial temperature of each tray as shown in Figure 9.4 (a).

Table 9.2 Recording temperature

Tray 1 Temperature reading	Tray 2 Temperature reading

(Temperatures would vary from place to place)

Which thermometer has higher reading? Why do you think so?

Answer: The thermometer in tray 2 has the higher reading because it has a plastic cover that has trapped the sun's heat energy.

In which tray do plants grow faster?

Answer: Plants in tray 2 grow faster.

Why do you think this happens?

Answer: This happens because tray 2 has the plastic cover that has helped in increasing the temperature by trapping the Sun's heat energy.

What does this experiment show?

Answer: This experiment proves that temperature is necessary for the growth of plants.

Check Your Progress

- i. Why would a greenhouse be useful in some parts of Bhutan?

Answer: In some parts of Bhutan, it is very cold and plants do not grow well. In such places, green house would be useful as it would help in increasing the temperature required for the growth and development of plants.

- ii. What do you think will happen to the growth of a plant if the temperature is either very high or very low?

Answer: If the temperature is very high or very low, the growth of plant will be affected leading to the extent of death.

9.4. Effect of Water on the Growth of Plant

Test Yourself

1. Is temperature important for growth of the plant?

Answer: Yes, temperature is important for the growth of plants.

2. A potted plant kept near the window bends towards sunlight. Why?

Answer: A potted plant kept near the window bends towards the sunlight because light is necessary for the growth of the plant.

3. Do plants grow properly during a very cold winter? Why?

Answer: No, plants do not grow properly during the very cold winter because plants require suitable temperature for proper growth.

4. What are the uses of water?

Answer: Water is used for drinking, washing, cooking, cleaning, etc.

5. What will happen to living things if there is no water?

Answer: If there is no water, living things will die.

Activity A

How is Setup A different from Setup B?

Answer: Setup A is watered while Setup B is not watered.

Which plant has grown better?

Answer: Plant in Setup A has grown better.

What does this experiment show?

Answer: This experiment shows that water is required by plants for its proper growth.

Activity B

Discuss in your group, the importance of water both for plants and animals.

Answer: Water is important for both plants and animals in terms of growth and development, keeping the body cool, movement of food materials within the body from one point to another, reduction of stress, etc.

Check Your Progress

i. What happens to the flowers if you do not water your garden regularly?

Answer: If we do not water our garden regularly, the flowers will wilt and die.

ii. What may happen to plants if there is excess of water?

Answer: If there is excess of water, plants may die due to the rotting of the roots.

9.5. Flower

Test Yourself

1. Name the parts of a plant.

Answer: The parts of a plant are roots, stems, branches, leaves, flowers, etc.

2. What are the necessary conditions for the proper growth of plant?

Answer: The necessary conditions for the proper growth of plant are right amount of water, right condition of air, right intensity of light, and suitable temperature.

3. Which is the most attractive part of a plant?

Answer: The most attractive part of the plant is its flower.

4. Name different parts of a flower.

Answer: The different parts of a flower are pedicel, sepal, petal, carpel, and stamen.

Activity A

What is the male part of a flower called?

Answer: The male part of a flower is called stamen.

Which part of a flower is brightly coloured?

Answer: Petal is brightly coloured part of a flower.

Which part of a flower is normally green?

Answer: Sepal is green part of a flower.

Activity B

(Students remove the parts of a flower and paste them in their scrap book with the labelling)

Check Your Progress

- i. Which is the reproductive part of a plant?

Answer: Flower is the reproductive part of a plant.

- ii. What is the stalk of a flower called?

Answer: The stalk of a flower is called pedicel.

Think Again

1. Choose the correct answer.

- i. All of the following are required by a plant for its proper growth EXCEPT

- a. *light.*
- b. *water.*
- c. *micro-organism.*
- d. *temperature.*

Answer: micro-organism.

- ii. The part of a plant that makes fruit and seed is

- a. *root.*
- b. *stem.*
- c. *flower.*
- d. *leaf.*

Answer: Flower.

- iii. The female part of a flower is called

- a. *carpel.*
- b. *stamen.*
- c. *sepal.*
- d. *petal.*

Answer: Carpel.

- iv. Greenhouse is useful in places where there is

- a. *lot of water.*
- b. *no water at all.*

c. low temperature.

d. high temperature.

Answer: low temperature.

v. In the absence of light, leaves become

a. yellow.

b. greener.

c. more in number.

d. bigger.

Answer: yellow.

2. Why is greenhouse used to grow vegetables in cold places?

Answer: Greenhouse is used to grow vegetables in cold places because it helps in maintaining temperature required by the plants for their growth and development.

3. Why is grass growing under the stone yellow?

Answer: Grass growing under the stone is yellow because it does not get sunlight which is important for its proper growth and development.

4. Plants do not grow well in dry soil. Why?

Answer: Plants do not grow well in dry soil because they do not get water which is important for their growth and development.

5. Why do farmers make soil loose around the plants?

Answer: Farmers make soil around the plant loose because it helps the soil to become rich in air.

Chapter 10

Food

10.1. Different Kinds of Food

Test Yourself

1. Human beings are generally omnivores. Explain.

Answer: Human beings are generally omnivores as we eat both plants and animals.

2. What is the main source of food for animals?

Answer: Plants are the main source of food for animals.

3. Why do you eat different kinds of food?

Answer: Different kinds of food provide different nutrients required by our body.

4. Can you name some foods that we eat?

Answer: Rice, potato, beans, meat, milk, egg, apple, banana, peach, etc.

5. Why do we need to eat food?

Answer: We need to eat food for a healthy living and for energy.

Activity A

Make a list of food that you eat.

Answer: Beans, peas, maize, rice, wheat, barley, mango, apple, peach, orange, cheese, butter, milk, curd, beef, pork, chicken, fish, cabbage, radish, potato, spinach, chilli, brinjal, etc.

Classify and write the name of the food that you have listed above under the food groups in the table below.

Pulses	Grains	Fruits	Milk products	Meat	Vegetables
<i>Beans, peas and soya beans.</i>	<i>Maize, wheat, rice and barley.</i>	<i>Mango, apple, orange and peach.</i>	<i>Cheese, butter, curd and milk.</i>	<i>Beef, pork, chicken and fish.</i>	<i>Cabbage, potato, spinach and radish.</i>

Note: The answers given in the above table are some of the expected answers.

What kinds of pulses are grown in your locality?

Answer: (Depend upon the locality).

What foods are generally included in:

i. Breakfast:

Answer: Bread, rice, potato, beef, spinach, beans, etc.

ii. Lunch:

Answer: Rice, potato, pork, milk, chicken, peas, peach, etc.

iii. Dinner:

Answer: Rice, radish, fish, spinach, beans, mango, etc.

Check Your Progress

i. Name at least three examples of the following:

a. *Pulses*

Answer: beans, peas, and grams.

b. *Grains*

Answer: Wheat, rice, and maize.

c. *Milk products*

Answer: cheese, butter, and butter milk.

ii. List the food items that are common in your locality.

Answer: (It will depend on the locality.)

10.2. Food for Activity

Test Yourself

1. What are the different kinds of food that we eat every day?

Answer: Rice, potato, beans, meat, milk, egg, apple, banana, peach, etc., are the different kinds of food we eat every day.

2. We feel tired when we do not eat food. Why?

Answer: We feel tired when we do not eat food because of the exhaustion of energy required by our body for various activities.

3. Can you name some pulses that we eat?

Answer: Peas, beans, grams, lentils, etc.

4. Which food do we eat as the major part of our diet?

Answer: Energy giving food like rice, potato, butter, etc.

5. Name three grains.

Answer: Wheat, rice, and barley.

Activity A

Study the graph in Figure 10.2 and answer the questions that follow.

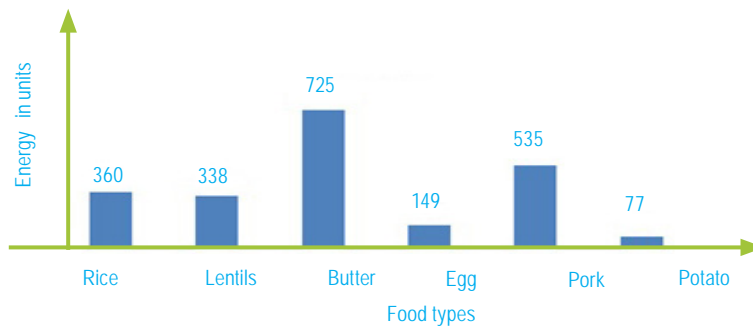


Figure 10.2. Energy contained in food

What kind of food should a farmer eat? Why?

Answer: Farmers should eat the foods that give more energy like rice, butter, etc. because farmer needs more energy to work in the field.

Which food item gives us the most energy?

Answer: Butter is the food item that gives us the most energy.

Activity B

(Students draw their favourite food they eat to enable us to work and display in the class)

Check Your Progress

i. Why should a heavy manual worker eat more rice than an office worker?

Answer: A heavy worker should eat more rice than the office worker because he/she need more energy to do heavy manual work than the office worker.

ii. Name five energy giving food found in your locality.

Answer: (Depends on location.)

10.3. Food for Growth

Test Yourself

1. Why do we need energy?

Answer: We need energy to carry out various activities.

2. Name three food items that give us energy.

Answer: Rice, butter, and potato.

3. Which food item give us the most energy?

Answer: Butter gives us the most energy.

4. Why should we eat lentils regularly?

Answer: We should eat lentils regularly in order to grow and develop properly.

Activity A

Study the bar graph in Figure 10.3 and answer the questions that follow.

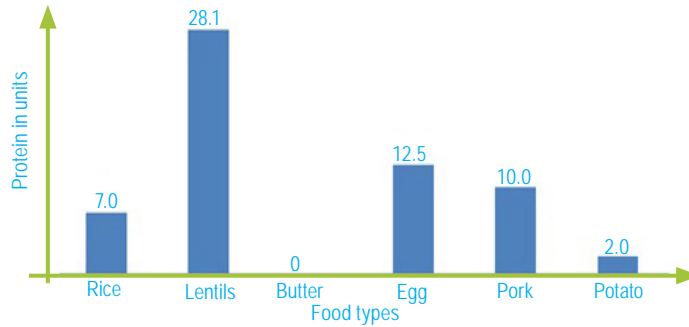


Figure 10.3. Food for growth

Write down two more examples of food that helps us to grow.

Answer: Soya bean and milk.

Which food is the best example of body-building food?

Answer: Lentils is the best example of body building food.

Who needs more body-building food, a father or a child? Why?

Answer: A child needs more body-building food than a father because as he/she is growing stage, the body require more protein diet for proper growth and development.

Activity B

(Students draw their favourite food that helps to grow and display them in the class)

Check Your Progress

i. What would happen if you do not eat body-building food?

Answer: If we do not eat body-building food, our body will not grow properly.

ii. Name five body-building food available in your locality.

Answer: Lentil, milk, egg, beans, and cheese.

10.4. Food for Protection

Test Yourself

1. Can you name some foods that help us grow?

Answer: Some of the foods that help us to grow are lean meat, fish, milk, etc.

2. Pork is an energy giving food as well as a body-building food. Can you name any other food which gives energy and helps us grow?

Answer: Egg, chicken, beef, fish, etc.

3. What food items do we use for making curries?

Answer: We use butter, vegetable, meat, etc., for making curries.

4. Name some fruits and vegetables.

Answer: Apple, orange, mango, potato, cabbage, beans, and carrot are some of the examples of fruits and vegetables.

5. What are protective foods?

Answer: Foods that protect us from diseases are called protective foods. For example, fruits and vegetables.

Activity A

Identify and list the food that help to protect us from diseases.

Answer: Lemon, aubergine, banana, carrot, cabbage, broccoli, grapes, onion, water melon, cauliflower, spinach, egg, beef, pork, cheese, lentils, and tomato.

Write some more examples of food for protection.

Answer: Apple, mango, peach, orange, guava, etc.

What would happen if protective food is not included in your meals?

Answer: If protected food is not included in our meals, we may suffer from diseases.

Activity B

(Students draw their favourite fruits and vegetables and display them in the class)

Check Your Progress

- i. Name the protective foods available in your locality.

Answer: (Depends upon locality.)

- ii. Why do you eat different types of vegetables and fruits?

Answer: We eat different types of vegetables and fruits to protect our body from different diseases.

10.5. Eat all Types of Food

Test Yourself

1. Make a list of food that:

a. gives us energy

Answer: Rice, potato, butter, egg, etc.

b. helps us grow

Answer: Lentil, fish, meat, milk, etc.

c. protects us from diseases

Answer: Carrot, apple, orange, cabbage, beans, spinach, etc.

2. Name some fruits and vegetables available in your locality.

Answer: (Depends on the locality.)

3. What are foods other than fruits and vegetables that you eat every day?

Answer: The foods other than fruits and vegetables that we eat everyday are pulses and grains.

4. Why should we include different kinds of food in our diet?

Answer: We should include different kinds of food in our diet in order to supply different types of nutrients required by our body for healthy living.

Activity A

List the types of food that are present in set A, set B, set C and set D.

Answer:

Set A: Energy giving food and body-building food.

Set B: Energy giving food, protective food, and body-building food.

Set C: Energy giving food and protective food.

Set D: Energy giving food and body-building food.

Which set of food is the best for health? Why?

Answer: Set B is best for health because it contains all types of food required by our body.

Activity B

Make a list of food that will keep you healthy. Each meal should contain at least one food item from each food group.

Table 10.2. Healthy menu

Day	Meal	Food for growth	Food for activity	Food for protection
1	Breakfast	Milk, egg, and chickpea	Bread, butter, and rice	Apple and banana
	Lunch	Fish, beans, and meat	Rice and potato	Spinach and apple
	Dinner	Lentil and meat	Rice, maize, and flour	Mango and spinach
2	Breakfast	Meat, milk, and egg	Bread and butter,	Orange juice
	Lunch	Meat and beans	Rice	Spinach and lettuce
	Dinner	Meat and cheese	Potato and rice	Banana and papaya

(Students share their food menu with their friends)

Check Your Progress

- i. Why is it important to include a variety of foods in your meals?

Answer: It's important to include varieties of food items in our meals because our body requires different types of nutrients to produce energy, for growth and development, and to protect us from diseases.

Think Again

1. State whether these sentences are true or false.

a. *Lean meat is protective food.*

Answer: False

b. *A farmer should eat less rice than a teacher.*

Answer: False.

c. *We should always include all the three groups of food in a meal.*

Answer: True

d. *The food that helps us grow is body-building food.*

Answer: True.

e. *Potatoes are also known as pulses.*

Answer: False

2. Why do we need to eat green leafy vegetables?

Answer: We need to eat green leafy vegetables in order to keep our body protected from diseases.

3. Study the following meals. Which one is the best to eat? Give reasons.

a. *Rice, chicken, spinach and oranges*

b. *Bread, butter, banana and apple*

c. *Rice, egg, potatoes and butter tea (suja)*

Answer: Rice, chicken, spinach and oranges is the best meal to eat because it is a balanced diet.

4. If you want to reduce fat intake, which food should you eat less?

Answer: Oil, butter, pork, etc., should be less in order to reduce the fat intake.

5. What is the common food that is eaten in your locality? Why?

Answer: (Depends upon the locality.)

6. Draw a food chart of a sports person showing the type of food he or she needs.

Answer: Students are expected to draw a food chart showing all kinds of food (food for activity, food for protection, and food for growth).

Chapter 11

Our Earth

11.1. Shape of the Earth

Test Yourself

1. What is the difference between day and night?

Day	Night
<i>Receive sunlight</i>	<i>No sunlight</i>
<i>See things around clearly</i>	<i>Do not see things clearly and/or do not see things around us</i>

2. What is the main source of light during the day?

Answer: Sun is the main source of light during the day.

3. What is the shape of a football?

Answer: The shape of the football is either spherical or round.

4. What is the most likely shape of the Earth? Why do you think so?

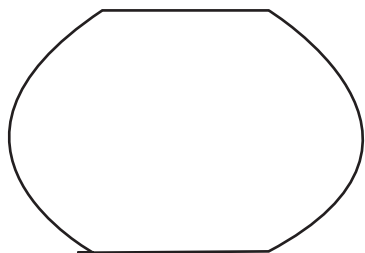
Answer: The earth is likely to be round because the shadow formed by the earth over moon during lunar eclipse is round or because the Moon and the Sun is also round or because the picture taken from outer space shows the Earth as a sphere.

Activity A

Materials required: Modelling clay.

Alternative teaching aids: We can also use clay soil or any other material that can be moulded.

Draw and name the shape of your model in your notebook.



(Expected drawing)

Answer: Shape – oblate spheroid.

Check Your Progress

- i. What do you call the heavenly objects which revolve round the Sun?

Answer: Planets.

- ii. Describe the shape of the Earth.

Answer: The Earth is almost round in shape but it is slightly flat at the top and bottom. Hence, the earth is oblate spheroid in shape.

11.2. Rotation of the Earth

Test Yourself

1. What is the shape of the Earth?

Answer: The shape of the Earth is called oblate spheroid.

2. State one difference between the shape of a ball and the shape of the Earth.

Answer: The ball is round and the Earth is round but slightly flattened at the poles (oblate spheroid).

3. Why does Sun rise in the morning and set in the evening?

Answer: The Sun rises in the morning and sets in the evening because of rotatory movement of the Earth.

4. How does Earth rotate?

Answer: Earth rotates in its own axis from west to east direction.

Activity A

Materials required: Globe

Show the spinning movement of the Earth with the help of a globe.

Note: We can also show the spinning of the Earth by spinning the ball of thread with a needle passed through it in a tilted position.

Activity B

Design a model to show the rotation of the Earth on its axis. Explain the working of your model.

Sample activity:

Materials required:

Ball of clay

Pencil.

Take a ball of clay

Pass a pencil through the centre of the clay ball.

Now spin your model and observe it.

It will spin similar as to how the Earth spins in reality. The pencil acts as an axis.

(Show another example with the help of a spinning top).

Check Your Progress

- i. What is an axis of the Earth?

Answer: Axis of the Earth is an imaginary line that pass through the centre of the Earth.

- ii. How long does it take for the Earth to complete one rotation?

Answer: Earth takes 24 hours to complete one rotation.

11.3. Day and Night

Test Yourself

1. How does the Earth rotate?

Answer: Earth rotates from west to east in counter clock wise direction on its own axis.

2. When do we experience day?

Answer: We experience day when the part of the Earth faces the Sun.

3. What do we experience on the other side of the Earth which is not facing the sun?

Answer: When the other side of the Earth does not face the Sun we experience night.

4. How does day and night occur?

Answer: Day and night occurs due to spinning movement of the Earth called rotation. When the time of the Earth receives sun light it is called day. On the other hand, the time of the Earth does not receive the sunlight, it remains dark. This duration is called night.

5. Is the duration of day and night equal? Why?

Answer: The duration of day and night is not equal because our Earth rotates on its own axis in tilted position.

Activity A

What does the torch represent?

Answer: The torch represents the Sun.

What does the globe represent?

Answer: Globe represents the Earth.

Observe the part that receives the light.

What does the lighted part of the globe represent?

Answer: Lighted part of the globe represents day.

What does the dark part of the globe represent?

Answer: Dark part of the globe represents night.

What do you observe?

Answer: As the globe rotates, some part of the globe experience day while other parts experience night.

What causes day and night?

Answer: Rotation of the Earth causes day and night.

What will happen if the Earth does not rotate?

Answer: If the Earth does not rotate, the parts that receives sunlight will always experience day and the parts that do not receive sun light will always experience the night.

Keep the torch on the same point.

Now turn the globe slowly in counter clockwise direction.

What do you observe?

Answer: Different places experience day and night.

What causes day and night?

Answer: Day and night is caused by the rotation.

Check Your Progress

i. Differentiate between day and night.

Answer:

Day	Night
<i>Receive sunlight</i>	<i>No sunlight</i>
<i>See things around</i>	<i>Do not see things clearly and/or do not see things around us</i>

ii. How many rotations will the Earth make in 24 hours?

Answer: One rotation.

11.4. Revolution of the Earth

Test Yourself

1. Why do you think day and night are not of equal duration?

Answer: Day and night are not of equal duration due to the tilted position of the Earth.

2. How many hours are there in a day?

Answer: 24 hours.

3. Does Earth revolve around the sun?

Answer: Yes, the Earth does revolve around the Sun.

4. How many days make a year?

Answer: 365 days make a year.

Activity A

What does the globe represent?

Answer: It represents the Earth.

What does the lighted candle represent?

Answer: It represents the Sun.

What do we call to the movement of globe around the candle?

Answer: Revolution.

Check Your Progress

- i. What is revolution of the Earth?

Answer: The movement of the Earth in counter clock wise direction around the Sun is called revolution.

- ii. How long does the Earth take to complete one revolution?

Answer: One year [about 365 days]

11.5. Seasons in a Year

Test Yourself

1. Where have you seen rotation and revolution taking place?

Answer: Rotation of prayer wheels and revolution of a rotating spinning top around the corner.

2. Why are seasons not same throughout the year in Bhutan?

Answer: Seasons are not same throughout the year in Bhutan because of the revolution of the Earth.

3. Name the seasons.

Answer: Spring, summer, autumn, and winter.

4. What will happen if the Earth does not revolve?

Answer: There will be no seasons.

Activity A

Teacher demonstrates how seasons are caused using the pictures or video of the revolution of the Earth and pictures or video of four seasons.

What will happen if there is no tilt in the Earth's axis?

Answer: If there is no tilt in the axis, then the places at two hemispheres with equal distance from the equator will have same seasons at the same time of the year. The duration of sunlight falling over the places will be equal, i.e. 12 hrs of day and 12 hrs of night.

What will happen if there is no tilt on the Earth's axis and the Earth revolves around the Sun at the same distance throughout the year?

Answer: There will be no seasons as the places on the earth will receive same amount of sunlight.

Activity B

(Students cut out the pictures related to the four seasons and past them in the respective section designated with different seasons. They then write the characteristics of each season and display their work).

Check Your Progress

- i. Name four seasons of the year.

Answer: Summer, winter, spring, autumn.

- ii. What causes the change in seasons on the Earth?

Answer: The revolution of the Earth around the Sun makes the change in seasons.

Think Again

1. Choose the correct answer from the bracket and fill it in the space provided.

- i. Days and nights are caused by the.....of the Earth. (rotation/revolution)

Answer: rotation

- ii. The movement of the Earth's rotation and revolution is in..... direction. (clock wise/counter clock wise)

Answer: counter clock wise

- iii. The movement of the Earth around the Sun is called..... (revolution/rotation)

Answer: revolution.

- iv. The Earth moves around the Sun in a fixed path called..... (orbit/ axis)

Answer: orbit.

- v. The Earth takes about days to revolve around the Sun. (365/24)

Answer: 365.

2. Rearrange the words in the bubble and write them down in your note book.

Answer:

- i. rotation
- ii. revolution
- iii. spheroid
- iv. axis
- v. orbit
- vi. autumn
- vii. season

3. Which one of the following shape is oblate spheroid?

Answer: The shape C is oblate spheroid.

4. Earth rotates and yet we do not feel its movement. Why?

Answer: The Earth rotates and yet we do not feel its movement because everything including us also rotate along with the earth at the constant speed.

5. How many seasons are there in a year? Name them.

Answer: There are four seasons, namely spring, summer, autumn, and winter.

6. Write the features of the four different seasons.

Answer: The features of four seasons are:

Spring: flowers blossoms, moderate rainfall, moderate temperature, etc.

Summer: wet and damp, heavy rainfall, high temperature, etc.

Autumn: leaves fall, cool temperature, harvest crops, etc.

Winter: cold temperature, dry weather, snowfall, etc.

7. Which movement of the Earth is shown in the following Figure 11.7 ?

Answer: Revolution.