

National School Curriculum

Department of School Education
Ministry of Education and Skills Development, Royal Government of Bhutan



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INSTRUCTIONAL GUIDE FOR SCIENCE CLASSES IV-VI



“Your parents, relatives, and friends would be very proud of what you have achieved. At your age, to have completed your studies is your personal accomplishment. Your knowledge and capabilities are a great asset for the nation. I congratulate you for your achievements.

Finally, your capabilities and predisposition towards hard work will invariably shape the future of Bhutan. You must work with integrity, you must keep learning, keep working hard, and you must have the audacity to dream big.”

- His Majesty Jigme Khesar Namgyel Wangchuck

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INSTRUCTIONAL GUIDE

FOR SCIENCE

CLASSES IV-VI



School Curriculum Division
Department of School Education
Ministry of Education and Skills Development, Royal Government of Bhutan

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Foreword

The erstwhile Royal Education Council (REC) developed an Adapted and Prioritised curricula for schools so that students can continue learning during the disruptions caused by the COVID 19 pandemic since March 2020. With the commencement of the 2021 academic session, the new normal curriculum, later renamed as the National School Curriculum (NSC), was embraced as a paradigm shift of education from the conventional knowledge-based learning to competency based, open source and experiential learning leveraged on digital technologies. In order to facilitate the effective implementation of the curriculum change, Instructional Guides were developed in all subjects, and the teachers were oriented through virtual and short contact modes as per the prevailing pandemic situations. The curricula were aimed at minimising the learning loss for learners as it was designed for implementation in different situations - during school closure or during regular contact instructional hours.

While these measures served as a solution to problems brought about by the pandemic and the global changing trend in education, a resilient and more dynamic curricula and instructions remain the current priority of the Government. In cognizance of some the shortfalls in the provisional edition of Instructional Guides (IG), the Department of School Education reviewed and revised the existing Instructional Guides across all subjects with the aim of enforcing the competency-based learning, and making teaching-learning happen ‘anytime anywhere’ commensurate to an inclusive education, so that all learners are provided the opportunity to learn at their pace and situation.

The revised Instructional Guides have drawn ideas and inspiration from various educational philosophies and principles, particularly the Delors Report, *Learning: The Treasure Within* (1996). The report prioritises the development of the whole person and not just academic knowledge through the four pillars: “learning to know”, “learning to do”, “learning to be”, and “learning to live together”. Therefore, the New Curriculum and the Instructional Guide is an attempt to transform education from the teaching of “what” to learning of “how” and “why” towards empowering learners with the transversal competencies and the 21st century skills, and preparing them to be lifelong learners.

It must be noted that the New Curriculum and the Instructional Guide are not just a response to the pandemic, but a culmination of the curriculum reform work for the last four years by the Royal Education Council. The school curricula are to be perceived as integrated, and based on themes and problems that inspire learners to learn and to live in peace with our common humanity and our common planet. This has the potential in the development of a strong base of knowledge about one’s self and about the world, the purpose of learning, and being better able to participate in social and political milieu. Thus, this initiative is envisaged to orient our educational process towards nurturing ‘nationally rooted and globally competent’ citizens.

Wish all our learners and teachers a life-enriching teaching and learning.

Tashi Delek

Tashi Namgyal

Director

Introduction

Conventional education, which is predominantly knowledge-based and examination-centred teaching and learning has been the time old practises. The stress of this model is on the learning of textual information perceived by educators important for the grade. On the other hand, with the advancement in ICT, the world is flooded with such information, which is widely read by all at their leisure. What learners cannot acquire from the multiple sources are the skills, values and change of behaviour, which are crucial in facilitating learners to realise their potential to be socially responsible and productive individuals, and optimise their contribution to the nation-building processes – economic, social, and political development. In the contemporary world, textbook-based, knowledge-based education compromises the development of psychomotor and affective domains of learning, affecting the holistic development and psychosocial well-being of learners.

The pandemic also explained that the old ways of working, teaching and learning, and lifestyle have limitations. Consequently, new ways of how we work and live, teach and learn, and stay connected are contemporary traditions. In this context, an overhaul of our thoughts and actions is imperative, not a choice. The transformation of classroom instruction from teacher-centred to that learner-centred learning however calls for the following adjustment or even the overhaul of some of the practices.

- i. Reduction of learning content to facilitate deep learning as opposed to the width of the teaching and learning through active engagement of learners.
- ii. Integration of ICT as tools and end of the learner's education. The use of multimedia and ICT software are commonly utilised in teaching and learning as innovation to introduce variation in stimuli, and sustain learners' interest and zeal in learning.
- iii. The adoption of theme-based learning content facilitates broadening the horizon of learning beyond the four walls and stimulates the transfer of the learnt concepts to the learner's immediate environment. This arrangement makes learners aware of the realities of the social, political, economic and cultural practices and ethos of the society. Being aware of the immediate environment of the scopes and challenges, learners are sensitised to the opportunities and issues.
- iv. Consideration to ground the curriculum design and instruction approaches on the epistemological theories is imperative to facilitate deep learning as opposed to factual learning. The selection and use of them, however, are subject to the nature of the subject. For instance, constructivism is more apt for science. At the same time, connectivism may be relevant for languages and ICT curricula to facilitate deep learning and inspire the generation of new knowledge and ideas.
- v. Active engagement of learners is imperative for competency-based education and learning. Inevitably, summative assessment has limitations in gauging the progressive development of the learner. This is achieved objectively by the use of continuous formative assessment (CFA). However, if summative assessment evidence is used to provide feedback to help learners in learning, it can serve as one of the techniques of CFA.

The curriculum is grounded on the wisdom and principles of competency-based learning, built on the reality of the immediate environment, and the belief system of the society, promotes personalised learning;

fosters life-enriching experiences, which inspires youth to generate new knowledge and create new ideas to innovate as young scientists or enterprising individuals.

Towards this, learning is facilitated through the “Instructional Guide” with learners taking responsibility for their learning. The roles of teachers are facilitation, guidance, evaluation in the course of learners’ active engagement, and assess the performance for improvement and enhance learners’ learning. Therefore, the NSC Science Instructional Guide (SCI IG) is an attempt to transform education from the teaching of “what” to learning of “how” and “why” towards empowering learners with the transversal competencies and the 21st-century skills and preparing them to be lifelong learners.

Purpose of the Instructional Guide

In the National School Curriculum, deep learning synonymous with “less is more” is facilitated with the use of an Instructional Guide for each subject and specific class. The content of the instruction in the guide for respective subjects is aligned with the subject’s curriculum framework. Therefore, the Science IG is purported to achieve the following objectives towards facilitating uninterrupted teaching and learning:

- i. Strengthen competency-based learning and experiential learning to foster sensitivity to the realities of life and the environment.
- ii. Strengthen blended learning and flip classrooms with multimedia, digital pedagogies and ICT devices and websites as tools and ends of the learning.
- iii. Prioritise learning content with an emphasis on creating time and space for deep learning and raising the sensitivity to the realities of the world around them through the active engagement of learners.
- iv. Facilitate the use of CFA for learning using diverse appropriate assessment techniques and tools commensurate with individual differences in learning, and gather evidence to guide the planning of educational programs and activities for learners.
- v. Promote inclusive learning through blended learning which facilitates learning anywhere, any time with the learner being responsible for the learning.
- vi. Inspire teachers to assume the roles of facilitation, guide, motivator and evaluator.
- vii. Guide both teachers and parents in facilitating the learning of their children.

Experiential and personalised learning practices are widely used around the world and are grounded on different models. One such model that suits the current situation and expectation of education for the 21st century is the ADDIE model (Analyse, Design, Develop, Implement and Evaluate).

How to Use an Instructional Guide?

The National School Curriculum (NSC) is inspired by the ideologies of competency-based education and the experiential learning ethos of educational practices. Therefore, the function of the NSC Instructional Guide (IG) is to facilitate deep learning and foster the learning of how to learn through active engagement and provisioning of diverse learning experiences. They include, but are not limited to, real-time interaction with the lived realities, designing and modelling of artefacts, knowledge hunting through diverse sources – books and digital, and the epistemological processes of investigation and analysis to generate knowledge and create ideas of doing things differently to suit the situation and the problems.

The NSC IG is arranged and aligned with the NSCF in a progressive manner, encompassing all the aspects of competency-based learning and assessment. The content of the Instructional Guide for Science is organised as follows:

1. Theme

Each Theme is introduced with a broad overview of the bigger ideas, issues and concerns setting the context of the learning and sensitising learners of what learning experiences they are to engage in. The context is also to raise curiosity and be concerned with issues and challenges related to the content, society and the environment.

The teacher presents the theme with brief explanations, sensitization, or questions to stimulate the learner's thinking and curiosity. Learner also reads the overview and formulates expectations he or she aspires to gain from the theme.

2. Topic

Each theme contains two to five topics in order to cover the desired fundamental concepts and principles. Each topic begins with an overview of the fundamental concepts, ideas, laws and principles, issues and concerns to set the context of the learning and sensitise learners of what learning experiences they are to engage in.

The teacher presents the topic with brief explanations, sensitization, or questions to stimulate the learner's thinking and curiosity. Learner also reads the overview and formulates questions and hypotheses answers to the questions, and validates during the course of learning.

3. Competency

Based on the topic, a set of competency statements are outlined as the expected outcome of the chapter. Competency *per se* is the ability to analyse and synthesise information and apply the knowledge, skills and abilities required to successfully perform tasks in diverse situations. It is generally framed based on three domains of learning; cognitive/intellectual, performance, social and emotional, and behavioural competencies.

These competencies are the basis for the identification and selection of competencies that the learner is expected to achieve as the desired outcome. Teachers must develop a clear understanding of the expected competencies.

4. Scope

Scope in each topic informs of the expected key concepts, ideas, laws, laws, principles and issues that the topic is expected to emphasise. This serves as the basis for formulating learning objectives both for the formal instruction and the informal setting.

5. Learning objectives

The learning objectives are statements of what learners will know, be able to do, and be able to display by the end of every lesson of experiential learning. Every learning objective contains action words relevant to the domain of competency-based learning, which includes cognitive, psycho-motor and affective.

The learning objectives under every topic are aligned with the competencies identified. The learning objectives inform the design and selection of learning experiences that the learner is envisaged to engage with. It also informs teachers, learners and parents of the target or purpose of their teaching and learning.

6. Learning experiences

This section is crucial in the NSC IG. Learning experiences are a wide variety of experiences across different contexts and settings which transform the perceptions of the learner, facilitate conceptual understanding, yield emotional qualities, and nurture the acquisition of knowledge, skills and attitudes. In educational settings, learning experiences are ideally challenging, interesting, rich, engaging, meaningful, and appropriate to learner needs. Previous learning experiences are considered to be key factors in predicting further learning. As such, learning experiences in SCI IG are based on specific content knowledge and skills that facilitates experiential and deep learning. Such experiences foster the development of critical thinking and problem solving, creativity and innovation, communication, collaboration, citizenship and sensitivity to social and cultural values and practise.

The epistemology of NSC informs that teachers assume the roles of facilitation, guide, motivator and evaluator. Learners are active players in the competency-based learning paradigm. In order to facilitate uninterrupted learning as influenced by the situation, the design of the SCI IG and selection of learning experiences are based on the Blended Learning and Flip Classroom modes of instruction delivery. Therefore, cognizant of the ideology of experiential learning, the need for uninterrupted learning, and helping learners learn how to learn, the NSC IG provides only the suggestive pedagogical strategies and approaches arranged based on the spiral curriculum for progressive learning, with digital technologies as one of the main drivers. Therefore, teachers have the freedom to deploy diverse teaching methods, mechanism of classroom management, and implementation of continuous formative assessment.

By this token, learners are expected to participate in every learning activity, choose a wide range of forms and means of recording their experiences and communicating with others, and reflect on the learning. Further, teachers need to inform learners that based on the progressive step-by-step organisation of the learning experiences, learners can continue learning anytime, anywhere.

The blended learning and flip classroom modes of lesson delivery mandate that teachers develop their own tutorial audio-visual materials and use them to inspire learners. They also upload any audio-visuals in the Google classroom or in any of the recommended social media to support learning. One crucial role of a teacher is to guide learners using various sources of information and ideas by using websites and library resources as stipulated by learning experiences. The teacher also digitises assessments. Owing to the heavy reliance of pedagogies on digital technologies, particularly the use of apps and online tools, teachers need to develop digital competencies. At the same time, teachers and schools need to ensure that accessibility and connectivity are not the learning barrier.

Based on the subject nature, the SCI IG envisages that the learner participates in real-time research studies, interaction with the environment and stakeholders, and investigations. During field visits and trips, school administration, local authorities and parents support and facilitate the conduct of studies in the community setting. Teachers and learners must plan and get all necessary approvals and consensus by taking all the safety measures and protocols into consideration. The teacher also conducts reflection sessions by asking a few questions and follow-up lessons based on the topic.

7. Questions

Learning experiences, whether visual viewing or reading, classroom task completion, investigations or field observations, are concluded with a set of questions. These questions are fundamental to facilitate learners to construct knowledge and create ideas. Teachers are to use these questions to evaluate the learner's actual participation in the learning processes and hence assess their learning. They can serve as the means of assessment as an integral part of CFA, or learners can use them to stimulate reflection to strengthen their metacognition of learning.

8. Assessment and Reporting

In the context of competency-based learning, assessment of intellectual, psychomotor, social and emotional competencies are imperatives; unfortunately, they cannot be assessed summative, but rather must be assessed on a real-time basis when learners are displaying their competencies and dispositions. Continuous formative assessment (CFA) is conducted throughout the educational process with a view to enhancing student learning. It implies: eliciting evidence about learning to close the gap between current and desired performance; providing feedback to students; and involving students in the assessment and learning process (CCSSO 2008).

Uncertain of the diversity of learners and the purpose and context of assessment, the IG does not provide specific assessment techniques and tools, rather the teacher can use appropriate assessment tools and techniques of CFA based on the topics and lessons. The assessment must happen in a continuous mode in accordance with the assessment section in the NSCF for Science (REC 2021).

Teachers use any appropriate techniques and tools leveraging digitised assessment, both for gauging learning progress on a quarterly basis, recording and reporting.

9. Resources

This section provides an overview of resources, digital - online and offline, and physical materials. It must be noted that in the NSC, textbooks are to be used as one of the resources. This discourages textbook teaching but promotes the facilitation of learners in learning.

10. Challenge Your Thinking

This section provides suggestive questions covering all the topics to assess learners' intellectual, psychomotor, social and emotional competencies. It has a mix of knowledge-based and competency-based and intellectually challenging questions. Challenging your Thinking can help learners understand and be aware of their performance, and of the areas for improvement. The diversity of questions is to stimulate learners to use critical thinking, creativity, analysis, making connections and drawing conclusions as the means to generate knowledge and ideas.

11. Annexure / Appendix

In helping the teacher and learners in effective teaching and learning, there is a need for pertinent information, ideas and clues which cannot be covered in the main text. Such resources are generally annexed for ready reference and information.

The teacher and learners refer to sample assessment techniques and tools in using CFA during the teaching and learning process, clarify their misconception by referring to the assessment scheme and modes with the assessment matrix, and plan lessons based on the topic-wise weighting and instructional time for each topic.

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INSTRUCTIONAL GUIDE FOR SCIENCE - CLASS IV

1. Life Processes

1.1 Classification and Variation

There are different things in our surroundings. These things have different characteristics varying amongst them. These differences can be used to classify things around us into different groups such as biodegradable and non-biodegradable, living and non-living, physical or chemical, etc. An understanding of the skill of classification can spark learners' interest in systematically studying living and non-living things, enabling them to gain knowledge about the world around them.

Competency

Classify things in the environment into living and non-living, and biodegradable and non-biodegradable to understand their characteristics.

1.1.1 Living and Non-living Things

Scope: This topic focuses on what living and non-living things are and their characteristics with examples and their significance.

Learning Objectives:

- *Identify the characteristics of living and non-living things.*
- *Classify things in the surrounding into living and non-living things according to their characteristics.*
- *Explain the significance of living and non-living things.*

Learning Experiences

Some things around us are living, some are non-living. Therefore, things around us can also be classified into living things and non-living things based on their characteristics. Have you ever wondered what makes something living or non-living? Are you a living thing or a non-living thing?

learners explore the meaning and examples of living and non-living things from the web link <https://bit.ly/3fxdHnt>, and lists down the characteristics of living and non-living things.

The learner goes outside the classroom to explore things that are living and non-living things. Classify them accordingly.

Design a worksheet using the characteristics before the field trip to help observe and classify things. Record in the worksheet.

After the trip, the learner exchanges the worksheet with a partner to compare and discuss the findings and answers the following questions:

1. List five examples of living things and non-living things discovered during the field trip.
2. Discuss with a partner and write down as many differences as possible between a living thing and a non-living recorded by you or your partner during the exploration.
3. A car moves but is not a living thing. Why?

To explore further, the learner plays an online game from the web link <https://bit.ly/3fF41ac>.

Things around us can be classified into living and non-living things based on their characteristics. All plants, animals and microorganisms are living things. There are many kinds of plants, animals and microorganisms in the world. This diversity of living things makes our earth a wonderful place.

Learners discuss the significance of living things and non-living things around them and share their findings in the class. Further learners answer the following question:

1. Explain the significance of living and non-living things for the continuity of life on the earth.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's conceptual understanding of living and non-living things and its significance.	<ul style="list-style-type: none">● Assess the learner's ability to observe carefully and classify things into living and non-living based on their characteristics using the worksheet.	<ul style="list-style-type: none">● Assess the learner's appreciation of diverse living and non-living things.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Characteristics of living and non-living things: <https://bit.ly/3fxdHnt>
6. Game on living and non-living things: <https://bit.ly/3fF41ac>

1.1.2 Biodegradable and Non-biodegradable Things

Scope: This topic begins with the introduction of biodegradable and non-biodegradable things with examples. It also covers the role of microorganisms in decomposition and making compost and the importance of managing waste.

Learning Objectives:

- *Classify things in our surroundings into biodegradable and non-biodegradable things.*
- *Investigate the role of microorganisms in decomposition of biodegradable waste by making a compost.*
- *Identify the consequences of improper waste management and suggest ways to address the problem related to waste.*

- Explain that biodegradable and non-biodegradable waste contributes to production of greenhouse gases.

Learning Experiences

There are many things around us. In one way, these things can be classified into biodegradable and non-biodegradable things. Some materials decay and some do not. Have you ever wondered why?

The learner reads the information from the web link <https://bit.ly/3Abnqcg> to learn about biodegradable and non-biodegradable.

After reading the information, the learner designs an experiment to investigate things in the surroundings to classify them into biodegradable and non-biodegradable things. Based on your understanding from the link and investigation, answer the following questions:

1. Explain biodegradable and non-biodegradable things based on your understanding.
2. How did you prove the materials you used in the investigation are either biodegradable or non-biodegradable?

Further, watch the video from the web link <https://bit.ly/34UuZZn> and in a team prepare compost at home or in school. Answer the following questions based on your experience:

1. Explain the steps of preparing compost.
2. Why do you think the waste you used decomposes gradually after a few days?
3. What are the impacts of throwing non-biodegradable waste into the surroundings?

Throwing non-biodegradable waste into the environment has many negative effects. Part of the waste human produce is biodegradable and can be used for preparing compost. Microorganisms and other conditions play a role in the process of decay. Composting is one way of managing our waste at home.

Learners explore and gather information on the causes of greenhouse gas production by watching a video from the link <https://shorturl.at/bceHV> and complete the following questions.

Questions

1. Explain greenhouse gases.
2. Name two biodegradable and non-biodegradable waste that produces greenhouse gases.
3. Are greenhouse gases harmful to the environment? Explain.

Challenge Your Thinking

1. Why are stone, air, and pen non-living?
2. Are you a living thing? Why?
3. What are the differences between plants and animals?
4. Why do people make compost?
5. Suggest how you can make the best use of biodegradable materials at home.
6. Reflect on what makes our world a beautiful place to live in?

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner's conceptual understanding of biodegradable and non-biodegradable things. 	<ul style="list-style-type: none"> Assess the learner's skill or ability to identify and prepare a compost. 	<ul style="list-style-type: none"> Assess the learner's consciousness about the importance of managing degradable and non-degradable waste.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Differences between biodegradable and non-biodegradable substances: <https://bit.ly/3Abnqcg>
6. How to make compost: <https://bit.ly/34UuZZn>
- 7.

1.2 Living things and their Environment

Look around. Everything you see and feel is a part of your environment. An environment includes living things such as plants, animals, people, and even the tiniest of microbes. The living things of the environment are called the biotic parts. The non-living things, such as rocks, sunlight, and air, are called the abiotic parts. Plants and animals need a healthy environment to survive. All living and non-living things in the environment depend on each other for their existence.

For all living things to survive in a particular area, food, water and shelter must be available. This area where all these necessary conditions required for growth, survival and reproduction are available is known as habitat. Adaptation is essential for the survival of living organisms. Animals, which are unable to adapt to changing environmental changes, die. Organisms in an ecosystem are connected in numerous ways. Some organisms may benefit one another, compete with each other for resources and of course, eat one another. Feeding on another organism passes energy from one organism to the next. The flow of energy through an ecosystem is represented in a food chain.

Competency

Explore habitat, feeding habits and the adaptive features of plants and animals to identify the interdependence in nature.

1.2.1 Animals and Plant Habitat

Scope: This topic introduces habitats, types of habitats such as water, land, desert, forest, and snow. It also includes adaptive features of plants and animals.

Learning Objectives:

- *Explore different types of habitats for plants and animals.*
- *Describe the adaptive features of plants and animals.*
- *Explore the effects of climate change on habitats (water, land, desert, forest and snow)*

Learning Experiences

A habitat is the home of an animal or a plant. Almost every place on the Earth, from the hottest desert to the coldest ice pack, is a habitat for some kinds of animals and plants. Most habitats include a community of animals and plants along with water, oxygen, soil or sand, and rocks.

The two main types of habitats are land habitats and water habitats. Rainforests, deserts, mountains and grasslands are some examples of land habitats. Water habitats may contain freshwater or saltwater. Freshwater habitats include streams, rivers, swamps, marshes, ponds, and lakes. Saltwater habitats include oceans, seas, salt lakes, salt marshes, and saltwater swamps.

Over long periods of time animals and plants adapt to fit their habitat by developing features that help them to survive. Animals and plants adapt so that they can stay safe, and find food in their habitat. Did you ever wonder why animals and plants live in different places? Do you think different animals and plants can be found in the same place?

The learner explores information on different habitats for plants and animals from the suggested web link <https://rb.gy/0xpuwj> or video link <https://rb.gy/he24nl> or any other relevant resources. Then the learner notes different habitats of plants and animals and presents them in the class. The learner answers the following questions:

1. Explain the habitat with an example.
2. List down the different types of habitats.
3. How are habitats different from each other?
4. Describe a habitat for a plant or an animal that is found in your locality.

Different animals and plants live in different habitats found on this Earth. Have you ever thought about how they adapt to those environments?

The learner watches a video from the web link <https://rb.gy/fzapf4> or explores any other relevant resources to understand about different adaptive features of an organism.

Then, plan and carry out the field trip to the nearest locality to study the types of habitats and the adaptive features of plants and animals in their habitat. The learner develops a plan and worksheet for the field trip. At the end of the field trip, the learner writes a short report on the habitat and features of plants and animals observed during the field trip.

The learner answers the following questions:

1. Describe how some animals survive in their environment.

2. List the adaptive features of plants from any habitat that exists in your locality.

Protecting the habitats of plants and animals is essential to protect the life of plants and animals living in that habitat. The interaction between plants and animals in their respective habitats helps them to survive better on this Earth. Therefore, to protect animals and plants, it is important to preserve their habitats.

Divide students into small groups and assign each group a specific habitat (forest, ocean, desert, etc.). Provide climate change impact scenarios related to each habitat and ask students to discuss and draw the potential effects on plants and animals in their assigned habitat.

learners watch a short video from the web link <http://tiny.cc/nma2vz> to further understand how things depend on each other in nature.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">Assess the learner's conceptual understanding of types of habitats and the adaptive features of plants and animals that live in a particular habitat.	<ul style="list-style-type: none">Assess the learner's classifying skill of plants and animals to different habitats based on their adaptive features.	<ul style="list-style-type: none">Assess the learner's way of showing an appreciation for the interdependence between nature and people.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Types of habitats: <https://rb.gy/0xpuwj> or <https://rb.gy/he24nl>
6. Adaptive features: <https://rb.gy/fzapf4>

1.2.2 Food Chains and Feeding Habits

Scope: This topic begins with the introduction of producer, prey, predator, herbivore, carnivore and omnivore and their examples. It also discusses the trophic levels of a food chain [producer-primary consumer-secondary consumer-tertiary consumer].

Learning Objectives:

- Explain producers, consumers and types of consumers.

- Describe the feeding relationship of organisms in different habitat.
- Create food chains based on organisms found in the locality.
- Interpret the trophic levels of a food chain to understand the interdependence of living things.

Learning Experiences

The food that we eat gives us the energy to survive, reproduce, grow, and do all the things that we need to do throughout the day. Every living thing needs the energy to live and grow. A food chain describes the order in which organisms, or living things, depend on each other for food. It represents the feeding relationship among organisms showing how energy is transferred from producers, consumers and decomposers.

Every ecosystem, or community of living things, has one or more food chains. Most food chains start with organisms that make their own food, followed by organisms that eat other living things. Can we prepare our own food? Or can we survive without plants?

The learner explores the suggested video link <https://rb.gy/15hhdt>. Explain about the food chain along with the classification of animals based on their feeding habits to the class for feedback and comments. With the information, the learner answers the following questions:

1. What is the first level in a food chain?
2. What are animals called in a food chain?
3. What could happen if you remove an animal from the food chain?

The learner carries out field visits to one of the habitats near the school to observe the feeding habits of animals in their locality.

The learner observes and records animals under the different classifications based on their feeding habits like prey, predator, herbivore, carnivore and omnivore. By observing the feeding habits of animals in the habitat, the learner constructs four to five food chains in their notebook and discusses them with the class.

All organisms in an ecosystem depend on each other for survival. A food chain is a list of organisms in a habitat that shows the flow of energy from one organism to another and their feeding relationship. The stages in food chains are called trophic levels. Food chains always start with a producer which is eaten by primary consumers followed by other animals, known as consumers. Animals that are hunted and eaten are prey, and these are consumed by predators. Any disturbance or negative impact on one species disturbs the entire food chain.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's conceptual understanding of feeding relationship and the	<ul style="list-style-type: none">● Assess the learner's analysing skill while	<ul style="list-style-type: none">● Assess the learner's realisation of the importance of interdependence.

trophic level of the food chain in a given habitat.	constructing food chains through observation	
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For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Food chain and feeding habit: <https://rb.gy/15hhdt>

Challenge Your Thinking

1. How do animals and plants depend on each other and their environment?
2. What happens if there are changes in a plant or animal’s habitat?
3. What are some similarities and differences between human and animal habitats?
4. What role do humans play in a food chain?
5. Do you know why there are more herbivores than carnivores?
6. What happens to the plants and plant-eaters if many of the predators have been removed from a place?
7. Write True or False for the following statements.
 - a. Clearing a forest would reduce the amount of energy available to the consumers.
 - b. Cutting down trees in a forest alters the habitat of the organisms living in the forest.
8. Multiple choice questions
 - I. All the energy in a food chain originates from:
 - a. Plant
 - b. Farmers
 - c. The Sun
 - d. Animal
 - II. Collectively, physical factors such as light, temperature, and moisture that affect an organism's life and survival are called the
 - a. biotic environment
 - b. Ecosystem
 - c. abiotic environment
 - d. niche
 - III. The physical location of a place in which a given living thing lives is called an
 - a. Habitat.
 - b. Niche.
 - c. trophic level.
 - d. biotic zone.

1.3 Human and Animal

Food is a basic part of our existence. Food provides the essential nutrients required by the body. The nutrients help in the development of the body and provide energy. Therefore, it is essential to eat different foods from all food groups to acquire all the nutrients required by the body for proper functioning.

Our teeth help to break down food into simpler substances before it is digested. The digestion of food starts from the mouth. Our mouth serves as a door to the internal parts of the body. Hence, good oral hygiene has to be maintained for our overall well-being.

Competency

Explain nutrition and food groups, and structure and function of teeth to understand the importance of eating all food groups and maintaining oral hygiene.

1.3.1 Nutrition

Scope: This topic begins with the introduction of nutrition and different food groups [food for activity, food for growth, food for protection]. It also highlights the importance of eating food from all food groups.

Learning Objectives:

- *Explain nutrition.*
- *Classify foods into foods for activity, growth and protection.*
- *Explain the importance of eating foods from all food groups to maintain good health.*

Learning Experiences

Nutrition is the process of obtaining the nutrients necessary for the health and growth of an organism. Food provides essential substances called nutrients which are used by our body to provide energy; grow, and keep its different systems working smoothly. Food and nutrition are essential for maintaining good health and preventing diseases.

Foods are classified into different food groups based on their functions. Therefore, it is essential to eat foods from all the food groups so that the body can acquire all the nutrients needed for the proper growth and functioning of a body. Can we survive without eating food?

The learner explores food groups and their functions from the video link <https://bit.ly/3HADeb3>. Next, the learner lists the various foods they eat and classifies them into food for activity, growth and protection and presents it to the class for discussion.

Further, the learner prepares a menu for their family that includes foods from all the food groups. Shares the importance of eating foods from all the food groups with the family.

Based on the understanding of food groups and their functions from the video and the importance of eating food from all the food groups, the learner answers the following questions:

1. Compare energy-giving food, body-building food and protective food with food for activity, food for growth and food for protection with examples.
2. Why is it necessary to eat foods from all food groups?

3. What will happen if we do not eat fruits and vegetables?
4. Why do we need to eat every day?
5. What is the difference between nutrition and food?

Different food groups consist of different food nutrients required by the body. Therefore, it is important to eat foods from all the food groups for the proper development of the body and good health.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">Assess the learner's conceptual understanding on different food groups and its function, and the importance of eating food from all food groups.	<ul style="list-style-type: none">Assess the learner's classifying skills while segregating the foods into three food groups and analysing skills while preparing a food menu for the family.	<ul style="list-style-type: none">Assess the learner's realisation on the importance of eating different foods.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Food group and their functions: <https://bit.ly/3HADeb3>

1.3.2 Teeth

Scope: This topic covers the types of teeth and their functions as well as ways to maintain oral hygiene.

Learning Objectives:

- Identify different types of teeth and explain their functions.
- Explore the importance of maintaining oral hygiene.

Learning Experiences

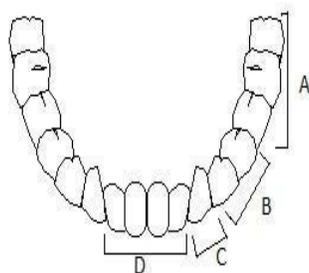
Digestion basically starts in our mouth. The teeth in our mouth help to break down food into simpler substances for the process of digestion. Our mouth has four different types of teeth. Each type has a specific function in chewing food. On average children have 20 teeth and adults have 32 teeth. The doctor that looks after our teeth is called a Dentist.

Poor oral health affects other body functions. This may lead to tooth decay and smell from the mouth. For this reason, it is important to take care of our teeth to maintain oral hygiene. Do you think our teeth can impact our body's health?

The learners explore the video link <https://bit.ly/3HDA4U0> to understand different types of teeth and their functions. Use the information from the video to look at each other's teeth and identify the different types of teeth.

Discuss the functions of different teeth types. Then they use the worksheet from the link <https://bit.ly/3FZj1eD> and identify the types of teeth and label the diagram.

After the activity, the learner uses figure 3.1 and answers the following questions:



- i. What is the function of the teeth labelled D?
- ii. Identify the parts labelled A and B?
- iii. The part labelled C is missing in cows. Give reasons.
- iv. What are the foods you need to avoid to prevent tooth decay?

Figure 3.1. Teeth

Further, the learner explores the ways of maintaining oral hygiene from the video link <https://bit.ly/34pyAP1>. Compare your oral hygiene routine with the ones from the video link. Then discuss in teams some of the ways applicable to their life.

The learners answer the following questions based on the video links and the activity.

1. Is brushing your teeth twice a day really necessary? Why?
2. What do you think is the best way to maintain oral hygiene you?

Our teeth have a vital role in the process of digestion and in maintaining the overall health of an individual. Hence, it is essential to take care of our oral and dental hygiene.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> ● Assess the learner's ability to identify different types of teeth and their function, and explain the importance of maintaining oral hygiene. 	<ul style="list-style-type: none"> ● Assess the learner's critical thinking skills while adopting and discussing the ways to maintain oral hygiene. 	<ul style="list-style-type: none"> ● Assess the learner's interest in learning about the ways of maintaining oral hygiene for overall health.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Types of teeth and their functions: <https://bit.ly/3HDA4U0>
6. Teeth worksheet: <https://bit.ly/3FZj1eD>
7. Ways to maintain oral hygiene: <https://bit.ly/34pyAP1>

Challenge Your Thinking

1. Multiple choice questions
 - i. Teeth not only help you eat, but they also help you:
 - a. Taste
 - b. Talk
 - c. Hear
 - d. Think
 - ii. The type of tooth that is pointed, sharp, and help to tear food:
 - a. Molars
 - b. Premolars
 - c. Incisors
 - d. Canine
 - iii. Which of the following is NOT true regarding the care of teeth?
 - a. Teeth get damaged by chewing food.
 - b. We should not eat too many sweets.
 - c. We should brush our teeth twice a day.
 - d. We should eat fruits and vegetables.
 - iv. Look at the picture. Which of these teeth performs a function similar to the given figure?
 - a. Incisors
 - b. Premolars
 - c. Canines
 - d. Molars



2. Analyse the food plate shown in the picture and give your feedback.



3. Examine your own eating habits and comment on them.
4. Tshering eats less amount of vegetables, Pema eats a good amount of rice and fruits but less amount of meat, whereas Dorji eats a good amount of meat, rice and vegetables. Comment on their health based on their eating habits.
5. Help Pema, Leela and Dorji choose their breakfast from the two meal options given in the following table. Tick the meal you would like them to have and give a reason for the choice made.

Name	Meal option I	Meal option II	Reason
Pema	Butter tea and puffed rice	Boiled eggs, beans and rice	
Leela	Potato, Spinach and rice	Chicken, pork, fish and rice	
Dorji	Mixed vegetable and rice	Milk tea and biscuits	

6. Look at the picture below. Compare and contrast the teeth of a tiger and a cow in the context of their eating habits.



7. Some Bhutanese usually chew doma saying that it makes their teeth strong. Do you agree with them? Support your answer.

1.4 Green Plants

Plants are seen almost everywhere. Plants play a very important role on the Earth. They provide food and oxygen to all other living things. They grow on land, on mountains, in deserts and under sea. Plants are the main source of food for humans and animals. They are living things which require suitable conditions such as light, air, temperature, nutrients, soil and water for proper growth.

Plants are the only living things that can prepare their own food using energy from the sun by a process called photosynthesis. The parts of a plant are roots, stems, leaves and flowers. A flower is an important part of a plant and helps in reproducing new plants.

Competency

Investigate the conditions required for the growth of the plants, and identify parts of flower to understand its role in reproduction.

1.4.1 Conditions for Growth

Scope: This topic emphasises on the conditions such as light, air, temperature and water which are necessary for the growth of a plant.

Learning Objectives:

- *Identify the essential requirements for optimal plant growth.*
- *Investigate the effect of light, air, temperature and water on the growth of a plant*
- *Explain the interdependence of various growth factors for healthy plant development.*

Learning Experiences

Light, air, temperature and water play an important role in the growth of a plant. The proper growth of a plant depends on the availability of the right number of necessary conditions. Plants get energy from light through photosynthesis. Without light, a plant would not be able to produce the energy it needs to grow. Plants need air for two purposes. They use carbon dioxide to make their own food. They also need oxygen to break down food for energy. Plants need suitable temperatures for proper growth, and water is essential for the germination of seeds and the growth of plants. Therefore, what will happen to the plant if we keep it in a dark place? And what will happen to plants if there is no air?

The learner watches a video clip from the web link <https://bit.ly/3nuJVUF> or from other relevant sources to learn about the conditions required for the growth of a plant and list those conditions.

After watching the video clip, the learner then in a team design and carries out experiments to investigate the effect of light, air, temperature and water on the growth of a plant respectively. The learner begins the investigation with light, followed by water, then air and finally the effect of temperature. The learner carries out the four different types of experiments over an extended period of time.

The learner regularly observes the plants and records data. The learner identifies dependent, independent, and controlled variables for each experiment.

The learner then presents the findings from each experiment to the class and answers the following questions:

1. A potted plant kept near the window bends towards sunlight. Give reasons.
2. How does the amount of water affect the growth of a plant?
3. How does the temperature affect the growth of a plant?
4. How is air and the growth of a plant related?

Thus, for a plant to be healthy, light, air, temperature and water are important. Can you name some other conditions besides these four conditions?

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner's understanding of the conditions required for the growth of a plant, dependent, independent and controlled variables. 	<ul style="list-style-type: none"> Assess the learner's ability to investigate the effects of light, air, temperature and water on the growth of plants and identify the variables. 	<ul style="list-style-type: none"> Assess the learner's understanding of the significance of these conditions on the growth and development of a plant.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Conditions required for growth: <https://bit.ly/3nuJVUF>

1.4.2 Flower

Scope: This topic focuses on different parts of a flower such as a pedicel, sepal, petal, filament, anther, stigma, style and ovary.

Learning Objectives:

- *Identify the basic parts of a flower using different flowers from the surroundings.*
- *Explain the flower with the help of a well labelled diagram.*
- *Explain the importance of flowers in a plant's life.*
- *Explain the impact of climate change on flowering of plants.*

Learning Experiences

A flower is the most attractive part of a plant. It is the reproductive part of a plant. Some flowers have both male and female parts, while some have only one part. Flowers produce seeds that can become new plants. What are the different parts of a flower?

The learner watches a video clip from the web link <https://bit.ly/3q6fGoT> or from other relevant sources to collect information on different parts of a flower and writes down the names of those different parts.

The learner collects a flower from the school garden, observes it carefully and identifies these parts: pedicel, sepal, petal, filament, anther, stigma, style, and ovary.

Then, the learner draws a labelled diagram of a flower and answers the following questions:

1. What is the male and female part of a flower called?
2. What does stamen consist of?
3. What are the different parts of a carpel?

A flower is an important part of a plant. The primary function of a flower is reproduction. Stamen is the male part of a flower made up of an anther and filament. Carpel is the female part of a flower made up of stigma, style and ovary.

Learners explore and gather scientific concepts on how climate change including changes in temperature and precipitation patterns impacts the flowering of plants in several ways.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's understanding of different parts of a flower.	<ul style="list-style-type: none">● Assess the learner's observation skills while identifying different parts of a flower.	<ul style="list-style-type: none">● Assess the learner's curiosity while performing tasks and ability to analyse the importance of flowers.

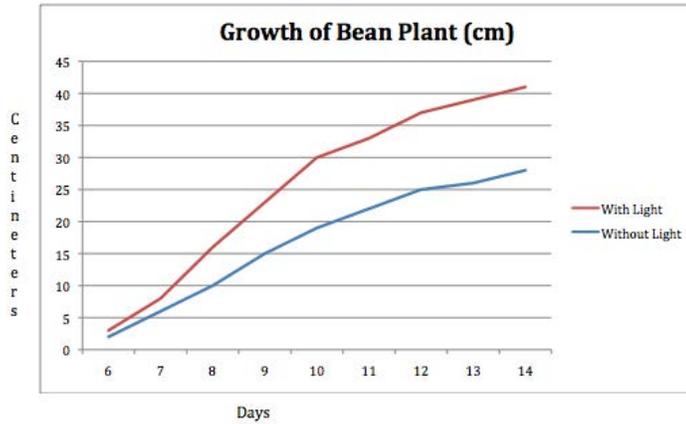
For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Parts of a flower: <https://bit.ly/3q6fGoT>

Challenge Your Thinking

1. Discuss the importance of a flower in the life of a plant.
2. Reflect on your experience in a garden. Why do bees hover over flowers?
3. Explain the roles of water and temperature on plant growth.
4. Study the graph provided:



Source: <https://www.google.com/search?q=plant+growth>

- What is the greatest height reached by the plant?
- How long does the plant take to reach that height?
- What can you conclude from the graph?

2. Materials and their Properties

2.1 Classifying Materials

Everything in this universe is made up of material which scientists have named “matter”. The objects around us are made up of these materials, and each of these materials is unique. They differ from each other on the basis of different properties such as composition, hardness, transparency and appearance. These properties can be used to classify things to make appropriate use in our life.

Competency

Investigate the transmission of light through materials and state of matter to understand their application in daily life.

2.1.1 Materials in Our Surrounding

Scope: This topic begins by observing the things in the surrounding and sorting them into transparent, translucent, opaque, etc.

Learning Objectives:

- *Explore various materials in the surrounding to study the transmission of light through it.*
- *Classify the materials in the surroundings into transparent, translucent, and opaque objects based on the transmission of light.*
- *Explore the use of transparent, translucent, and opaque objects in daily life.*

Learning Experiences

Materials are used to make objects around us. Each of these materials has different properties. Materials with different properties are used for different purposes. Why do we use glass for window panes? or why car windshields are made up of glasses only?

The learner explores the information on the properties of materials such as transparent, translucent and opaque from the web link <https://youtu.be/8rrnMOjIGjI> and notes the differences with appropriate examples.

The learner collects various materials from the surroundings and classifies them into transparent, translucent and opaque objects based on their properties. The learner shares their work with the class for feedback and comments. Based on the activity, the learner answers the following questions:

1. Your parents are planning to make a house. Which material would you prefer for window panes, glass or wood? Why?
2. Based on the amount of light that passes through them, write the difference between a transparent bottle, frosted glass and black paper.

The learner writes the uses of each classified material. Materials can be classified based on the amount of light they allow to pass through them. Materials, which allow light to completely pass through them are called transparent. Any object can be seen through transparent material. One example of transparent material is pure glass. Opaque materials either reflect or absorb any incident light. As a result, light rays

cannot pass through opaque materials. Wood, stone, etc. are opaque materials. Translucent materials allow a small amount of light through them.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">Assess the learner's conceptual understanding of transparent, translucent and opaque objects.	<ul style="list-style-type: none">Assess the learner's ability to classify materials into transparent, translucent, and opaque.	<ul style="list-style-type: none">Assess the learner's ability to justify the use of transparent, translucent and opaque objects for different purposes.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Transparent, translucent and opaque concept: <https://tinyurl.com/323twp6e>
6. Transparent, translucent and opaque concept: <https://youtu.be/8rrnMOjIGjI>

2.1.2 States of Matter

Scope: This topic begins with understanding the characteristics of matter through investigation, its states [solid, liquid, gas and plasma] and their characteristics [mass, volume and shape].

Learning Objectives:

- *Explain matter and classify the states of matter.*
- *Verify that all three states of matter have mass.*
- *Investigate the shape and volume of three states of matter.*

Learning Experiences

Every material around us is composed of matter. The air we breathe, the food we eat, stones, clouds, stars, plants and animals, even a small drop of water or a particle of sand – everything is matter. What other things do you know about the matter? Why should one know about the matter?

The learner watches a video from the link <https://tinyurl.com/3y46544k> to explore more about the matter and lists the characteristics of matter.

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The learner looks around the classroom and school surroundings to list at least five examples of matter. And answers the following questions:

1. Is chair a matter? Give reasons.
2. Is shadow a matter? Give reasons.

The learner explores the given web link <https://youtu.be/LqFrYYPFztLE> and <https://tinyurl.com/bdebdwtp> to know about the different states of matter and their properties.

Based on the properties of matter, the learner then designs and performs an experiment to prove that solid, liquid and gas are matter, and presents it to the class for peer feedback.

The learner further answers the following questions.

1. List the different states of matter. Provide examples for each state of matter that is found in your everyday life.
2. Why is the air used to inflate balloons?
3. Karma drank a bottle of juice and threw the empty bottle. As a science student, how can you justify that the bottle is not really empty?

To study the properties such as shape and volume of the three states of matter, the learner designs an experiment in teams and demonstrates it to the class. The learner then records the findings based on the experiment and answers the question given below:

1. Explain the three states of matter based on their mass, shape and volume.

The matter is anything that has mass and occupies space. And, it can be found in three main states with their own properties of shape and volume.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's conceptual understanding of matter and states of matter.	<ul style="list-style-type: none">● Assess the learner's ability to design and perform experiments and classify materials into different states of matter.	<ul style="list-style-type: none">● Assess the learner's understanding of the application of three states of matter based on its properties, in everyday life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Matter: <https://tinyurl.com/3y46544k>

6. States of matter: <https://youtu.be/LqFrYPFztLE>
7. States of matter: <https://tinyurl.com/bdebdwtp>

Challenge Your Thinking

1. Computers, ox, orange juice, house, car, football, and smoke are all examples of matter. Give two characteristics that qualify them as matter.
2. Observe the things in and around your house and sort them into transparent, translucent and opaque.
3. A slab of stone can be carried without any container. But water needs a container. Explain.
4. Is liquid a matter? Why?
5. In the three boxes, write the names of things that are most important to you.

Most important solid in your life	Most important liquid in your life	Most important gas in your life

6. Which state(s) of matter takes the shape of the container they are placed in?

2.2 Materials and Change

Materials exist either in pure form or mixtures. They undergo changes in a variety of ways either naturally or artificially. There are many conditions that bring change in materials. Change in materials brings about the alteration in the properties of matter and helps people to use them in their daily lives. How would your life be if no changes are happening in and around you?

Competency

Investigate the physical process (heating and cooling) and types of mixtures to understand the importance of physical processes in daily life.

2.2.1 Heating and Cooling

Scope: This topic introduces the learner to the processes of heating and cooling which results in melting and freezing.

Learning Objectives:

- *Explore the process of heating and cooling.*
- *Investigate the effects of heating and cooling on materials.*
- *Explain the importance of heating and cooling in daily life*

Learning Experiences

Change in temperature is one of the conditions required for bringing change in substances. For instance, increasing temperature (heating) makes objects burn, dried up, break off and melt. It mainly brings a change in the states of the matter. For example, ice cream (solid) melts when exposed to sunlight (heating), and water (liquid) becomes ice when put into the refrigerator (cooling). Do you sometimes wonder how and why changes take place around you?

The learner explores more about melting and freezing by watching a video from the web link <https://tinyurl.com/2p9afy77>

After watching the video, the learner collects some materials which they think (predict) will melt on heating and freeze on cooling.

The learner in the team carries out an experiment by heating and cooling to test their predictions. The learner records their predictions and observations in the following format:

Table 2.1. *Observation table*

Name of the materials	Prediction before observation		Observation during experiment		Materials that have not undergone any changes
	Materials that will melt on heating	Materials that will freeze on cooling	Materials that have melted on heating	Materials that have frozen on cooling	

After carrying out the experiment, the learner shares the findings to the class and explains why the predictions were right or wrong. Based on the activity, the learner answers the following questions:

1. Which predictions were correct?
2. What can you conclude from your investigation?
3. Do you think heating and cooling are important in our everyday life? If so, list a few examples.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner’s conceptual understanding of melting and freezing as a result of heating and cooling respectively. 	<ul style="list-style-type: none"> Assess the learner’s ability to experiment and investigate things that can melt and freeze by heating and cooling 	<ul style="list-style-type: none"> Assess the learner’s ability to relate the application of heating and cooling in everyday life.

	respectively.	
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For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Effects of heating and cooling: <https://tinyurl.com/2p9afy77>

2.2.2 Materials in Mixtures

Scope: This topic focuses on investigating pure substances, soluble and insoluble substances. Also, mixtures and their types [solid-solid, solid-liquid, and liquid-liquid mixture.

Learning Objectives:

- Explain pure substances and mixtures with examples.
- Classify the mixtures into solid-solid, solid-liquid, and liquid-liquid mixture with examples.
- Distinguish between soluble and insoluble substances using simple experiments.
- Relate the importance of mixtures and solutions in daily life.

Learning Experiences

We are surrounded by many different substances. You have already learnt that these substances around us can be classified into solid, liquid or gas. Some of them are pure and others are mixtures. Mixtures contain one or more pure substances. Therefore, substances can be classified as pure substances and mixtures. Can you think of any pure substances and mixtures that you see every day?

The learner explores mixture and pure substances from the web link <https://tinyurl.com/yesym5z7> and lists down some examples of mixtures and pure substances that they see and use on a daily basis.

The learner can test their understanding by answering the following questions:

1. What are impurities?
2. How can we differentiate pure substances from a mixture?
3. Write down any two situations where you use mixtures.
4. Why are mixtures important to people? Give examples.

Mixtures can be classified as solid-solid, solid-liquid and liquid-liquid mixture based on the nature of the components in the mixture. The learner uses the link <https://tinyurl.com/yc8y2mrt> to explore the types of mixtures and their examples.

The learner in teams then prepares different types of mixtures by using locally available materials and records by using drawings or taking photographs. The learner writes a brief description of each type of mixture.

Have you ever poured sugar into your tea and stirred it? Why does the sugar seem to disappear?

The learner performs an experiment to test the solubility of different solids in water, records the results and answers the following question.

1. You are asked to prepare tea with tea leaves, water, milk and sugar. Describe the solubility of each component of the mixture.
2. How does the solubility of each component affect the quality of the tea?
3. In solid-liquid mixtures, some solid dissolves in liquid while some do not. Explain soluble and insoluble substances.
4. What liquid-liquid mixture does your mother give you at home?

The learners in groups read the case study on the importance of mixtures and solutions in daily life.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's conceptual understanding of pure substances, mixtures and solubility.	<ul style="list-style-type: none">● Assess the learner's ability to classify substances into pure and impure, and soluble and insoluble substances.	<ul style="list-style-type: none">● Assess the learner's understanding of applications of pure substances, mixtures and solubility in everyday life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Pure substances and mixtures: <https://tinyurl.com/yesym5z7>
6. Types of mixture: <https://tinyurl.com/yc8y2mrt>

Challenge Your Thinking

1. Is orange squash a pure substance? Why?
2. In cold winter, water changes into ice but during the day, the ice again melts into water. Explain how this change is important for people.
3. Emma Datshi is a mixture of chilli, onion, tomato, salt and cheese in water. In this mixture, all the components are visible except salt. Give a reason why we cannot see salt in the mixture.
4. You are provided with rice, water, stones, sugar and orange juice. Make as many mixtures using these items and classify them as a solid-solid, solid-liquid and liquid-liquid mixture.
5. Explain whether you can classify each of the following items as a pure substance or a mixture: apple juice, salt, distilled water and tea.

6. Explain how heating and cooling bring about a water cycle in nature. Why is the water cycle important for us?
7. Identify some important physical processes for living things brought about by heating and cooling.

2.3 Separating Mixtures

Separation is a method of separating a mixture into its components. Different separation techniques are used to separate components of different mixtures. For example, the solid-liquid mixture can be separated using separating techniques like sedimentation, decantation and filtration. These methods are important to get substances from the mixture for use in our life.

Competency

Demonstrate various methods of separation of mixtures (sedimentation, decantation, and filtration) to illustrate their applications in everyday scenarios.

2.3.1 Methods of Separation

Scope: This topic begins with introducing what separation is, and different techniques of separating mixtures such as [sedimentation, decantation and filtration] for separating insoluble solids from the solution.

Learning Objectives:

- *Explain the process of sedimentation, decantation, and filtration.*
- *Demonstrate separation of insoluble solid from the solution by sedimentation, decantation, and filtration.*
- *Explains the application of sedimentation, decantation, and filtration in everyday life.*

Learning Experiences

Substances that we eat, drink, or use contain soluble and insoluble substances. Some of them are useful and some may be harmful. Therefore, we need to remove them. For example, we do not drink tea mixed with tea leaves. We use a strainer to separate them while pouring the tea into the cup. Different mixtures can be separated using numerous methods of separation. What happens to water after heavy rainfall? What would you do to make muddy water drinkable?

The learner watches the video from the web link <https://youtu.be/sBCLafMPVt8> to understand sedimentation, decantation and filtration methods to separate the solid-liquid mixture.

The learner designs an experiment to demonstrate sedimentation, decantation, and filtration to separate insoluble solids from solid-liquid mixtures.

Based on the understanding, the learner answers the following questions:

1. Explain sedimentation, decantation and filtration based on your understanding.
2. Which method best separates muddy water in a beaker? Explain.

The learners in a team discuss the list of given mixtures. Then find out which mixtures can be separated by sedimentation, decantation, and filtration.

Mixtures of insoluble solids in liquid can be separated by the method of sedimentation, decantation and filtration. These methods are only possible if the mixture consists of one insoluble solid mixed with a liquid. These methods of separation can be applied as per the mixture found in surroundings and according to the individual's needs.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">Assess the learner's conceptual understanding of separation, sedimentation, decantation, and filtration.	<ul style="list-style-type: none">Assess the learner's ability to design an experiment and separate the insoluble solid from the solid-liquid mixture.	<ul style="list-style-type: none">Assess the learner's understanding of the importance of separating mixture and its application in everyday life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

- Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
- National School Curriculum Framework for Science
- REC repository
- Science Class Four (2020), REC
- Separating methods: <https://youtu.be/sBCLafMPVt8>

2.3.2 Making Water Safe for Drinking

Scope: This topic incorporates ways to make water safe and clean for human consumption.

Learning Objectives:

- Explain ways to make water safe for drinking.*
- Design a simple filter for purifying muddy water to make it drinkable.*
- Justify that safe drinking water is important for people.*
- Relate climate change with occurrence of waterborne diseases.*

Learning Experiences

Bhutan has fresh and clean water sources from the snow peak mountains, lakes, springs, streams, etc. Water is essential for all living beings. Roughly 70% of our body consists of water. Our body needs clean water for good health. However, water is made dirty by people and natural events. What would happen if we drink unclean water?

The learner lists the effects of drinking unclean water through relevant resources and presents them to the class. Furthermore, the learner explores through a web link <https://youtu.be/UxVMTx-v11Y> or any other relevant sources to make water safe for drinking. Based on the information gathered the learner answers the following questions:

1. Why is it advisable to filter and boil water before drinking?
2. Which method best suits you for making water safe for drinking at your home? Give reasons.

The learner then designs a water filter to purify the water using the available resources from their locality and demonstrates it to the class. Based on the experiment, answer the following questions:

1. What role do gravel, sands and charcoals play in the filtration of water?
2. In which order should gravel, sand, charcoal and filter be kept in the designed filter?
3. Which would you prefer, charcoal powder or charcoal granules? Give a reason.

Water is one of the basic needs of life. However, drinking unclean water risks our life with diseases, thus it is of utmost importance to have safe and clean drinking water. Therefore, one must filter and boil the water to have safe drinking water.

Learners in groups read the article on “how climate change affects waterborne diseases” from the web link <http://tinyurl.com/5frueztj> and complete the table given below.

Learners share their findings on how climate change causes waterborne diseases with the class.

What are waterborne diseases caused by?	Some of the waterborne diseases are?	How is climate change increasing the risk of waterborne diseases?	What are the risks?	What can be done to reduce the risk?

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
● Assess the learners on	● Assess the learner’s ability	● Assess the learner's ability to

explaining the ways of making water safe for drinking.	and skills to design simple filters.	understand the importance of safe and clean drinking water for a healthy life.
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For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Methods to purify water: <https://youtu.be/UxVMTx-v11Y>

Challenge Your Thinking

1. A teacher provides a student with 150 mL of water containing sand and sawdust. Write the steps that you will use to separate the water, sand and sawdust.
2. Explain why decantation cannot be used to separate the mixture of salt and water.
3. Why is it unsafe to drink water straight from the tap?
4. Why is diarrhoea common among children during summer?
5. In summer, drinking water is usually muddy. How would you make it clean?
6. You are carrying out an experiment to separate a mixture of chalk powder and water. Which process do you think would best separate the mixture and why?
7. Why is filtration more effective than decantation?
8. What are the two situations where sedimentation and decantation are used?

3. Physical Processes

3.1. Forces and Motion

Everything around us is in motion. The object moves only if it is pushed or pulled. This push or pull is called force. We cannot see force, but it makes an object move, change shape or change its direction. Different types of forces exist in nature. When an object is put into water, it pushes the object upward creating an upward force called buoyancy. An object with a weight greater than the buoyancy sinks, while an object with a weight lesser than buoyancy floats.

Competency

Investigate the effects of forces and floating and sinking phenomena, to comprehend the impact of both force and density.

3.1.1 Types of Forces

Scope: This topic begins with the introduction of the concept of force and motion and types of forces [contact and non-contact forces]. The contact force includes push and pull, and the noncontact force includes gravitational and magnetic force. It also discusses the effects of force.

Learning Objectives:

- *Explain force and motion.*
- *Explore the types of force with examples.*
- *Investigate the effects of force.*
- *Explain the significance of force in everyday life.*

Learning Experiences

When we look around us, we can see leaves falling from trees, prayer flags fluttering in the wind and people moving many things. What causes things to fall, flutter and move?

The movement of an object from one place to another is called motion. Motion is also considered a change in the position of an object. Have you ever wondered why objects remain in the same place if people do not displace it? Or what causes the motion?

The learner moves the objects by pushing or pulling to understand motion and its causes. For further understanding of force and motion, the learner watches the video from the link <https://bit.ly/3GFxTzc>.

Based on your understanding, answer the following questions:

1. Explain motion based on your understanding of video
2. Draw the relationship between force and motion.

There are different types of forces namely contact force and non-contact force. Further, there are various effects of force. For a better understanding of different types of forces and its effects, watch the video from the link <https://bit.ly/33kUP8N>.

Then the learner explains the types of force by using the information gathered from the video. Based on the information gathered by watching videos, answer the following questions:

1. Explain force based on your understanding.

2. Categorise different forces that you use to do your daily activities.
3. Explain gravitational and magnetic forces with examples.
4. Compare contact and non-contact force with examples.
5. Mention the significance of force in our daily life.
6. Write the changes that a force can bring to an object

We cannot see force, but it makes an object move or changes its direction. Hence, force and motion are fundamental to all matter in the universe.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">Assess the learner's conceptual understanding of force and motion.	<ul style="list-style-type: none">Assess the learner's ability to identify different contact and non-contact forces.	<ul style="list-style-type: none">Assess the learner's understanding of the importance of force in daily life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science, (2022)
3. REC repository
4. Science Class IV (2020), REC
5. Force and motion: <https://bit.ly/3GFxTzc>
6. Contact and non-contact force: <https://bit.ly/33kUP8N>

3.1.2 Floating and Sinking

Scope: This topic introduces the concept of floating and sinking based on the density of an object in relation to a liquid.

Learning Objectives:

- *Explain density of a substance.*
- *Investigate the density of different solids in liquid.*
- *Justify the effects of density to demonstrate the understanding of floating and sinking.*

Learning Experiences

When various objects are put into water, some stay on the surface (float), while some sink to the bottom of the water. Did you see objects floating and sinking in the water? Why does this happen? And how do people use floating and sinking in their lives?

The learner watches the video from the link <https://bit.ly/3liNPb1> to understand what makes objects float or sink. Then the learner gathers different objects and predicts whether they will float or sink in a liquid. Then, the learner carries out an experiment to investigate the floating or sinking of objects in a liquid. After that, the learner compares the prediction and post-experiment results and explains floating and sinking based on the density of an object. The learner may use the following table to record the observations.

Table 1.1. Floating and sinking

Objects	Predict	Observe	Explain

Put an orange in the jar containing water. What would happen to the orange? Then, peel off the cover of the orange and put it in the water. What would happen to the peeled orange? Give a reason for your answer. For further understanding of the floating and sinking of objects in a liquid, watch the video from the link <https://bit.ly/3GDnNiz> and answer the following questions:

1. Name three objects we use everyday that float in water.
2. If a paper boat is placed in a bucket of water, what would happen to it? Give reasons.
3. Some objects float while others sink in water. Justify the statement.
4. Why does a swimmer flap his arms and feet while swimming?

Floating and sinking are a part of everyday life. An object's ability to float depends on its density. Objects float if they are less dense than the liquid they are in, and objects sink if they are denser than the liquid they are in. All the materials in the surroundings have their own mass and occupy space. So, different materials have different densities. Therefore, whether an object floats or sinks depends on its density. Explore for more information on density, and how it affects our life.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's conceptual understanding on density.	<ul style="list-style-type: none">● Assess the learner's ability to predict and sort the floating and sinking objects.	<ul style="list-style-type: none">● Assess the learner's understanding of the importance of density in daily life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC

2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Sink or float video: <https://bit.ly/3GDnNiz>
6. What makes object float or sink: <https://bit.ly/3liNPb1>

Challenge Your Thinking

1. When you dust a carpet, the dust on the carpet falls instead of rising up in the air. Explain.
2. Pema was playing with a magnet, and suddenly found a pin being attracted by the magnet though it did not touch the magnet. Identify the type of force occurring between the magnet and the pin.
3. List the effects of force that you observe in a moving car.
4. If you have to keep an iron nail afloat in water, what condition do we need to apply?
5. Design an experiment to find whether an object filled with air floats or sinks. Your write up on the experiment should include the followings:
 - a. Materials required
 - b. Procedures
 - c. Observations
 - d. Variables
6. Why does a football float in water?
7. Why do people use rubber tubes while swimming?

3.2. Energy

Everything that exists in nature possesses energy. It exists in different forms and comes from different sources. Energy can be changed from one form to another. Energy causes many changes in nature. Humans use energy to do everything in their lives. The sources of energy can get exhausted over time. Thus we must use energy wisely. One of the ways can be to create awareness about the use and saving of energy amongst the people.

Competency

Explore various forms of energy and ways to save energy.

3.2.1 Forms of Energy

Scope: This topic introduces energy, forms of energy and ways to save energy.

Learning Objectives:

- *Explain energy.*
- *Explore various forms of energy with examples.*
- *Investigate the use of energy in daily activities.*
- *Suggest ways to save energy.*

Learning Experiences

We need energy for everything that we do in our lives. Energy comes from various sources. All work that we do in our life needs energy. Therefore, energy is the ability to do work. There are different forms of energy to do different kinds of work. Do you know different forms of energy exist in nature?

We use energy in our daily life. At the same time, we also waste energy resulting in the wastage of resources. Therefore, it is important to understand how and why energy can be used and saved. People use different ways of creating awareness about saving energy. Why do you think it is important to save energy?

The learner watches the video from a web link https://youtu.be/1JdvH_8cz-I or any other relevant sources to understand the conversion of energy in nature. The learner in a team identifies different forms of energy used at home and in school and prepares a presentation using chart paper or other available materials and presents it to the class. Then, investigate the forms of energy through observation, such as burning candles, rotating fans, lighting torches, water dripping from the tap, etc.

The learner answers the following questions:

1. List down all different forms of energy that exist in nature.
2. Identify the following activities into different forms of energy and write them in the table.

(Flashlight, talking, fire, music, sun, birds singing, watching television)

Table 2.1. Classification

Forms of energy	Activity
heat	
light	
Sound	

3. Look in and around the classroom and identify the different forms of energy that are in use.

We waste lots of energy in our daily activities and it's our responsibility to make efficient use of energy. When we minimise energy usage, we lower impacts on the environment.

The learner watches the video from the web link <https://tinyurl.com/ymvphh2k> or from other relevant sources to understand how one can save energy and its benefits in our life. After watching the video, learners in a team or individually design posters on how to save energy and the importance of saving energy.

The learner presents the work to the class. Then display it in places like the classroom, library, home etc. to create awareness of ways and the importance of saving energy.

The learner answers the following questions:

1. How can you save energy both inside and outside of your home?
2. Explain how the wastage of energy affects oneself?
3. Suggest two ways to reduce energy consumption?
4. If you could use any source of energy for heating your food, which one would you use and why?

We are able to perform different tasks using energy. Light, sound, heat, wind, chemical, mechanical, potential and kinetic are some forms of energy that people use. As people use energy, it is used up and also wasted. There are many ways that we can use to save energy in our day-to-day life.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">Assess the learner's ability to conceptual understand about energy, forms of energy and ways of saving energy.	<ul style="list-style-type: none">Assess the learner's ability to investigate the uses of energy in daily life, explore ways to save energy and design posters to create awareness of the importance of saving energy.	<ul style="list-style-type: none">Assess the learner's participation in teamwork, and ability to identify the energy in one's own daily life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Energy and different forms of energy: https://youtu.be/1JdvH_8cz-I
6. Easy ways to save energy: <https://tinyurl.com/ymvphh2k>

Challenge Your Thinking

1. What is the name given to the source of energy created by the burning of decaying plant or animal waste?
2. Narrate the forms of energy involved while your mother prepares food in the traditional oven.
3. Is Bhutan saving energy when forest resources are being preserved? How?
4. Explain how your parents use and save energy at home.
5. Draw a diagram of any device that you can think of for saving energy.
6. Identify the forms of energy in the following objects in use:
 - a. Water falling from the cliff
 - b. Burning oven
 - c. Torch battery
 - d. Radio in use
7. Is it possible to reduce energy consumption without affecting human well-being?
8. "Saving energy is saving money". Do you agree with this statement? Justify with reasons.

3.3. Electricity and Magnetism

Electricity and magnetism are related effects that have many useful applications in everyday life. Electricity is one of the important forms of energy. There are different natural sources from which electricity can be generated. For example, water, wind, and burning coal are examples of sources of electricity. Electricity can also be stored in batteries. The flow of electricity can be understood by making a simple circuit.

A magnet is a rock or a piece of metal that can pull certain types of metal toward itself. Magnets are used in different things. For example, in hydropower generators, radios, and mobile covers. Can you name some more? All materials can be either magnetic or non-magnetic materials based on their magnetic properties.

Competency

Explore the sources of electricity, components of simple circuits and its construction, properties of magnets and magnetic substances to understand their applications in society.

3.3.1 Sources of Electricity

Scope: This topic includes the sources of electricity such as battery, wind, water and solar. It also deals with the importance of electricity for a healthy lifestyle.

Learning Objectives:

- *Identify different sources of electricity.*
- *Explain the roles of natural resources to produce electricity.*
- *Discuss the importance of electricity for a healthy lifestyle.*

Learning Experiences

Electricity is one of the most widely used forms of energy. There are different sources and ways of generating electricity. In Bhutan, it is produced by using water. Do you know why? The sun, wind and water are considered as clean sources of energy compared with fossil fuels.

The learner explores different sources of electricity from the web link: <https://bit.ly/3Hjl918> . After that, the learners list different sources of electricity. Based on understanding from the video, the learners answer the following questions:

1. Explain electricity based on your understanding.
2. What are the important sources of electricity in the video?
3. What are the sources of electricity used in Bhutan?
4. Explain how electricity is generated using water, sun and wind.

Learner further explores the uses of electricity in maintaining a healthy lifestyle from the link [Uses of Electricity and Its Applications In Day to Day Life](#). After reading the notes, the learner answers the following questions.

1. Provide two examples of how electricity is employed to maintain personal well-being.
2. In what way has electricity changed the lifestyle in your village or home?
3. Name two common uses of electricity in daily life.

Then, the learners in a team, discuss how the electricity is used at home and share the work in the class.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's understanding of the sources of electricity.	<ul style="list-style-type: none">● Assess the learner's ability to explain the generation of electricity using water, sun and wind.	<ul style="list-style-type: none">● Assess the learner's understanding of the importance of electricity.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Sources of electricity: <https://bit.ly/3Hj1918>

3.3.2 Circuits

Scope: This topic consists of the concept of a circuit and its components. It further includes the construction of simple circuits to demonstrate the flow of electricity.

Learning Objectives:

- *Explain the electrical circuit.*
- *Construct a simple electric circuit to demonstrate the flow of electricity.*

Learning Experiences

Electricity flows in the form of current through a closed path called a circuit. Some materials allow electricity to flow through them while others do not. For electricity to flow, a circuit must be complete.

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To understand the concept of the circuit, the learners may watch the video from the given web link <https://bit.ly/3FLvC52> or other relevant sources.

Then, the learner gathers the required materials available from the locality and constructs a simple circuit to demonstrate how the electricity flows in the circuit. In the process, the learner identifies the components used to construct the circuit. The learners answer the following questions to check their understanding of the topic:

1. Explain electric circuits based on your understanding.
2. What types of materials did you use to construct the simple circuit?
3. Explain the correct ways of constructing a simple circuit.
4. Suggest ways to check the working of the electric circuit after the construction.

The learners in a team, reflect and discuss the design of the circuit used at home and present in the class for feedback and comments from the friends and teacher.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's understanding of electric circuits.	<ul style="list-style-type: none">● Assess the learner's ability to construct simple electric circuits to investigate the flow of electricity.	<ul style="list-style-type: none">● Assess the learner's understanding of the importance of electricity for leading a healthy life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Electric circuit: <https://bit.ly/3FLvC52>

3.3.3 Magnet

Scope: This topic deals with what magnet is, magnetic and non-magnetic materials, and examples of things that use magnets.

Learning Objectives:

- *Explore magnets, magnetic and non - magnetic substances.*
- *Identify home appliances that use magnets.*

Learning Experiences

You might have experienced that some metal pieces such as nails, pins and needles when brought near the magnet, get attracted. However, not all the materials are attracted by the magnet. Did you ever think why? Magnets are used in various devices and play an important role in people's life.

The learner watches the video from the link <https://bit.ly/3JwexpR> and <https://bit.ly/3FI3akP> and <https://bit.ly/3tNKrkm> to understand what magnets are, their uses and the differences between magnetic and non-magnetic materials.

Then, the learner gathers different materials from their locality and investigates magnetic and non-magnetic materials using magnets.

The learner answers the following questions to check their understanding of the topic.

1. What is a magnet?
2. What are magnetic and non-magnetic materials?
3. Why do magnets attract other magnetic materials?
4. List down a few uses of magnets in our daily lives.

The learners in a team conduct an experiment to investigate the properties of a magnet and complete table 3.1.

Table 3.1. *Magnetic Properties.*

Substance	Observation	Conclusion (Magnetic or non-magnetic)

Further, the learners in the team design and construct a model to show how magnets are used and display their work in the class.

Magnets have a force to attract materials based on their magnetic properties. There are different types of materials in our surroundings. Some are attracted by the magnet and some are not. Those substances that are attracted by the magnet are called magnetic materials, and the substances which are not attracted are called non-magnetic materials.

Learners identify some of the home appliances that use magnets and present them to the class.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
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<ul style="list-style-type: none"> ● Assess the learner’s conceptual understanding of magnets and magnetic and non-magnetic materials. 	<ul style="list-style-type: none"> ● Assess the learner’s ability to investigate magnetic and non-magnetic materials using magnets and designing models to show the uses of magnets. 	<ul style="list-style-type: none"> ● Assess the learner’s understanding of the use and importance of magnets every day.
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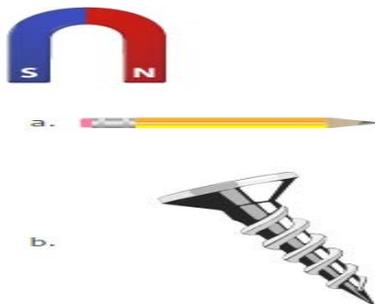
For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Magnetism: <https://bit.ly/3JwexpR>
6. Uses of Magnets: <https://bit.ly/3FI3akP>
7. Magnetic and non-magnetic: <https://bit.ly/3tNKrkm>

Challenge Your Thinking

1. What differences did you find between the new battery and the old battery when you are using them in the circuit? Why?
2. Describe in a few sentences’ life without electricity.
3. What will happen if you connect more batteries to the electrical circuit? Why?
4. If people throw waste into the river, will it affect the production of electricity? How?
5. While playing, Dema lost the gold ring on her finger. Can she use magnets to search for her lost ring in the grass? Justify your answer.
6. What properties of the magnet are used in the following?
 - a. Mobile cover
 - b. Compass
7. Which object will the magnet attract? Why?



8. If you try to attract a magnetic material by a magnet in the water, what will happen?
9. Explain the behaviour of a bar magnet if it is suspended freely with the help of a thread.

3.4. Light and Sound

Light and sound are forms of energy. Light helps us to see the world, while sound helps us in hearing and communication. Light and sound are crucial in helping people to appreciate the beauty of the Earth. Have you ever wondered how you see things around you? How are you able to enjoy the music?

Competency

Explore the concept of light and sound and their sources and properties to understand the significance in daily life.

3.4.1 Sources of Light

Scope: This topic begins with light as a form of energy that helps us see, sources of light, the primary source of light, and explains the importance of light.

Learning Objectives:

- Explain light as a form of energy.
- Identify different sources and primary sources of light.
- Explain the importance of light.

Learning Experiences

Light is produced by objects such as fire, sun and torch. Such objects are the sources of light. However, the primary source of light for the Earth is the Sun. There are many other sources of light that people use. What are the other sources of light that people use? Find out by carrying out a survey.

The learner in teams carries out a survey to find out as many sources of light people make use of within the school or the community, they live in. The learner represents the information using a graph and shares it with the whole class. Does the learner then answer the following questions as a follow-up of the survey:

1. What is the most common source of light used in the school or your community?
2. What conclusion can you draw about the common sources of energy in school and the community?
3. What are your suggestions on the use of sources of light in school and the community? Explain why?

Explore more about the importance of light using <https://impoff.com/importance-of-light/>

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> ● Assess the learner's conceptual understanding of sources of light. 	<ul style="list-style-type: none"> ● Assess the learner's ability to carry out the survey to find the sources of light used in the community. 	<ul style="list-style-type: none"> ● Assess the learner's ability to work in collaboration with the other learners in the team.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC

3.4.2 Properties of Light

Scope: This topic deals with properties of light and formation of shadow

Learning Objectives:

- *Explore the properties of light.*
- *Investigate the properties of light to understand its nature.*
- *Explain the formation of shadows.*

Learning Experiences

Have you ever wondered how and why shadows are formed or why you cannot see things behind a wall? The learner watches the video from the following web link <https://youtu.be/q5pzVJ197dc>. After watching the video, the learners design an experiment on their own, other than the one in the video to investigate the property of light under study.

Having completed the investigation, the learner answers the following questions:

1. In the experiment shown in the video, why was the light seen when the cardboards were aligned straight?
2. Why was the light not visible when one cardboard was moved?
3. What property of light does the experiment show?

Does the learner explore the following web link <https://mocomi.com/shadow/> on how shadows are formed?

After having read the article, the learner in teams carries out the following activity:

- I. Draw any cartoon character on a piece of cardboard.
- II. Cut out the drawing neatly.
- III. Attach the cut-out to a stand.
- IV. Take the stand with the cut-out near a whiteboard.
- V. Shine a torch on the cut-out from the side facing you.
 - a. What do you see on the whiteboard?
 - b. Why is the shadow formed?
 - c. What do you conclude from the experiment?

Shadow is formed only when light is present. The darkness of shadow depends on the brightness of the light. Shadow formed is less dark by a dimmer light than the shadow formed by a bright light.

Learner explores the following web link [What is a Shadow? - General Knowledge for Kids | Mocomi](#) on how shadows are formed?

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">Assess the learner's ability to explain how light travels and how shadows are formed.	<ul style="list-style-type: none">Assess the learner's ability in carrying out an investigation on the property of light	<ul style="list-style-type: none">Assess the learner's ability to work in a team.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Four (2020), REC
5. Rectilinear property of light: <https://youtu.be/q5pzVJ197dc>
6. What is a shadow: <https://mocomi.com/shadow/>

3.4.3 Sound

Scope: This topic begins with sound as a form of energy and production of sound through vibration.

Learning Objectives:

- Explain sound as a form of energy.
- Investigate how sound is produced.
- Explain the importance of sound in people's life.

Learning Experiences

Sound is a form of energy, which is necessary for communication. Unlike light, sound can travel in all directions. Have you ever thought of how sound is produced? Watch the short video from the link to find out <https://rb.gy/2fbmvi>.

Based on the understanding of the production of sound from the video, the learner in teams designs a simple experiment to show how sound is produced and demonstrates it to the class. The learner then answers the following questions:

1. What is a sound?
2. Explain how the sound is produced.
3. Analyse conditions needed for the production of sound.

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Explore the production of sound by using any materials around you. Vary conditions to prove that different sounds can be produced by the same object. Demonstrate in class.

Then,

1. Write what did you do? Why?
2. What conclusion can you draw from your innovations?

There are different sounds produced in the environment. Some are pleasant to hear while some are loud and unpleasant. The unpleasant sound is noise.

Learners in teams discuss the importance of sound in their daily life and present to the class.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's conceptual understanding of what and how sound is produced.	<ul style="list-style-type: none">● Assess the learner's ability to investigate how sound is produced.	<ul style="list-style-type: none">● Assess the learner's ability to work in collaboration with other learners during the experiment.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science, (2022)
3. REC repository
4. Science Class Four (2020), REC
5. How is the sound produced: <https://rb.gy/2fbmvi>

Challenge Your Thinking

1. Analyse the relationship between sound and light.
2. How would life be on the Earth if the light does not travel in a straight line?
3. What do you think would be the consequence if sound only travels in a straight line?
4. Study the picture and answer the questions that follow.



Picture Source: <https://www.google.com/search?q=sound+production+experiment>

- Describe the experiment demonstrated by the picture.
- How can you vary the sound?
- What conclusion can you draw from the experiment?
- Name one or two instruments that use this method of sound production.

3.5. The Earth and Beyond

The Sun is the source of light and has eight planets, moons and other heavenly bodies revolving around it. This makes a solar system and the Earth is part of this system. We live on the Earth. Our solar system is part of the universe. The Earth is the fifth largest planet in the solar system in terms of size and mass. Earth spins on its axis and moves around the sun.

Each planet has its own orbit around the sun at different distances. However, the Earth is the only planet in the solar system known to support life.

Competency

Explore the shape and movement of the Earth to understand their effects on the earth and life of people.

3.5.1 Our Earth

Scope: This topic includes the shape of the earth, rotation and revolution of the earth and their effects.

Learning Objectives:

- Explain the shape of the Earth.
- Demonstrate rotation and its effect on the Earth.
- Demonstrate revolution and its effects on the Earth.
- Explain the importance of movement of Earth in our daily life.

Learning Experiences

Like all the planets the Earth moves around the sun. It has two types of movements called rotation and revolution. Earth is tilted 23.5° degrees on its axis. Both rotation and revolution are important for all living beings on Earth. Do you know the shape of the Earth? Have you ever wondered what causes day and night? Have you ever wondered what causes a change in season?

Learners explore the shape of earth form the link [How is the shape of Earth|| Earth Shape || Spheroid || Oblate Shape||](#)

Watch the video from the web link <https://bit.ly/3HqianO> or <https://bit.ly/3F5cqOK>. Based on your understanding of the video, develop a model to demonstrate the rotation and revolution of the Earth around the sun and present it to the class with a short explanation. Then explore ideas to prove the shape of the Earth. Write what did you do?

Now, answer the following questions:

1. Explain the rotation and revolution of the Earth based on your understanding.
2. What would happen if the Earth didn't rotate and revolve around the sun?

3. Is the shape of the Earth flat? Justify?
4. Analyse the effects of rotation and revolution of the Earth on people's life.

In this activity, the teacher provides each learner with a globe and a torch each in the group. Using the materials provided, the learners in the group demonstrate the rotation of the earth and its effect. The teacher validates the demonstration and asks a few questions as follows:

1. What does the torch light represent in your demonstration?
2. What happens if the globe doesn't rotate?

The Earth moves around the sun all the time. A complete rotation of the Earth takes 24 hours, and a complete revolution of the Earth takes about 365 days. The Earth rotates toward the east, so the sun appears to rise in the east, move across the sky, and disappear in the west.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">Assess the learner's conceptual understanding of the shape of the Earth, its axis, rotation and revolution.	<ul style="list-style-type: none">Assess the learner's ability in information gathering skill, and skills of transforming the knowledge into the design and make models.	<ul style="list-style-type: none">Assess the learners through their abilities to relate the significance of Earth's movements to people's lives.

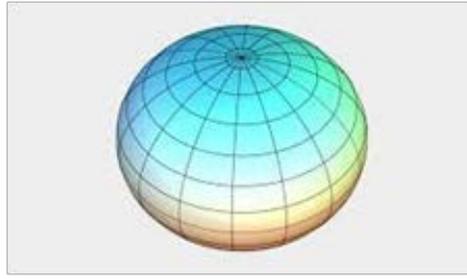
For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

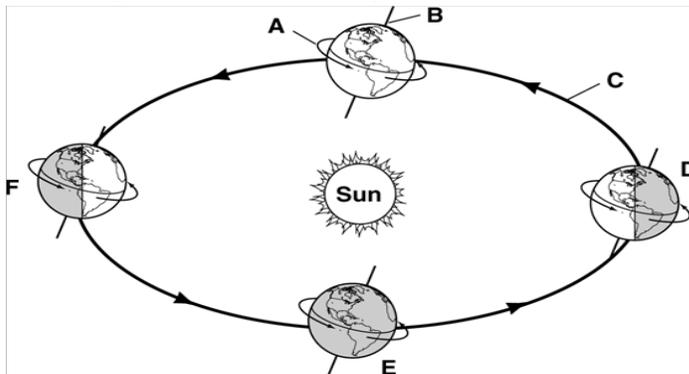
1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science, (2022)
3. REC repository
4. Science Class Four (2020), REC
5. The rotation and Revolution: <https://bit.ly/3HqianO>
6. The rotation and Revolution: <https://bit.ly/3F5cqOK>
7. Effects of rotation and revolution of the Earth: <https://bit.ly/3qpa9df>

Challenge Your Thinking

1. Compare the shape of the ball and the Earth.



2. Explain the causes of day and night and their importance.
3. Why are seasons not the same throughout the year in Bhutan?
4. Narrate your life without the Earth's revolution?
5. How many times does the Earth rotate on its axis in one year?
6. What would be living on the Earth if there is no rotation and revolution?
7. The Earth is a unique planet compared to other planets. Justify with two reasons.
8. Do rotation and revolution happen at the same time? Explain.
9. Explain with evidence that the Earth rotates around all the time.
10. Use the diagram to answer the questions.



- a. What is the line labelled B called?
- b. What is represented by the line labelled C?
- c. How long will it take Earth to move through one cycle from point D to point D?
- d. When Earth is at point F, does the Northern Hemisphere receive direct or slanted rays from the Sun?

INSTRUCTIONAL GUIDE FOR SCIENCE - CLASS V

1. Life Processes

1.1. Classification and Variation

You know that we live among living and non-living things. All plants, animals and microorganisms are living things. Each plant or animal has its own distinctive characteristics or features. There are many small differences in the characteristics among the individuals of the same plant or animal or different plants or animals. These differences among living things lead to a diversity of life on the earth.

Competency

Explore variations among organisms and their traits to understand the significance of the existence of diversity in life forms.

1.1.1 Variation

Scope: This topic focuses on what variation is, and features of different plants and animals and significance of diversity of plants and animals.

Learning Objectives:

- Explain variations in plants and animals.
- Explore the variations in plants and animals based on their size, colour and shape.
- Explain the significance of diversity of plants and animals in the ecosystem.

Learning Experiences

Plants and animals have their own unique characteristics or features. These characteristics are not exactly the same among the individuals of the same plant or animal. For example, not all dogs are exactly the same. There are small differences in the features of the dogs. Have you ever wondered what these differences are called? Why do these differences exist?

The learner takes a field trip to the school campus to study plants and animals. During the field trip, the learner observes a number of individuals of the same plant and compares their various features and records the similarities and differences in table 1.1. The learner may add as many features as possible in the table.

Table 1.1. Record table for plants

Feature of Plant	Similarity in Individuals	Difference in Individuals
Leaf		
Size of plant		
Flower		
Branch		

In a similar way, the learner compares a few individuals of the same animal in terms of their body features and records the similarities and differences in table 1.2. The learner may add as many features as possible to the table.

Table 1.2. Record table for animals

Feature of Animal	Similarity in Individuals	Difference in Individuals
Leg		
Tail		
Colour		
Eye		

After the field trip, the learner uses the information gathered to construct an explanation of features and variations in plants and animals. The learner may watch the video link <https://bit.ly/3HtbW72> or any information source to verify and validate the explanations constructed.

Draw and colour a few plants and animals to show the diversity among them. Paintbrush or other ICT apps can be used. Then answers the following questions:

1. Write down the similarities and differences observed in the plant leaves.
2. What similarities and differences did you find among animals?
3. What can you conclude from your observations of similarities and differences in the leaves and animals?
4. Why do you think individuals of plants and animals have differences in their features?

Every plant or animal has its own unique features. The features in the individuals of a plant or animal are not exactly the same. There are many differences in the features of the members of a particular plant or animal. These differences make plants and animals diverse and help them survive in the environment.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner’s ability to explain the concepts of characteristics/features and variations. 	<ul style="list-style-type: none"> Assess the learner's scientific skill to observe, sketch and compare and then identify features and variations in the plants and animals investigated during the field trip. 	<ul style="list-style-type: none"> Assess the learner’s understanding of the role of diversity of life on the earth.

For recording and reporting, refer to the National School Curriculum Framework in Science.

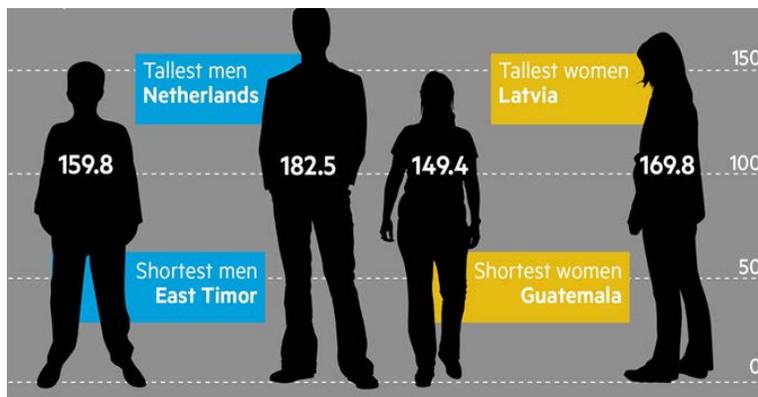
Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC

2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. What is variation link: <https://bit.ly/3HtbW72>

Challenge Your Thinking

1. Explain characteristics and variations with examples in your words.
2. Reflect and write how you are different from your family members.
3. Some birds have thick beaks, while others have thin and long beaks. Suggest your reasons for these differences.
4. Analyse variations in plants and animals.
5. Study the diagram and answer the following questions.



(Source: <https://bit.ly/34xRa06>)

- a. What feature is used to compare the different groups of people in the world?
- b. What can you understand about the world's people?
- c. What are the benefits of knowing this feature?

1.2. Living Things and Their Environment

All life forms need favourable conditions, food and shelter for their survival and health. An ecosystem is a place where living things can survive because it provides all the necessary food and shelter with suitable conditions. Therefore, an ecosystem consists of living and non-living things in a particular area. An ecosystem can be small, such as a flower garden, or large, such as the Amazon rainforest. It may be terrestrial, such as grassland, or it may be aquatic, such as a pond.

All of the organisms living within an ecosystem rely on each other for their survival. Each living thing is part of many different food chains, and all the food chains in an ecosystem make up a food web. Organisms in food webs are grouped into different trophic levels. All the resources should be in place for the energy to flow from one organism to another.

Competency

Explain the feeding relationships and interdependence of organisms to understand the impacts of human activities on their feeding relationship.

1.2.1 Food Web

Scope: This topic introduces what a food web is and discusses the interconnectedness of food chains to form a food web, impacts of human activities on their feeding relationship.

Learning Objectives:

- *Construct a food web using organisms found in the locality.*
- *Interpret the interdependence among different organisms in the food web.*
- *Explain the impacts of human activities on the feeding relationships in nature.*

Learning Experiences

All living things depend on each other and on the environment for their survival. Plants produce food for animals, and these animals' become food for other animals. This feeding relationship is known as the food chain. It shows a sequence of living things in which one organism depends on the one below it for food.

In an ecosystem, some animals depend on multiple animals for food, resulting in a network of feeding relationships. These interconnected food chains constitute a food web. A food web combines many separate food chains. In a food web, nutrients are recycled in the end by decomposers. How many food chains would be there in your surroundings?

The learner explores information about the food web and interdependence amongst organisms from the suggested web link <https://rb.gy/3wqtma> or watches the video link <https://tinyurl.com/2p9btxaw> or any other relevant resources. Explain their understanding of the food web to the class for further discussion.

Next, the learner plans and carries out field visits to a nearby area to observe organisms and their feeding relationship. Based on the information about the food web from the link and organisms found in their locality, the learner constructs a food web and shares it with the class for feedback and comments. Then the learner answers the following questions:

1. What is the difference between a Food Chain and a Food Web?
2. What is the role of worms, bacteria and fungi in a food web?
3. What effects can you expect with the food web, if one or two animals are removed from the food web?

Learners explore information about the food web from the web link <http://surl.li/pvcvo> to develop a deeper understanding of interdependence in the food web. Learners discuss and answer the questions given below:

1. Do you think one food chain is enough to balance or maintain a healthy ecosystem?
2. If one of the organisms is removed from your food web, which organism will be affected and why?
3. How can you make sure that the food web is not disturbed in the environment? Share some points based on your understanding.

Based on the picture shown by the teacher, learners in groups would discuss each activity to determine the impact on the local environment and the feeding relationships among organisms.

A food web is essentially a visual representation of who eats who in a given habitat, but in more technical terms, it charts the flow of energy from one set of organisms to another. Plants are the base of all food webs on earth.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">Assess the learner's conceptual understanding of the food web and the interconnectedness of food chains to form the food web.	<ul style="list-style-type: none">Assess the learner's ability to observe the organisms in their locality and construct the food web.	<ul style="list-style-type: none">Assess the learner's realisation of how organisms are important for interdependence.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. Food web: <https://rb.gy/3wqtma>
6. Disruption of the food web: <https://tinyurl.com/2p9btaxaw>

1.2.2 Threat to Habitat

Scope: This topic begins with the study of the various human activities that cause destruction of habitats and measures to save habitats. It includes threatened plants and animals and measures to save them.

Learning Objectives:

- *Explore various human activities that pose a threat to habitat.*
- *Suggest some ways to conserve habitats.*
- *Identify threatened plants and animals in the locality and suggest measures to save them.*

Learning Experiences

Habitats are constantly changing due to natural processes such as drought, fires, earthquakes, and disease, or due to human activities. Habitat change or destruction can be a serious issue for many animal and plant species living there. Habitats are fragile, so even small changes can have big effects.

The loss of habitats due to major habitat changes or destruction is probably the greatest threat to the variety of life on this planet today. Habitats continue to disappear with an increase in the human population and their activities. Some species can benefit from habitat changes, whereas others suffer or even die out. Have you ever wondered how the needs of humans lead to the loss of life from the environment?

The learner watches the suggested web link <https://tinyurl.com/muwuxz4v> and in a small team explores and notes various human activities in their locality that alter and pose threat to the habitats. Make video clips of what you observed.

In addition, the learner in the same team discusses and creates a video on habitat found in their locality and the ways to conserve it. Later, upon completion of the video, the team uploads and shares it in their social media platform to advocate the community on the conservation of habitats in the locality.

To check their understanding of the topic, the learner answers the following questions:

1. Explain the habitat
2. How can habitats change?
3. Mention a few human activities that posed threats to the habitat.
4. Explore ways to conserve habitats that are in danger.

Next, the learner plans and carries out a small survey of their locality to identify the threatened animals and plants. The learner discusses the measures to save threatened animals and plants with the class.

Finally, the learner answers the following questions:

1. List down all the threatened animals and plants in your locality.
2. What are the threats to the animals and plants in the locality?
3. Mention a few ways to conserve the threatened plants and animals.

The loss and degradation of natural habitat is the main factor contributing to the decline of species in many parts of the world. The world's habitats continue to disappear as they are cleared to make way for agriculture, housing, roads, and industrial development. Therefore, it is the primary responsibility of humans to preserve and protect animals and plants to protect the Earth.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's conceptual understanding of human activities and their impact on habitat destruction and ways to conserve the threatened plants and animals.	<ul style="list-style-type: none">● Assess the learner's ability to advocate for the community to save habitats and threatened plants and animals.	<ul style="list-style-type: none">● Assess the learner's realisation of how organisms and the environment are important for interdependence.

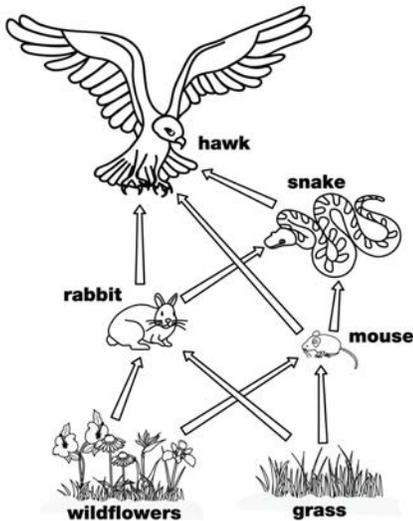
For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. Human impact on habitat: <https://tinyurl.com/muwuxz4v>

Challenge Your Thinking

1. There are many animals which are harmful to us. However, all animals are important in a food web. Explain.
2. Describe what would happen if one link of a food chain is removed.
3. Why is the black-necked crane an endangered species?
4. Why does our government put restrictions on collecting cordyceps?
5. Explain why threats to the environment cause changes in the ecosystem?
6. Answer the following questions using the figure given beside.



- a. One group of organisms is not shown in the food web. These organisms are very important in maintaining the food web. What is this group of organisms?
- b. How does this group of organisms help to maintain the food web in a balanced state?
- c. Give two examples of the organisms.
- d. Identify the ultimate source of the food.

1.3. Human and Animal

Our bodies are made up of multiple systems working as a team. Each system in the human body has a special function. The skeletal system gives support and structure to the body so that you can stand up.

Each of these systems also interacts with the others. For example, the bones in your skeletal system would not be very useful without the muscular system to help them move around. The functioning of muscles is coordinated by your nervous system. Similarly, the digestive system provides the nutrition required by the other systems in your body to function. The circulatory system carries food and oxygen around the body and the reproductive system is responsible for the continuity of life. All these systems need to interact with each other for the proper functioning of the body.

Competency

Explain different life processes (circulation, movement and reproduction), nutrients, and types of nutrients to recognize their roles in proper functioning of an organism.

1.3.1 Nutrition

Scope: The topic introduces food nutrients [macro and micro] which includes carbohydrates, proteins, fats, vitamins, minerals, and water with examples. It also deals with a balanced diet and food guide pyramid with significance for the body.

Learning Objectives:

- Explain macronutrients and micronutrients with examples.
- Explain a balanced diet and state the importance of eating a balanced diet.
- Construct a food guide pyramid to promote healthy eating habits.

Learning Experiences

Food provides the nutrients that our body needs for its proper functioning. Nutrients consist of macronutrients and micronutrients. Macronutrients are eaten in large amounts and include the primary building blocks of your diet. Micronutrients are nutrients that a person needs in small doses. Although the body only needs small amounts of them, a deficiency can cause ill health.

The Food Guide Pyramid shows the types and serving sizes of foods we should eat every day to stay healthy. The pyramid is constructed by placing the group of foods that we consume in large quantities at the base. Above it, is the group of food that we need less than the first. The group of foods that we need least is placed at the top. We should eat more of the foods at the base than the foods at the top. Think of your daily meals. Are you eating right? Are you getting your recommended daily servings of nutrients?

The learners work in teams to explore information on food nutrients, macronutrients and micronutrients from the video links: <https://bit.ly/3pVecNV> and <https://bit.ly/3Hz2Vc8> respectively. Using the information from the video, they list down the food they eat every day and segregate nutrients into macronutrients and micronutrients.

Learners watch a video to explore and gather scientific concepts of a balanced diet from the link <https://bit.ly/3va7ICf> and read the article from the link <https://bit.ly/3YNnD1i>, and answer the questions that follow.

1. What is a balanced diet?
2. Why is a balanced diet important for a child?
3. List some consequences of not eating a balanced diet.

Learners then perform tasks given in the worksheet from the link <https://bit.ly/3WDuicz> for further understanding of the topic.

Based on the understanding from the video links and through their discussion, the learners answer the following questions:

1. What is the function of carbohydrates and proteins?
2. Explain the importance of macro and micronutrients with examples.

3. What are the effects on your body, if you do not eat fruits and vegetables?
4. Why is water an important part of our diet?

Next, the learner goes through the link <https://bit.ly/3HFGge7> to analyse the importance of the food guide pyramid in promoting healthy eating habits.

Using the information gathered and the food guide pyramid chart, the learner creates a balanced diet plate in teams and presents it to the class for discussion. Next, the learner answers the questions below:

1. Explain the benefits of eating a balanced diet.
2. Explain the importance of the food guide pyramid in promoting healthy eating habits.
3. Construct a food guide pyramid for your family with the foods available in your locality.

Food is the source of all nutrients required by the body. Some nutrients are required in large amounts and some are required in small amounts. The food guide pyramid helps you to understand the type and amount of food one should eat for a balanced diet and better health.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's ability to explain the food nutrients and their function with examples, and the benefits of eating a balanced diet.	<ul style="list-style-type: none">● Assess the learner's segregation skills while segregating foods into macronutrients and micronutrients and the critical thinking skills while creating a balanced diet plate from the food guide pyramid and the presentation skills while presenting their work to the class.	<ul style="list-style-type: none">● Assess the learner's understanding of the significance of a balanced diet and food guide pyramid for promoting healthy eating habits.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. Food nutrients: <https://bit.ly/3pVecNV>
6. Macro and micronutrients: <https://bit.ly/3Hz2Vc8>
7. Food Guide Pyramid: <https://bit.ly/3HFGge7>

1.3.2 Healthy Habits

Scope: This topic focuses on the impacts of consuming junk food, tobacco, alcohol, drugs on our health and lifestyle. It also discusses the causes, impacts and prevention of malnutrition [undernutrition and overnutrition] and calculation of Body Mass Index [BMI] and its significance

Learning Objectives:

- *Discuss the impacts of consuming junk foods, tobacco, alcohol, and drugs on our health.*
- *Discuss the causes, impacts and prevention of malnutrition based on undernutrition and overnutrition.*
- *Calculate Body Mass Index (BMI) and explain the significance of knowing their BMI to maintain good health.*
- *Justify why a healthy eating habit is necessary for one's own health.*

Learning Experiences

A healthy habit is any activity or behaviour that can benefit your physical, mental, or emotional well-being. Eating healthy food is one of the ways to maintain good health. Consumption of unhealthy foods can cause malnutrition. In order to keep your health, it is crucial to find your Body Mass Index [BMI]. It is an indicator of your good health; hence, it needs to be examined routinely.

The learner works in a team to analyse the following:

1. Effects of consuming junk foods, tobacco, alcohol and drugs on our health
2. The causes, impacts and prevention of malnutrition and make a presentation using ICT tools.

The learner presents their work to the class and invites discussions, feedback and comments. After the presentation, the learner answers the following questions to check their understanding.

1. What are the consequences of consuming junk foods, tobacco, alcohol and drugs?
2. Explain overnutrition and undernutrition with examples.
3. How can the consumption of unhealthy food cause malnutrition?
4. Mention ways to prevent malnutrition.
5. Overnutrition is also a form of malnutrition. Explain.

Additionally, the learner watches the videos in the suggested weblinks: <https://bit.ly/3nGgi2R> and <https://bit.ly/3fl6JvC> to realise the ill effects of consuming drugs, tobacco and alcohol.

Next, the learner goes through the video link <https://bit.ly/3pU0M4H> and learns how to calculate BMI and its significance. The learner uses a form to record their weight, height and BMI.

The learner measures their body weight in kilograms and height in metres. Next, they calculate their BMI using the formula or use the BMI calculator app to calculate their BMI. They record their measurements in the form and later discuss them in class.

The learner responds to the following questions:

1. Explain the significance of BMI to maintain good health.
2. Mention some ways to maintain a normal BMI.
3. Phuntsho weighs 75 Kg and his height is 1.57 m. Calculate his BMI.

4. What health suggestions can you provide to him based on his BMI?

It's important to reflect on our personal habits and how it impacts our overall health. Therefore, it's important to take simple and consistent steps in order to develop healthy habits. A healthy habit ensures the holistic development of an individual. The Body Mass Index [BMI] is an indicator of our health. It helps us to know the status of our health and thus helps us to adopt healthy habits.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner's ability to explain the impacts of unhealthy habits and causes, impacts and prevention of malnutrition. 	<ul style="list-style-type: none"> Assess the learner's presentation skills and the ability to calculate BMI using the formula or the BMI calculator app. 	<ul style="list-style-type: none"> Assess the learner's interest in developing healthy habits and exploring possibilities to maintain a normal BMI.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

- Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
- National School Curriculum Framework for Science
- REC repository
- Science Class Five (2020), REC
- Effects of drugs on our body: <https://bit.ly/3fl6JvC>
- Effects of alcohol and tobacco on the brain: <https://bit.ly/3nGgi2R>
- BMI Calculation: <https://bit.ly/3pU0M4H>

1.3.3 Circulation

Scope: This topic introduces circulation and deals with the function of the heart, arteries, veins, and their roles in blood circulation.

Learning Objectives:

- Identify different parts of the circulatory system and explain their roles.
- State the importance of circulation in humans.

Learning Experiences

The circulatory system consists of the heart and blood vessels. The heart's job is to pump blood throughout our body. Explore for a picture of the human heart on the internet or in textbooks.

The respiratory system provides oxygen to the body. The left side of the heart takes oxygen-rich blood from the lungs and pumps it to other parts of the body for use. The right side of the heart pumps blood back to the lungs to add oxygen to it. The circulatory system also helps your body get rid of waste products dissolved in the blood.

Now, watch the video at this link <https://tinyurl.com/2n8nhx25> You can also try this link <https://tinyurl.com/4nnd2fuz>.

When we are resting, our heart pumps between 60-100 times each minute. When we are exercising, it pumps much faster to deliver blood to our muscles.

The learner watches the video on the circulatory system from the video link <https://bit.ly/32J8tlO>. The learner writes down the functions of the heart, arteries, and veins from the video and shares them with their team. Based on the information, designs the model of a human heart and exhibit their model with a short presentation on the importance of circulation in humans.

After the completion of the activity, the learners respond to the questions below:

1. Compare and contrast the structure and function of arteries and veins.
2. Did you notice your heart beats faster when you are running? What could be the reason?
3. What would happen if the human body did not have a heart?
4. Why is circulation important for the survival of an organism?

The human heart is an organ that pumps blood throughout the body via the vessels of the circulatory system, supplying oxygen and nutrients to the cells and removing waste from the cells. It sits inside the chest, in front of the lungs and slightly to the left side. Our body needs a constant supply of oxygen and nutrition in order to be active. If the heart is not able to supply blood to the organs and tissues, it will die.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's ability to explain the functions of the heart, arteries and veins.	<ul style="list-style-type: none">● Assess the learner's creative skills while preparing the model of the circulatory system using locally available materials and analysing skills while answering the questions.	<ul style="list-style-type: none">● Assess the learner's curiosity in understanding the significance of the circulatory system for the proper functioning of the body.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science

3. REC repository
4. Science Class Five (2020), REC
5. Circulatory system: <https://bit.ly/32J8tIO>
6. How does Heart work? <https://tinyurl.com/2n8nhx25>
7. How the heart works <https://tinyurl.com/4ndd2fuz>

1.3.4 Movement

Scope: This topic focuses on the functions of the skeleton, and the names and functions of different parts of the skeleton - skull, ribcage, backbone; and muscle - biceps, triceps

Learning Objectives:

- Identify different parts of the skeleton in the human body.
- State the functions of the skull, rib cage, and backbone.
- Explain the importance of the skeleton in our life.
- Identify biceps and triceps of muscles and relate the functions of muscles to the important movement of the body.

Learning Experiences

The skeleton serves as a framework for the body. It consists of many bones and cartilage which carry out different functions to make our body work. There are 206 bones in our body which work with the help of muscles. The muscles that are attached to the bones are called skeletal muscles, together it helps in the movement of the body.

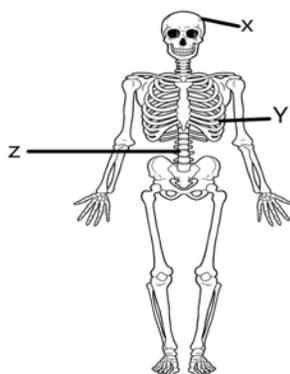
Watch the video at <https://tinyurl.com/2p9fupas>. The learner notes the understanding of the skeletal muscles. Talks to the class.

The learner watches the video in the link <https://bit.ly/32ObLnH>. After watching the video, the learner writes down the function of the skeleton and discusses the functions of the skull, ribcage and backbone.

Next, they use the model of the skeleton to identify the bones using the information gathered from the video. Use the worksheets from the link <https://bit.ly/3eUgW7S> to label the important parts (skull, ribcage, backbone) of the skeleton and write the functions of each.

The learner answers the following questions to check their comprehension of the topic.

5. Explain the functions of the skeleton.
6. Look at the diagram and answer the questions that follow:



- What is the function of the part labelled **X**?
- Why do vital organs need to be protected by the part labelled **Y**?
- What will happen if the part labelled **Z** is injured or damaged?

Allow learners to watch a video on the importance of skeletons from the web link [Importance of Skeleton](#). Encourage the learners to note the importance of skeletons as they watch the video.

The learner explores the working of the bicep and the triceps muscles from the link <https://t.ly/y4jD2> [how.muscles-bone work](#) or any other relevant source and explains the working of the bicep and triceps muscles.

Using the information from the link, the learner prepares a model to show the working of the biceps and triceps muscle and present it to the class with a short explanation.

The learner responds to the following questions after the completion of the activity to check their understanding:

- Explain the working of the biceps and triceps muscles in your own words.
- Will the bones move on their own without the support of the muscles? Why?
- Mention any other location where these types of muscles are found.

The movement of our body is possible due to the collective action of muscles and bones. Together, they support our body’s weight, maintain our posture and help us move. The bones and muscles together form the musculoskeletal system of our body. We can keep it healthy by eating a balanced diet, maintaining a healthy weight and exercising regularly.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner’s ability to explain the functions of the 	<ul style="list-style-type: none"> Assess the learner's creativity in preparing the 	<ul style="list-style-type: none"> Assess the learner’s understanding of the

skeleton, identify the ribcage, skull, and backbone with their functions, and explain the working of biceps and triceps muscles.	model of the biceps and triceps and the presentation skills.	significance of bones and muscles in the body's movement.
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For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. Skeleton: <https://bit.ly/32ObLnH>
6. Skeleton worksheets: <https://bit.ly/3eUgW7S>
7. Biceps and triceps: <https://bit.ly/31xkBW0>
8. The Musculoskeletal System: <https://tinyurl.com/2p9fupas>

1.3.5 Reproduction

Scope: This topic begins with the introduction of fertilisation and reproduction and includes the different stages of a life cycle and importance of reproduction in continuity of life.

Learning Objectives:

- Explain fertilisation and reproduction in animals.
- Explain the life cycle of an animal.
- Explain the significance of reproduction in animals.

Learning Experiences

The role of reproduction is to provide for the continued existence of a species; it is the process by which living organisms duplicate themselves. Fertilisation is an essential stage in the process of reproduction. Birth, growth, reproduction and death represent the four stages of the life cycle of all animals.

Learners are instructed to read the handout provided by the teacher and further explore more information on reproduction and fertilisation using the internet and library, and share to the class.

Further, explore for more information on reproduction at this web link <https://tinyurl.com/2p8fyccw>. The learners explore information on fertilisation and reproduction from relevant sources and write down the notes most appropriate to their level.

Watch the video at <https://tinyurl.com/yckktedx> or other sources on the life cycle of animals. Describe the lifecycle of your favourite animal and share it with the class.

Further, they explore the life cycle of any animal from the web or books and use the information gathered to observe the life cycle of any animal in their surroundings and create a video presentation or presentation using pictures and present it to the class.

Learners discuss the significance of reproduction in animals and respond to the questions below:

1. Explain the role of fertilisation and reproduction in the continuity of life.
2. Why are life cycles important to living things?

A life cycle is a series of stages a living thing goes through during its life. All plants and animals go through life cycles, which often include starting as a seed, egg, or live birth, then growing up and reproducing. Life cycles repeat again and again. Fertilisation and reproduction are important processes in the continuity of life on earth.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's ability to explain the role of fertilisation and reproduction in the continuity of life and the different stages of the life cycle of any animal.	<ul style="list-style-type: none">● Assess the learner's observation, recording and communication skills based on the presentation on the lifecycle of any animals.	<ul style="list-style-type: none">● Assess the learner's curiosity in understanding the life cycle of any animals and the significance of fertilisation and reproduction in the continuity of life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. Life cycle in animals: <https://tinyurl.com/yckktdx>
6. Animal Reproduction: <https://tinyurl.com/2p8fyccw>

Challenge Your Thinking

1. What benefits are there in eating a balanced diet?
 - b. Good health
 - c. Good mood and energy
 - d. Improved health and reduced illness
 - e. All of the above
2. What are the drawbacks of using BMI to measure your health?
 - a. It is too general
 - b. It helps you to know your health status
 - c. It helps determine if you are at risk for disease,

- d. It can help you know if you should lose weight
3. How do muscles attached to the bones move the body?
 - a. Automatically
 - b. Pull movement only
 - c. Push movement only
 - d. Push and pull movement
4. Which of the following statements about bones is INCORRECT?
 - a. Bone is where most blood cells are made.
 - b. Bone serves as a storehouse for various minerals.
 - c. Bone is a dry and non-living supporting structure.
 - d. Bone protects and supports the body and its organs.
5. Tadpole is the developing stage of which of these
 - a. Dogs
 - b. Cats
 - c. Frogs
 - d. Humans
6. Which one of the following represents the correct sequence in the life history of a butterfly?
 - a. Egg - Larva - Adult - Pupa
 - b. Egg - Pupa - Adult - Larva
 - c. Egg - Larva - Pupa - Adult
 - d. Egg - Pupa - Larva - Adult
7. The circulatory system works with the _____ system to provide our body with oxygen.
 - a. Respiratory
 - b. Digestive
 - c. Muscular
 - d. Skeletal
8. Why does blood that flows from the lungs to the heart appear bright red rather than dark red?
 - a. Oxygen makes it red
 - b. Carbon dioxide makes it red
 - c. Gastric juices produce the red colour of the blood.
 - d. The lungs add pigment to blood as it flows through them.
9. Examine your eating habits. Are you eating right? Comment on your eating habits in the context of nutrient intake.
10. Which type of malnutrition (overnutrition and undernutrition) is more common in children these days? Justify your answer.
11. Analyse the effects of using unhealthy substances like alcohol, tobacco, drugs and drugs. Suggest ways to control or minimise their usage.
12. What rules would you set at home in order to minimise the consumption of junk foods?
13. Is there anything the school can do in order to ensure a normal BMI for children? Suggest some ways.
14. Compare your heartbeat when you are walking at a normal pace and when you are running. Are the heartbeats the same? Give reasons to support your answer.
15. Explain the role of the skeletal muscles in the movement of the skeleton.

16. The eggs that are produced in the poultry farm for commercial purposes will not turn into a chick even after incubation. What is your understanding of this information?

1.4. Green Plants

A plant is a living thing that requires specific conditions in order to grow and develop properly. The part of a plant that is above ground is known as the shoot, and the part that is below ground is known as the root. There are branches, leaves, flowers, and fruits on the shoot. Root hairs can be found on the root.

In plants, roots and stems play an important role in delivering water and minerals. Flowers play an important role in plant reproduction. Many flowers, known as bisexual flowers, have both male and female parts. Unisexual flowers, on the other hand, are those that only contain male or female parts.

Competency

Describe the functions of root, stem and different parts of flower to recognise their importance for the survival and continuity of plant life.

1.4.1 Water and Mineral Transport

Scope: This topic deals with the parts of a plant, and general functions of root and stem.

Learning Objectives:

- *Identify the parts of a plant using different plants found in the surroundings.*
- *State the functions of roots in plants.*
- *State the functions of the stem in plants.*
- *Explain the importance of root and stem in the growth of a plant.*

Learning Experiences

A plant, like the human body, is made up of many different parts. Each part has a specific function. For example, a plant's roots take in water and minerals from the soil. They also serve to anchor the plant to the ground and keep it stable. The stem transports water and minerals throughout the plant. It also acts as a support and helps to keep the plant upright.

In order to understand the different parts of a plant, the learner uses the web link <https://bit.ly/3frbcmq> or other relevant sources and lists down the names of different parts.

Then, the learner collects a plant from the school campus and observes and identifies its different parts. The learner further differentiates which parts fall undershoot and root.

The learner draws a labelled diagram of a plant and answers the questions given below:

1. Which part of the plant is usually green?
2. What do you call the part of a plant below the ground?

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3. What are the different parts of a shoot?
4. What is the relationship between the stem and the root?

The learner gathers information to learn about the function of root from the web links <https://bit.ly/33g8ixS> or from other relevant sources. Lists down those functions.

Then, the learners in a team carry out an experiment to investigate the functions of the root. The learner carefully observes the experimental set-up, records the observations made and finally presents to the class the conclusions drawn from the experiment.

The learner watches a video clip on the function of the stem from the <https://www.youtube.com/watch?v=bbZ27YOYHEw> web or from other relevant sources and notes down those functions.

After watching the video, the learners in a team conduct an experiment to investigate the function of the stem. Write down the observations made and present the findings to the class.

Learners write a short reflection on the significance of stems and roots by reflecting on the following questions:

1. What are the different functions of roots and stems?
2. How do these functions help plants stay healthy and strong?
3. What would happen if plants are without roots and stems?

Thus, roots and stems play important roles in plants. Roots help to keep plants fixed in the ground as well as the absorption of water and nutrients from the soil. Stems support the above-ground parts of the plant and carry water and nutrients to all other parts of the plant.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's understanding of parts of a plant, and the functions of root and stem.	<ul style="list-style-type: none">● Assess the learner's ability to investigate the functions of the root and stem.	<ul style="list-style-type: none">● Assess the learner's interest and curiosity while investigating the functions of root and stem.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC

5. Parts of a plant: <https://bit.ly/3frbcmq>
6. Functions of roots: <https://bit.ly/33g8ixS>
7. Functions of stem: <https://bit.ly/3q5IWfb>

1.4.2 Reproduction

Scope: This topic focuses on functions of different parts of a flower. It also introduces the terminologies such as calyx and corolla.

Learning Objectives:

- Explain the primary functions of different parts of a flower using a flower.
- Explain calyx and corolla.
- Explain the importance of flowers in plants.

Learning Experiences

The flower is the reproductive part of a plant. The male part of a flower is made up of an anther and filament and the female part of a flower is made up of a stigma, style and ovary. The sepals are usually green in colour while the petals are bright. Different parts of the flower carry different functions. Thus, what is the main function of a flower?

Then, the learner gathers information on the parts of a flower and their functions from the web links <https://bit.ly/3n5UrBH> and <https://bit.ly/3A5kePm> or from other relevant sources and lists down the functions of these parts: pedicel, sepal, petal, anther, filament, stigma, style and ovary.

Next, the learner collects a flower available in the locality and observes it carefully with a hand lens and identifies its different parts. The learner then draws a labelled diagram of a flower and discusses with a team about calyx and corolla. As a follow-up activity, the learner answers the following questions:

1. Explain calyx and corolla.
2. What is the role of an anther in a flower?
3. Petals are usually bright in colour? Why?
4. What is the importance of reproduction in maintaining the continuity of life?

A flower has different parts with particular functions to carry out. As in nature, flowers have cultural significance. Recollect when and where you see this in practice. Finally, watch this video at <https://tinyurl.com/2p8jhbyj>. Share about the importance of flowers in plants.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> ● Assess the learner's understanding of different 	<ul style="list-style-type: none"> ● Assess the learner's observation skills by 	<ul style="list-style-type: none"> ● Assess the learner's interest and curiosity while identifying different parts of a flower.

parts of a flower and their functions.	identifying different parts of a flower.	
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For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. Parts of a flower: <https://bit.ly/3n5UrBH> / <https://bit.ly/3A5kePm>
6. Pollination and fertilisation in plants: <https://tinyurl.com/2p8jhbyj>

Challenge Your Thinking

1. How do bees play an essential role in the reproduction of plants?
2. Among different parts of a flower, which part is necessary for reproduction and why?
3. A forest ranger has advised people in your village to plant trees in landslide-prone areas. What could be the reason behind this?
4. Plants do not have arms like humans, yet water and nutrients reach to leaves for food production. How does this happen?
5. A student after cutting a twig of a plant, observes a drop of water collected at its end. What could be the reason for the appearance of this drop of water?
6. Deki conducted an experiment in which she filled a glass with one-third of the water. She added a drop of red ink into that glass and then stirred it for a few minutes. After that, she made an oblique cut at the base of the stem of a tender twig and then put it into the water. This setup was left overnight. What can be observed by her on the next day?

2. Materials and their Properties

2.1. Classifying Materials

People use all types of materials. These materials can be classified as pure substances and mixtures. Pure substances can be classified as elements and compounds. Elements have a single type of small particle called an atom. Compounds have more than one type of atom. Are you aware that we use different types of elements and compounds in our everyday life?

Competency

Classify common substances into elements and compounds based on their atomic composition to understand their applications in daily life.

2.1.1 Element and Compound

Scope: This topic begins with an introduction of atoms, and classification of substances into elements and compounds based on the types of atoms present in them.

Learning Objectives:

- Explain atoms, elements, and compounds with examples.
- Classify substances found in the locality into elements and compounds. to understand their significance.

Learning Experiences

All materials are composed of tiny particles called atoms. Some substances are made up of only one type of atom and some substances are made up of more than one type of atom. Therefore, substances are classified as elements or compounds based on the types of atoms present in them. Do you know the oxygen you breathe in is made up of atoms?

The learner explores the concept of atoms, elements and compounds from the weblink <https://www.youtube.com/watch?v=KSfgSw2WKfU> and answers the following questions:

1. Explain atoms, elements and compounds in your own words.
2. How can we differentiate elements and compounds? Explain with the help of examples.

After knowing the differences between an element and a compound, the learner classifies substances available in the classroom or locality into elements, compounds or mixtures as follows:

Table 1. *Classification*

Elements	Compounds	Mixtures

The learner in a team, analyses the uses of elements and compounds in everyday life and shares them to the class or uploads them on social media for peer review and feedback.

Watch the video links at <https://tinyurl.com/mryu788u>. Write a summary report and talk about elements and compounds.

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All materials around us are elements, compounds or mixtures. Elements consist of only one type of atom and compounds consist of more than one type of atom. When two or more substances are mixed together, it forms a mixture.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">Assess the learner's conceptual understanding of atoms, elements and compounds.	<ul style="list-style-type: none">Assess the learner's ability to sort and classify materials into elements and compounds.	<ul style="list-style-type: none">Assess the learner's ability to relate to and appreciate the importance of elements and compounds in our daily life.

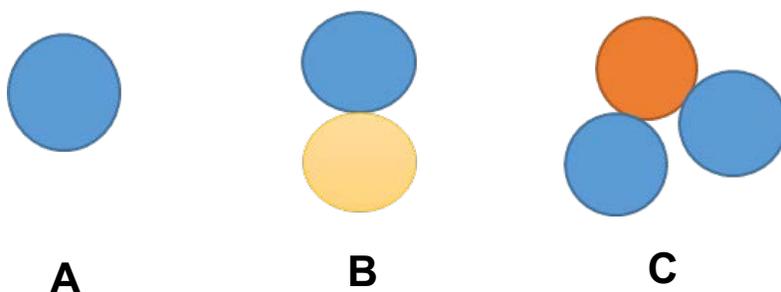
For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. Atoms, elements and compounds: <https://tinyurl.com/mr7c9nkd>
6. Elements and compound: <https://tinyurl.com/mryu788u>

Challenge Your Thinking

1. The water we drink is composed of hydrogen and oxygen, the air we breathe in is composed of oxygen and the air we breathe out is composed of carbon and oxygen. Identify them into elements and compounds with justification.
2. Atmosphere is a mixture of gases. Identify the gases into elements and compounds.
3. Identify the elements used at home, and state their uses.
4. Study the diagram and answer the questions that follow.



- a. Identify elements and compounds.
- b. How many elements can you see in the diagram?

- c. Identify the compound which has the maximum number of atoms.
5. What are elements and compounds?
6. Salt is a compound made up of sodium and chlorine. A salt solution is a mixture of salt and water. Name the atoms present in salt and salt solution.

2.2. Materials and Change

We have seen and observed many changes taking place around us in our day-to-day life. These changes occur due to energy in and around them. Changes in shape, size, colour and composition of the matter are commonly seen. For example, the breaking of glasses, breaking of an egg, melting of ice cream, cutting grass, dissolving sugar in water, fluttering of the flag on a pole, etc. are some of the changes that occur in day-to-day life. These changes can be either physical or chemical. All these changes affect our life and other living and non-living things.

Competency

Explore the properties of matter, various changes, and the interconversions occurring in and around oneself to understand their effects in nature.

2.2.1 Matter

Scope: This topic deals with matter and its interconversion through the processes of melting, freezing, evaporation, condensation, sublimation, and deposition. In addition, it explains the characteristics of three states of matter based on the arrangement of particles in them.

Learning Objectives:

- *Identify various processes involved in interconversion of matter.*
- *Investigate the process of melting, freezing, evaporation, condensation, and sublimation using experiments.*
- *Explain the properties of solid, liquid, and gas based on particle arrangement*
- *Explore the effects of the interconversion of matter in nature.*

Learning Experiences

We have already studied that matter can exist in three states - solid, liquid and gas. It is interesting to observe that everything around us undergoes a state of change. Have you ever wondered why substances change their states? And, how do these changes affect our life?

The learner explores the interconversion of matter through the given link <https://youtu.be/ZnizM4qb06I> or <https://tinyurl.com/2p8f3678> . Make a list of the processes involved in the interconversion of matters with observed examples. Based on their understanding, the learner answers the following questions:

1. What do you mean by interconversion of matter?
2. What causes the interconversion of matter?
3. In what ways sublimation differs from deposition? Give a suitable example.
4. Give two suitable examples for the application of sublimation in everyday life.

Using the above knowledge and understanding, design an experiment to investigate the processes of interconversion in the matter.

Learners watch a video on water cycle to understand effects of interconversion of matter in nature from the link <https://shorturl.at/ltWZ0>. After watching a video, learners engage in a hands-on activity in making a model of various stages of the water cycle to understand the interconversion of matter in nature, and present their work to the class.

Based on the understanding of the interconversion of matter, explore how the particles are arranged in different states of matter through the given link <https://youtu.be/21CR01rlmv4>.

Based on particle arrangement matter can exist as solid, liquid or gas which defines its shape and volume. Matter also has the tendency to change states through various processes namely melting, freezing, condensation, evaporation, sublimation and decomposition, which involves energy.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">Assess the learner's conceptual understanding of particle arrangement of matter and its interconversion of matter.	<ul style="list-style-type: none">Assess the learner's ability to design and carry out an experiment to demonstrate the interconversion of matter.	<ul style="list-style-type: none">Assess the learner's ability to observe different natural phenomena happening in the surroundings and identify the processes of change and their properties.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

- Continuous Formative Assessment Guide, Classes PP-VI (2020), REC.
- National School Curriculum Framework in Science
- REC Repository.
- Science Class Five (2020), REC
- Change in state of matter: <https://youtu.be/ZnizM4qb06I>
- Changing states of matter: <https://tinyurl.com/2p8f3678>
- States of matter: <https://youtu.be/21CR01rlmv4>

2.2.2 Changes

Scope: This topic covers what natural and artificial changes are with their examples. It also includes what physical change is and its properties such as reversible and irreversible physical change.

Learning Objectives:

- Investigate physical change based on its physical properties.
- Investigate conditions of physical change
- Identify natural and artificial changes in the locality.

- Explain the significance of different types of change in everyday lives.

Learning Experiences

Many changes happen in and around us. Some changes occur naturally and some changes are human-made. For example, the ripening of fruits is a natural change whereas breaking glass is a human-made change. Human-made changes are also called artificial changes. Some of the natural changes and human-made changes can also be classified as physical changes. Some physical changes are permanent and irreversible changes. Some physical changes are temporary and reversible changes.

Learners carry out an experiment to investigate the properties of physical changes and answer the following questions

1. List down your observations from the activity.
2. What happens to the identity of substance during the activity?
3. Is there any formation of new substances? justify.
4. Is the change reversible or irreversible? Why?
5. Is the change permanent or temporary? Why?

Learners investigate the conditions of physical change through experiment and group activities.

The learner watches the video from the web link <https://www.youtube.com/watch?v=2iW9CZATS2Y> to understand natural and human-made changes. The learner then identifies the natural and human-made changes. List examples of natural and human-made changes in their surroundings. Identify the uses of natural and artificial changes. How do you know that change occurred in the examples you listed earlier?

The learner identifies the observable properties of different objects like dough, paper, rocks, pencils, water, etc. The learner in teams discusses what changes can be made with these substances.

Then the learner further explores the concept of physical change from the web link <https://tinyurl.com/4uc2ku2p>. Then the learner in the team demonstrates the properties of a physical change using some examples from natural settings.

Now, answers the following questions:

1. List the important properties of physical change that you observed in the experiment.
2. Explain reversible and irreversible physical change based on your demonstration.
3. Explain temporary and permanent physical change based on your demonstration.
4. Explain the change in components of a physical change based on your experiment.

Learners in a group discuss the importance of types of change in our life and present to the class. After the presentation, learners answer the following questions.

1. Is man-made change necessary for our survival? Justify?
2. What would happen if there is no physical change?
3. What are the negative impacts of physical change to the environment?

The changes which are brought about by nature itself and are not under the control of humans are called natural changes. Changes which humans bring about are called human-made or artificial changes.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">Assess the learner's conceptual understanding of natural, human-made changes and physical change and its properties.	<ul style="list-style-type: none">Assess the learner's ability to identify the properties of changes and their examples.	<ul style="list-style-type: none">Assess the learner's understanding of the significance of different types of changes happening in and around them in their everyday life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC.
2. National School Curriculum Framework in Science
3. REC Repository.
4. Science Class Five (2020), REC
5. Natural and human-made changes: <https://tinyurl.com/2mja3f3n>
6. Physical change and its properties: <https://tinyurl.com/4uc2ku2p>

Challenge Your Thinking

1. Blowing a balloon is a reversible physical change. When the balloon bursts, it is still a physical change.
 - Explain why it is a physical change.
 - Give more examples of temporary and permanent physical change.
2. Draw a water cycle and indicate all the physical processes taking place in it.
3. Analyse the advantages and disadvantages of the interconversion of matter in nature. Do you think change is important? Why?
4. Naphthalene balls disappear with time without leaving any solid. Explain.
5. Phuntsho is spending his winter vacation in Paro. Each day, early in the morning he sees droplets of water on the window panes in his room. He wonders why water droplets are seen on window panes in Paro but not at his home in Gelephu. How will you help him understand this phenomenon?
6. You get to be a particle in a solid, a liquid, or a gas. Which would you rather be? Why?
7. How do people use the knowledge of natural and artificial changes in their life?

2.3. Separating Mixtures

We come across different things and use them in our daily life for different purposes. Most of the materials exist in the form of a mixture. They are separated using different techniques based on the properties of their

components. Various separating methods such as sieving, handpicking, winnowing etc. can be used to separate solid-solid mixtures into individual components.

Competency

Explore the separation techniques for separating solid – solid mixtures according to their characteristics to purify the mixtures for appropriate use in everyday situations

2.3.1 Methods of Separation

Scope: This topic emphasises on separating solid-solid mixtures by using methods such as [hand-picking, sieving, winnowing, threshing and magnetic separation] based on the characteristics of the components of the mixture.

Learning Objectives:

- *Identify methods for separating solid-solid mixture based on the characteristics of constituents.*
- *Demonstrate the methods of separating solid-solid mixtures.*
- *Explain the importance of separating mixture and separation techniques.*

Learning Experiences

Different mixtures such as solid-solid, solid-liquid, and liquid-liquid mixtures can be separated into individual components using different methods. Physical methods are used to separate solid-solid mixtures. How do you separate the mixture of rice and stone? Which method can be used to separate sand from gravel?

Learners reflect on or in a team visit the community to understand what separating methods people use in their daily life. Share the experiences with the class.

The learner explores physical methods of separating different solid-solid mixtures from the link <https://tinyurl.com/5n6dx52z> Identify and list the characteristics of the components of mixtures discussed.

Learners further explore the common methods for separating solid-solid mixtures like hand-picking, threshing, magnetic separation, winnowing and sieving through the web link, [METHODS OF SEPARATION](#).

The learner in teams demonstrates methods of separating solid-solid mixtures based on the characteristics of the mixtures. Based on the understanding, the learner answers the following questions.

3. Explain the differences between winnowing and threshing?
4. What type of solid-solid mixtures can be separated by winnowing?
5. Why are you able to separate the mixtures by winnowing?
6. What are the properties of the components of the mixture necessary for separation by using a magnet?

Learners explore deeper into the significance of separating mixtures by Analysing a simple case study and responding to follow-up questions.

The solid-solid mixtures can be separated by using physical methods. The unique characteristics of the components of the mixtures are the basis by which they are separated.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner’s conceptual understanding of the components present in mixtures and methods of separating by handpicking, sieving, winnowing, threshing and magnetic separation. 	<ul style="list-style-type: none"> Assess the learner's ability to identify methods and separate solid-solid mixtures. 	<ul style="list-style-type: none"> Assess the learner’s understanding of the importance of separating mixture and its application in everyday life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC.
2. National School Curriculum Framework in Science
3. REC repository.
4. Science Class Five (2020), REC
5. Methods of separating mixtures: <https://tinyurl.com/5n6dx52z>

Challenge Your Thinking

1. You are working at a construction site and you are asked to separate sand from the mixture of sand and gravel. What method of separation do you see workers using and why?
2. Do you think a mixture of salt and sugar can be separated by a magnet? Explain.
3. You volunteered to help in a cleaning campaign. The garbage contains all kinds of substances. How would you separate the plastics from those mixtures?
4. Why do we need to separate the components of mixtures?
5. You are provided with a mixture of maize, rice and iron filings. Which method of separation would you prefer to use and why?
6. Your mother is preparing the evening meal. The menu is roti using wheat flour, and chilli cheese curry with coriander and onion as spices. If you are observing your mother cooking, you would become curious. Write those 3 to 5 curious questions.

3. Physical Processes

3.1. Forces and Motion

A force is anything that can change the state of motion of an object, like a push or a pull. All things in the surrounding exert force on each other and are not able to move freely in nature. The force which opposes the motion of an object is called frictional force. It is caused when one object rubs against the other surface and applies the force in the opposite direction of the main force. The SI (international system) unit of force is Newton (N).

Different liquids have different densities. When immiscible liquids are mixed, they form different layers based on their densities.

Competency

Investigate frictional force, ways to enhance or reduce it, and compare the density of liquids to understand the effect of both frictional force and densities in daily activities.

3.1.1 Frictional Force

Scope: This topic begins by introducing what friction is, then explores effects of frictional force and its application. It also deals with methods on how to increase and decrease friction.

Learning Objectives:

- *Explain frictional force.*
- *Suggest ways to increase or decrease the frictional force.*
- *Investigate the effects of frictional force.*

Learning Experiences

Friction is a force that tries to stop a moving object. It can either slow down the movement of an object or completely stop movement of the object. Friction is felt when two surfaces slide against each other. For instance, if you rub your palm on the table, how do you feel? OR can you feel the friction? Why do you slip when you walk on the steps on a rainy day?

Watch the video from the web link <https://bit.ly/3q1s75g> to explore the concept of friction. Then the learner explains the concept of friction.

Friction can be increased or decreased depending on its application. The tyres of a vehicle have treads that help to increase friction and prevent slipping on roads. Similarly, your shoes have grooves to increase friction. Are there any other ways to increase or decrease friction?

The learner explores the web link <https://bit.ly/3GJSP8s> to understand more about friction. Based on their understanding, the learner in teams identifies an activity carried out in their daily life and investigates the ways to increase and decrease friction for the activity. The team then presents the findings to the class.

Further, the team watches the video from the web link <https://bit.ly/33awphM> to understand more ways of increasing and decreasing friction.

Now, answer the following questions:

1. What happens if the door hinges are rusty and rough? Why? Suggest a solution?
2. If you go for a hike, what type of shoe sole would you prefer to wear? Why?
3. Why do we need to increase or decrease friction?
4. Give two examples where friction is useful in your life.
5. Do you think friction is bad for you? Justify your answer.

Frictional forces are of great importance in our daily life. However, its importance depends on the situation where friction exists. The soles of your shoes create friction with the ground, preventing you from slipping over. However, friction can be unhelpful too—friction on a bike chain can make the bike harder to pedal.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner's conceptual understanding of the frictional force. 	<ul style="list-style-type: none"> Assess the learner's ability to identify ways of increasing or decreasing friction in daily activities. 	<ul style="list-style-type: none"> Assess the learner's understanding of the importance of friction in daily life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. Friction: <https://bit.ly/3GJSP8s>
6. Friction video: <https://bit.ly/3q1s75g>
7. Increasing and decreasing friction video: <https://bit.ly/33awphM>

3.1.2 Floating and Sinking of Liquids

Scope: This topic begins by explaining what density is and compares density of different liquids.

Learning Objectives:

- Explain density of a liquid.
- Design and carry out simple experiments to compare the density of different liquids.
- Analyse how densities of liquids affect the floating and sinking among the liquids.

Learning Experiences

The density of a liquid is the ratio of the weight and the volume of a liquid. Different liquids have a different density that determines whether they float on or sink in another liquid. Have you ever seen oil floating on water? Did you ever wonder why one liquid floats on other liquids?

Watch the video from the web link <https://bit.ly/3Ikh3Gu> to understand the density. Then the learner collects water, vegetable oil and honey to carry out experiments to compare their densities. First, they predict which liquid would appear on the top, middle and bottom layers. Then carry out an investigation by mixing all three liquids and observing the result. Record the observations, and identify the liquid which has greater density and the least.

Further, the learner watches the video from the web link <https://bit.ly/3FCdJFb> to understand more about the density of liquids and answers the following questions:

1. Explain the layers of liquid observed based on their density.
2. List down three liquids which are used in daily life that float on water.
3. Elders generally advise not to use water to put off the fire on the petrol. Explain.
4. Design innovative ways of finding the density of liquids.
5. Design an experiment to separate the liquid-liquid mixture. Identify the criteria used in the experiment.

Learners discuss how densities of liquids affect the floating and sinking among the liquids and share to the class.

The density of different liquids differs from each other. Therefore, liquid with lower density will float on the liquid with higher density.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> ● Assess the learner’s conceptual understanding of the density of the liquid. 	<ul style="list-style-type: none"> ● Assess the learner's ability to explain the appearance of liquids in distinct layers in the mixture using the concept of density. 	<ul style="list-style-type: none"> ● Assess the learner's understanding of the application of the concept of density of the liquid in daily life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science, (2022)
3. REC repository

4. Science Class Five (2020), REC
5. Density video: <https://bit.ly/3lkh3Gu>
6. Density of liquids video: <https://bit.ly/3FCdJFb>

Challenge Your Thinking

1. While playing carrom, people usually use flour or talcum powder. What could be the reason for this?
2. If friction is increased, what would happen to the speed of an object?
3. Yeshey's father and mother are trying to move a box full of grain from the common room to the store room. They are finding it difficult to move. What suggestion would you provide to Yeshey's parents?
4. It is advisable to change the worn-out tyres. Explain the statement.
5. Lhamo felt very cold and rubbed her hands together. She observed her hands getting warmer after some time. Why?
6. In the olden days kerosene lamps were used; people usually added water to the kerosene lamp when the oil was less. Why?
7. Butter floats on the cup of suja. Explain.

3.2. Energy

Energy is important to do work. It can be transformed from one form of energy to another. The transformation of energy into different forms helps us to do a variety of work and activities. During the transformation of energy, energy is neither lost nor created as explained by the law of conservation of energy. However, a small amount of energy is rendered useless in the form of dissipated energy. For example, in lighting the bulb, a small amount of heat is produced which cannot be used.

Competency

Examine various forms of energy transformations and relate the law of conservation of mass based on energy transformation to recognize the significance of energy changes in everyday life.

3.2.1 Forms and Transformation of Energy

Scope: This topic deals with forms and transformation of energy to explain the law of conservation of energy, importance of energy transformation.

Learning Objectives:

- *Explore various forms of energy transformation.*
- *Explain the law of conservation of energy based on the transformation of energy.*
- *Justify the importance of transformation of energy in everyday situations.*
- *Analyse how transformation of energy can cause climate change.*

Learning Experiences

Energy can be transformed from one form to another. This process is called the transformation of energy or conversion of energy. However, the total energy during the conversion always remains the same. Have

you ever realised how heat is produced while burning wood? or, how heat is produced when we use an electric heater?

To understand the forms and transformation of energy and its applications, watch the video at <https://bit.ly/350CnCB> or from other relevant sources.

The learner designs a model to demonstrate the transformation of energy using available resources based on the information that is gathered.

Now, answer the following questions:

1. List different forms of energy.
2. Explain the energy transformations in the following.
 - a. walking
 - b. electric heater
3. Name the device used to convert
 - a. solar energy into heat and
 - b. solar energy into electricity

Learners explore the law of conservation of energy by watching the video from the link [Potential and Kinetic Energy | #sumsum #kids #science #education #children](#). After watching the video, learners discuss and exchange their acquired information. Then answer the following questions.

1. State the law of conservation of energy.
2. What happened to the energy in the law of conservation of energy?
3. Give one example of the law of conservation of energy.

Learners exhibit the example of law of conservation after watching the video from the link [Law of conservation of energy](#) and derive the importance of energy transformation after watching the video from the link [Uses of Energy Transformation](#). Learner's list down the examples and uses of energy transformation after watching the videos. Then answer the following questions.

1. What are the materials required to design simple examples to show the law of conservation of energy?
2. What is the significance of energy transformations to people's lives?
3. How does energy transformation affect climate change?
4. Suggest a few approaches to mitigate the impact of energy transformation on climate change.

Energy can neither be created nor be destroyed but it can be converted from one form to another.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
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<ul style="list-style-type: none"> Assess the learner based on the understanding of the concept of transformation of energy and law of conservation of energy. 	<ul style="list-style-type: none"> Assess the learner's ability to prepare a presentation and investigate the transformation of energy through simple experiments. 	<ul style="list-style-type: none"> Assess the learner's ability to explain the importance of transforming energy and its impact on daily life.
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For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. Energy and different forms: <https://bit.ly/3qJXGkl>
6. The Law of Conservation of Energy: <https://urlshortner.org/SQIdY>

Challenge Your Thinking

1. Trace the energy transformation in the given picture



2. Provide examples of the transformation of energy for the following activities:
 - i. Glowing electric bulb.
 - ii. Rolling down a stone from the hill.
3. Use a real-life example to explain the law of conservation of energy.
4. Write the importance of energy in our life with examples.
5. Justify how the energy transformation helps people.
6. You are interested in doing an investigation to understand how to minimise energy dissipation during energy conversion. Write 4 to 5 questions to guide your investigation.
7. What type of energy conversion happens when you draw a picture on the floor?

3.3. Electricity and Magnetism

Electricity is a very important source of energy in our life. Electricity can be generated from different sources such as water, wind and sunlight. For electricity to flow from one place to another, it requires wires and cables. The flow of electricity can be understood by using simple series circuits.

Magnets are substances that attract iron pieces to them. They have the property to attract or repel each other. Magnets have two different poles. Based on their properties, they are used in diverse appliances.

Competency

Explain circuits, conductor, insulator, magnetic poles, generation of electricity from renewable sources and construct a series circuit to understand their uses in different appliances.

3.3.1 Generate Electricity

Scope: This topic introduces the process of generating electricity using hydropower, solar and wind energy, its transportation to our homes and its significance.)

Learning Objectives:

- Explain the generation of electricity using hydropower.
- Explain the generation of electricity using solar energy.
- Explain the generation of electricity using wind energy.
- Explain the transportation of electricity from the source to consumers.
- Justify hydropower, solar and wind energy as clean energy sources.

Learning Experiences

Electricity can be generated using water, sunlight, wind and other resources. In our country, electricity is mainly generated from flowing rivers. We do not use all the electricity and therefore export to our neighbouring countries to generate income in the country.

The learner may use the web link <https://bit.ly/3qEosJK> and <https://bit.ly/3mNaJPv> and <https://bit.ly/3FLUF89> or other available resources to understand how electricity is generated from water, sun and wind. The learner answers the following questions after watching the video.

1. Write a summary of the process of generating electricity using water, solar or wind and record it in the Science Journal or Scrapbook.
2. Explain how electricity is transported from the generation station to the consumers.

Electricity generated from water is called hydroelectricity. In Bhutan, electricity is mainly generated from water. There are only a few places where electricity is generated using wind and sun in small quantities.

Learners in a team explore to find out more about how and why wind and solar energy sources are used to generate electricity in Bhutan. Further, discuss and justify hydropower, solar and wind energy as clean energy sources. Make a presentation. Use ICT where appropriate.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> ● Assess the learner's conceptual understanding on the process of generating electricity and sources of electricity. 	<ul style="list-style-type: none"> ● Assess the learner's ability to design models to explain the process of generating electricity from different sources. 	<ul style="list-style-type: none"> ● Assess the learner's understanding of how electricity helps in reducing pollution.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. How does hydropower work? <https://bit.ly/3qEosJK>,
6. How does a wind turbine work? <https://bit.ly/3mNaJPv>
7. Solar power: <https://bit.ly/3FLUF89>

3.3.2 Circuits

Scope: This topic covers the concept of conductors and insulators, differences between open and closed circuits and construction of series circuits.

Learning Objectives:

- *Conduct an experiment to identify conductor and insulator.*
- *Demonstrate the construction of open and closed circuits using available materials.*
- *Construct a series circuit using available materials to determine its characteristics.*
- *Suggest safety measures of using electricity safely.*

Learning Experiences

Electricity flows through a closed path called a circuit. Circuits can be opened or closed. The open circuit allows the electricity to flow through it but open circuits do not allow the electricity to flow through it. Have you ever thought about why electricity does not flow through all the materials?

The learner may use the link <https://bit.ly/3mPDF9P> to explore open, and closed circuits, conductors and insulators.

The learner answers the following questions to check their understanding.

1. How is an open circuit different from a closed circuit?
2. What is a series circuit?
3. How are insulators different from conductors?

The learners in the team construct a simple series circuit using the available resources to differentiate between open and closed circuits. The learners further classify materials as conductors and insulators by connecting them to the series circuit.

Learner explores electrical safety tips of using electricity safely and present to the class.

By using your understanding of circuits and conductors and insulators, design an innovative device that you can use at home or as a toy. Ideas can be explored from diverse sources.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner’s conceptual understanding of series circuits, conductors and insulators, and open and closed circuits. 	<ul style="list-style-type: none"> Assess the learner’s ability to construct simple series of electrical circuits using locally available materials. 	<ul style="list-style-type: none"> Assess the learner’s ability to identify conductors and insulators and their uses in everyday life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. Electricity-Open vs closed circuits: <https://bit.ly/3mPDF9P>
6. Electrical conductor and insulators: <https://www.youtube.com/watch?v=oiKwivoR4dY>

3.3.3 Magnet

Scope: This topic focuses on attraction and repulsion of magnets based on their polarity.

Learning Objectives:

- Explore the magnetic poles using bar magnets to identify its poles.
- Conduct an experiment to prove that unlike poles attract each other and like poles repel each other.

Learning Experiences

When two or more magnets are brought together, they are either pulled towards each other or pushed away from each other. Have you ever wondered why? Magnets have two poles called the north pole and the south pole.

Watch the video from the link <https://bit.ly/3g38TGE> and <https://bit.ly/3HwbeFw> to understand the concept of the north pole and south pole of a magnet.

The learner answers the following questions after watching the video.

1. How can you identify the poles of a magnet?
2. Why does a freely suspended bar magnet point its south pole towards the north direction and its north pole points towards the south direction?

Learners carry out hands-on activity using the materials like thread, magnetic compass and bar magnet to identify the polarity of the magnets, Further, learners find out the attractive and repulsive nature of the magnets.

The learners in the team carry out an experiment using the available resources to investigate the properties of magnets. Makes a report of how the experiment was conducted and what has been drawn.

Learners explore the attraction and repulsion of magnets using available magnets and answer the following questions.

1. Which poles attract each other?
2. Which poles repel each other?
3. Where do we see magnets in our homes?

The learner in a team studies one or two appliances where the magnets are used. Make posters to share experiences gained.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner's conceptual understanding of the poles of magnets, and attraction and repulsion properties of magnets based on polarity. 	<ul style="list-style-type: none"> Assess the learner's ability to carry out an experiment to investigate the attractive and repulsive properties of magnets. 	<ul style="list-style-type: none"> Assess the learner's disposition of an interest in learning science, and appreciate the values of teamwork and cooperation and individual participation.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. Magnetic force: <https://bit.ly/3HwbeFw>
6. Magnetic poles: <https://bit.ly/3g38TGE>

Challenge Your Thinking

1. Design an experiment to investigate that like poles repel and unlike poles attract.
2. Magnet is found in the compass used to find the Earth's North pole and South pole. What property of the magnet is applied here?
3. How does dumping waste into the river affect the income generation from hydropower plants?
4. If a bar magnet is divided into two, would the two halves remain as magnets?
5. Which source is the most reliable source for generating electricity in our country? Justify your answer.
6. List at least three important pieces of equipment used in the production of electricity.
7. How does electricity help to reduce pollution?
8. What are the advantages and disadvantages of a hydropower house?

9. Design a model to illustrate the generation of electricity from solar, hydro and wind.

3.4. Light and Sound

The vibrant colours of rainbow, flowers and clothing are the results of light. Seeing ourselves in the mirror or a pool of water is also a result of light. A combination of various pleasant sounds is soothing to listen to. Therefore, learning about light and sound helps to understand why we see colours, why we see ourselves in a mirror, and how musical sounds are produced.

Competency

Investigate the composition and reflection of light and production of sound from musical instruments to understand the nature of light and sound.

3.4.1 Properties of Light

Scope: This topic begins with composition of white light (VIBGYOR), [Newton’s disc, light through prism,] and some properties [reflection from even and uneven surfaces].

Learning Objectives:

- Explore the composition of white light using prisms and Newton’s disc.
- Explore and list some properties of light and investigate reflection of light from even and uneven surfaces.

Learning Experiences

Light from the sun is white. If so, how and why do we see colours? What happens when light falls on an object? You may have experienced seeing your image in a pool of water. What kind of image would you see if the water is disturbed?

Learners watch the videos to explore the composition of white light using prism and newton's colour disc <https://rb.gy/qi94n8> and <https://tinyurl.com/4z5k2cvp>.

After watching the video, the learner in teams explores the internet on Newton’s Disc designs. The learner then answers the following questions:

1. What would happen if the seven coloured lights are passed through a prism?
2. What do you conclude from the experiment?

The learner then explores around to produce a spectrum which proves that the white light is made up of seven different colours.

Whether or not you see a clear image is dependent on the reflecting surface. Learners complete the table below by carrying out activity that requires the learners to predict, observe and explain whether the light gets reflected, absorbed, and transmitted by using materials (torch, book and magnifying glass)

Materials	Prediction (What light will do)	Observation (What did the light do)	Explain (Why light do)
Mirror			

Book			
Magnifying glass			

Browse the internet or any other resources to find out what happens to light when it reflects from rough and smooth surfaces.

After browsing for information, the learner in teams designs an experiment to see the image formed with the light on a smooth and rough surface.

1. What kind of image is formed when light reflects off a rough surface?
2. What conclusion can you draw from the experiment?

Reflection is a very important property of light. Everything that we see around us is because of the light and its reflection.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner’s conceptual understanding of the composition of white light and reflection of light. 	<ul style="list-style-type: none"> Assess the learner’s based on ability to perform the experiment on Newton’s Disc and reflection off a smooth and rough surface 	<ul style="list-style-type: none"> Assess the learner’s ability to explain the application of reflection of light and composition of light in daily life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. Dispersion of white light: <https://rb.gy/qi94n8>
6. Reflection of light: <https://tinyurl.com/4z5k2cyp>

3.4.2 Sound

Scope: Musical sound, concept of volume and pitch through activity, activity on musical instruments [percussion, stringed and wind], sound production and its significance.

Learning Objectives:

- Describe the production of sound using different musical instruments.
- Construct a simple musical instrument to study the variation in volume and pitch of sound.

- Explore the significance of sound produced by musical instruments.

Learning Experiences

Sound is produced when an object vibrates. Different objects vibrate differently. In nature, we hear different sounds. Some of the sounds are sharp; some are dull, while others are loud. Did you wonder what causes variation in sound?

Learners engage in playing musical instruments available in the school such as piano, guitar and drum. This activity provides learners with the opportunity to observe, record and explain. Based on their observation, learners fill in the source and its types in the table below.

Source of sound	Types of sound	
	Noise	Music
1.		
2.		
3.		

Watch the video link <https://rb.gy/eo1dug>.

Using the knowledge of pitch and loudness, the learners in teams, design simple musical instruments to investigate how different sounds can be produced. Use locally available resources or from the science laboratory. Explore ideas from the available sources.

The learner answers the questions as a follow-up:

1. Does the volume of the sound affect the pitch of a sound?
2. Describe the sounds produced by mosquitoes, bees and the barking of dogs.
3. From the experiment, what conditions did you find necessary to produce a loud sound, and to produce a sound with a high pitch?

To explore the significance of sound produced by musical instruments, learners watch a video on the types of musical instruments and classify traditional musical instruments into string, wind and percussion musical instruments based on their properties. They further their knowledge by playing an online quiz on musical instruments.

A combination of sounds produced by different vibrating objects produces music. Music is a pattern of sound intended to give pleasant sounds.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner's conceptual understanding of pitch and volume. 	<ul style="list-style-type: none"> Assess the learners based on their ability to design musical instruments and investigate the pitch and volume of sounds. 	<ul style="list-style-type: none"> Assess the learner's ability to collaboratively work in teams.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. Pitch and volume: <https://rb.gy/eo1dug>

Challenge Your Thinking

1. How would life on Earth be without colours? Justify.
2. If you were to make a dull-lit room brighter without the use of an additional light source, how would you do it? Explain.
3. What relation do you see between sound and distance? Explain using a simple experiment.
4. If you are given a metre-long string to produce sound, how would you increase and decrease the pitch of the sound?
5. Mirror which is made of glass helps you to see yourself clearly, while you cannot see yourself clearly in window glass. Explain.
6. People can hear the sound in the next room, but cannot see the people in the next room. Explain why?

3.5. The Earth and Beyond

The Earth and beyond provides an opportunity to learn about the solar system, the movements of the Earth, Moon and planets. The heavenly bodies which move around the planets are called natural satellites. The moon is the Earth's only natural satellite. The objects which are placed into orbit in space by human beings are called artificial satellites.

Competency

Explore the lunar phases and lunar cycle to understand the scientific facts and local beliefs.

3.5.1 Our Moon

Scope: This topic deals with the nature and properties of the moon, its phases in different weeks and their significance in Bhutanese belief system.

Learning Objectives:

IG-NSC

- Explain the moon as one of the heavenly bodies in the universe.
- Describe different phases of the moon.
- Make a model to understand different phases of the moon.
- Recognize its significance in Bhutanese socio-cultural settings.

Learning Experiences

The Moon is our nearest neighbour in space. It is smaller than the Earth. The Moon has no light of its own. It gets light from the sun. This light has reflected the Earth as moonlight. It takes about a month to revolve around the Earth. It also takes about the same time to complete one rotation.

Have you ever observed the sky at night? If so, you might have observed different stars and different shapes of the Moon. Sometimes the Moon might look like a narrow crescent or a bright circle and sometimes the Moon is not visible at all. The changing shapes of the moon that we see are its phases. Have you ever wondered why the shape of the moon changes? or what causes the change in the shape of the moon?

Learner watches the video from the given link: [Phases Of The Moon | Why Does The Moon Change Its Shape? | Space | Dr Binocs Show | Peekaboo Kidz](#) . Learners then engage in group discussions and provide following questions to enrich learning experience:

1. What is the moon?
2. Does the moon emit its own light?
3. Why do we see the moon with different shapes?

The learner takes photographs of the moon and keeps the record on a daily basis. Record the shapes for one whole month. At the end of the observation, analyse the shapes of the Moon and prepare the form of a poster using suitable ICT tools and share it with the whole class.

Watch the video from the web link <https://bit.ly/3JvJvGN> or <https://bit.ly/3zbzY2U> to name different phases of the moon recorded through observations and photographs. Refer to relevant sources to explore the phases of the moon.

The learner draws and writes the names and shapes of the different phases of the moon in the correct sequence and discusses them in class.

Based on the understanding, the learner answers the following questions:

1. The Moon appears to change its shape all the time. Why?
2. Compare the characteristics of the Earth's Moon with the Sun.
3. Imagine a full moon night. Draw a picture of the moon and explain the spots observed on the moon.
4. Explore the significance of different phases of the moon in Bhutanese socio-cultural settings from elderly people at home. Write a summary of the information gathered.

The phases of the Moon depend on its position in relation to the Sun and the Earth. The cycle begins with a **New Moon**. The New Moon rises at approximately 6 am and sets at approximately 6 pm. The New Moon is not visible from the Earth as the light from the Sun is reflected completely away from the Earth.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner’s conceptual understanding of the moon and its phases. 	<ul style="list-style-type: none"> Assess the learner’s ability to identify the phases of the moon and record them by using drawings and photographs. 	<ul style="list-style-type: none"> Assess the learner’s understanding of the significance of different phases of the moon in Bhutanese socio-cultural settings.

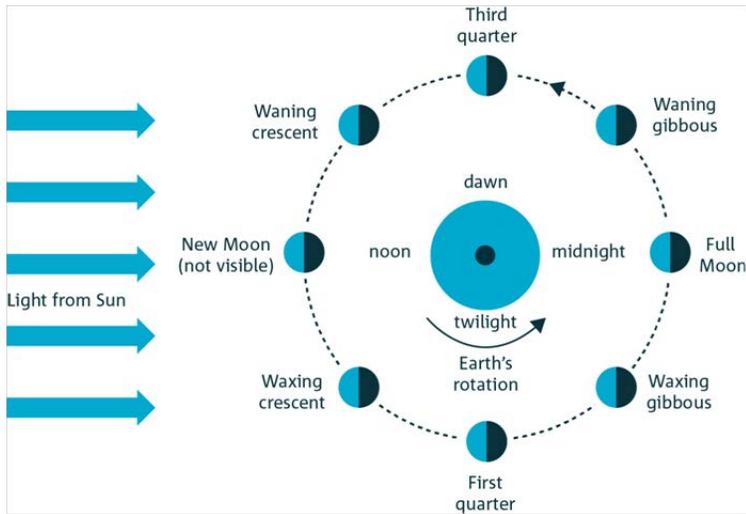
For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class Five (2020), REC
5. Phases of the Moon: <https://bit.ly/3JvJvGN>
6. Lunar Cycle: <https://bit.ly/3zbzY2U>
7. How Earth & Sun affect the Phase of the Moon: <https://bit.ly/33cXH6T>

Challenge Your Thinking

1. How long does it take to observe the next full Moon after observing the full Moon in a particular month?
2. What is the difference between the full moon and the new moon phases?
3. Narrate the significance of full moon night and new moon night in relation to a Bhutanese belief system.
4. Why is it completely dark during the new moon? How does it affect people's lives?
5. The average time between the new moons is 29 days, 12 hours, 44 minutes and 3 seconds. How many, on average, new moons are there in a year? Show your work.
6. What would happen if there is no Moon on the Earth?
7. Why does the Moon rise and set? Can people in different countries see the Moon on the same day?
8. Mr Kuenzang watched the Moon from his bedroom window for one week. He noticed that, at first, it was round and fully lit. At the end of the week, the Moon was lit on the left side and looked like it had been cut in half. How do scientists describe this stage of the moon phase cycle?
9. Draw the phases of the moon which are significant as per the lunar calendar in Bhutanese socio-cultural settings.
10. As we look into the sky, the Moon takes the following eight phases.



Now, explore different sources to understand the following curious questions, and discuss them among the team.

- a. Does the Moon have gravity?
- b. Why do you think objects float on the Moon?

INSTRUCTIONAL GUIDE FOR SCIENCE – CLASS VI

1. Life Processes

1.1. Classification and Variations

Plants and animals are the common features of the Earth. Animals are categorised into five classes of reptiles, fishes, amphibians, birds and mammals. The basis of their classification is the presence of backbones. Similarly, plants are classified into mesophytes, hydrophytes, epiphytes, lithophytes and xerophytes based on their habitats and characteristics.

The knowledge of characteristics of all the life forms is vital to know more about them and classify them appropriately. This classification helps us study them and appreciate the diversity of life on Earth.

Competency

Classify plants and animals into distinct groups according to their characteristics to foster an appreciation for the diversity of life in nature.

1.1.1 Classification of Animals

Scope: This topic introduces the classification of animals into vertebrates and invertebrates, and into five classes [reptiles, fish, amphibians, birds, mammals] based on their characteristics with examples.

Learning Objectives:

- *Explore the characteristics of vertebrates and invertebrates.*
- *Classify different animals into vertebrates and invertebrates based on their characteristics.*
- *Examine the characteristics of different animals found in the locality.*
- *Classify animals into different groups (reptiles, fish, amphibians, birds, and mammals) based on their characteristics.*
- *Identify the differences and similarities in animals within the same group.*

Learning Experiences

There are millions of animals on the Earth. How do we study them? Scientists classify them into different groups in many ways. For example, animals are classified into reptiles, fishes, amphibians, birds and mammals based on their shared characteristics. How are all the birds similar to each other and how are they different from fishes?

Learners watch the video to explore and gather scientific information on vertebrates and invertebrates from the link <https://rb.gy/njarow>. Learners then write down examples of vertebrates and invertebrates, and their characteristics in the worksheet provided by the teacher. Learners further carry out experiential learning activity to investigate the vertebrates and invertebrates found inside the school campus.

The learner either reads the information from the web link <https://bit.ly/3qOTOyJ> or watches the video from the link <https://bit.ly/3qGsh2a> and notes the characteristics of the five classes of animals with examples.

Based on the understanding from the above links, the learner observes some animals in the locality, notes their characteristics and classifies them into five classes of reptiles, fishes, amphibians, birds and mammals. Alternatively, the learner may use the preserved specimens in the biology laboratory for the activity. Finally, the learner shares the work with a friend for comment and feedback.

Then, the learner answers the following questions:

1. A dolphin is not a fish though it lives in water and swims like a fish. Why?
2. A bat has wings and flies like a bird but it is not a bird. Justify.
3. Compare the characteristics of a frog with those of a snake.

Learners in teams discuss and write the differences and similarities between various animals within the same group and share them to the class.

The learner examines, makes a coloured drawing and describes one’s own favourite animal and displays it in the classroom.

Animals are classified into reptiles, fishes, amphibians, birds and mammals. Each group has its own characteristics which differentiate it from the other groups. This classification helps us study the animals in a systematic manner and wonder about the diversity of animals on the earth.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner’s conceptual understanding of the characteristics of reptiles, fishes, and amphibians, birds and mammals with examples.	<ul style="list-style-type: none">● Assess the learner's scientific skills of observation and sketching and the ability to identify the characteristics and classify the animals.	<ul style="list-style-type: none">● Assess the learner’s appreciation of diverse animals on the earth.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Animal classification: <https://bit.ly/3qOTOyJ>
6. Classification/types/groups of animals: <https://bit.ly/3qGsh2a>

1.1.2 Classification of Plants

Scope: This topic introduces the classification of plants into five classes [mesophytes, hydrophytes, epiphytes, lithophytes, xerophytes] based on their characteristics with examples.

Learning Objectives:

- Examine the characteristics of different plants found in the locality.
- Classify different Plants into mesophytes, hydrophytes, epiphytes, lithophytes, and xerophytes according to their characteristics.
- Identify the differences and similarities in plants within the same group.

Learning Experiences

There are millions of plants on the Earth. They provide food and shelter for all life forms. How do we study them? Scientists classify them into different groups. For example, plants are classified into mesophytes, hydrophytes, epiphytes, lithophytes and xerophytes. How are all the mesophytes similar to each other? How are they different from hydrophytes?

The learner explores plants growing in different places such as in water, dry areas, on rocks, in areas with moist soil and on other plants. The learner writes down the characteristics of different plant groups. Next, they go out and observe the plants in the surrounding area and classify them.

The learner may use any plant identification app to identify and name the plants. The learner then watches the video link <https://bit.ly/3AjzE2L>. Based on the understanding, the learner identifies the plant groups to which the sketched plants belong and answers the following questions:

1. Compare mesophytes with xerophytes, and write any two differences between them.
2. Analyse the features of a maize plant and classify it into the appropriate plant group.
3. What are some common characteristics among all the plant groups?

The learner adopts a plant or tree and observes how it changes through seasons and over the years. Records the observations in the scrapbook or science journal. The learners will use the following format to record the observation in their scrapbooks.

Table 1.1. *Observation Table*

Seasons	Changes observed	Remarks
Spring		
Summer		
Autumn		
Winter		

Plants grow in different places. According to the places where they grow, these plants have different characteristics which help them grow and survive there. These characteristics are used to identify the plants and categorise them into different groups.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner’s conceptual understanding of the characteristics of mesophytes, hydrophytes, epiphytes, lithophytes and xerophytes with examples. 	<ul style="list-style-type: none"> Assess the learner's observation skills, information gathering and differentiating skills, investigation skills and analysing skills while exploring information and observing plants. 	<ul style="list-style-type: none"> Assess the learner’s appreciation of diverse plants on the earth.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Adaptations in plants: <https://bit.ly/3AjzE2L>

Challenge Your Thinking

1. To which class of animals do humans belong? Why?
2. Categorise the following animals into different classes reptile, fish, amphibian, bird or mammal. (Whale, duck-billed platypus, salamander, porcupine, eel, kangaroo mouse, elk, kiwi, shark, Rhacophorus)
3. How are epiphytes different from mesophytes?
4. How would you identify a plant which grows in water?
5. Study the table. The first column describes the characteristics of which group of plants and animals.

Characteristics	Groups - animals and plants
Body hair	
Feather	
Give birth	
Lays eggs	

Grows on rocks	
Found in water	

1.2. Living Things and their Environment

Organisms in the environment are connected through feeding relationships where energy always flows from primary producers to various levels of consumers as observed in food chains and food webs. Each step in a food chain or food web is called a trophic level. Organisms are either autotrophs with the ability to produce food for oneself and others, or heterotrophs that depend on others for food.

An ecological pyramid is also known as a trophic pyramid or energy pyramid. It graphically represents the number of organisms, biomass and productivity of the biomass at each and every trophic level in an ecosystem. All ecological pyramids start at the bottom with the producers and ascend through various trophic levels. There are mainly three kinds of ecological pyramids, such as the Pyramid of energy, the Pyramid of numbers, and the Pyramid of biomass.

Competency

Analyse the trophic levels of the ecological pyramid and their roles in maintaining the ecological equilibrium to understand the flow of energy in the ecosystem.

1.2.1 Feeding Relationships

Scope: This topic introduces the trophic levels (producer-primary consumer-secondary consumer-tertiary consumer-quaternary consumer) and explains the significance of each level to balance the ecosystem. It also includes the ecological pyramids: pyramid of numbers, pyramid of biomass and pyramid of energy with examples.

Learning Objectives:

- Explain the trophic level of the ecological pyramid using examples from the locality.
- Examine the impact of climate change on the trophic levels in the food chain.
- Explore various ecological pyramids and trophic levels.
- Rationalise the significance of energy flow in maintaining the ecological equilibrium in the ecosystem.

Learning Experiences

The feeding relationship in the ecosystem is based on a hierarchical order. Plants are the main producers of food forming the first level, known as the producer. Animals feeding on them are herbivores that make the second level the primary consumers. The group of animals that feed on the primary consumers make up the third level as the secondary consumers. In a subsequent order, various consumers occupy every other level.

Discuss what kinds of organisms are typically at the top of the food chain. Why does the feeding level always start from Producers? Share your answers with the class.

The learner in a team plan and carries out field trips to the nearby area to observe and note the feeding relationship of organisms. After identifying the organisms, the learner in the same team will classify the organisms into different levels. The learner represents the trophic levels observed either with presentation software or improvising with available resources and explains how climate change would affect the food web.

Next, the learner watches the suggested video link <https://tinyurl.com/2tavo52t> and also explores the web link <https://rb.gy/8b10sx> or any other relevant resources to explore information on feeding relationships. Later explain the different levels of organisms in the feeding relationship to the class.

Learners learn the various ecological pyramids and trophic levels from the web link <http://surl.li/pvzzl> Based on their findings, the learner constructs all three ecological pyramids for the same feeding relationship. Then the learner shares their ecological pyramids with the class and answers the following questions:

1. Identify producers, primary consumers, secondary consumers, tertiary consumers, and quaternary consumers in your food web.
2. Why are there fewer organisms at the top of the ecological pyramid?
3. Draw an ecological pyramid and explain the trophic levels in the pyramid.
4. How is the energy flow important for people?

Most of the energy in a food web is found at the bottom of the ecological pyramid where producers are found. As these plants are consumed by primary and secondary consumers, most of the energy is used by the animal, and very little is passed to the next consumer.

The pyramid of numbers indicates the number of individuals at different trophic levels. The pyramid of biomass indicates the biomass of the members of the food chain present at different trophic levels. Pyramids of energy indicate energy at different trophic levels.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's conceptual understanding of trophic levels and balance to the ecosystem, the ecological pyramids and its significance.	<ul style="list-style-type: none">● Assess the learner's ability to observe the organisms in their locality and construct the appropriate ecological pyramids.	<ul style="list-style-type: none">● Assess the learner's realisation of how significant energy flow is in maintaining the ecological equilibrium in the ecosystem.

For recording and reporting, refer to the National School Curriculum Framework in Science.

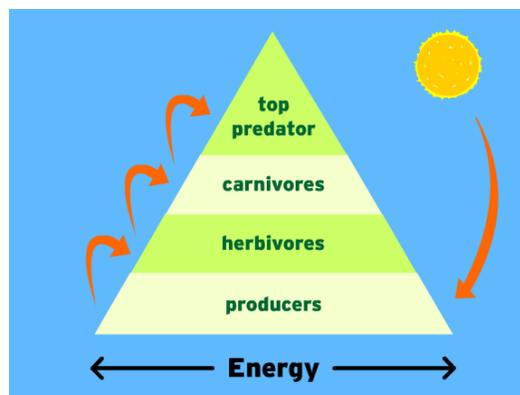
Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC

2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Ecological pyramids: <https://tinyurl.com/2tavc52t>
6. Feeding relationship: <https://rb.gy/8b10sx>

Challenge Your Thinking

1. Explain why a vegetarian diet is considered a more energy-efficient diet for humans than one based on beef, chicken or pork.
2. Why do wild animals like elephants and wild pigs attack our crops?
3. What trophic level do humans occupy? Explain your reasoning.
4. In an ecosystem, what might happen if you have more carnivores than herbivores?
5. What might happen if you removed an apex predator from the food web?
6. What do you think would happen to an ecosystem if the number of plants was drastically decreased due to disease or another threat? How would this affect the animals in the levels above them?
7. Which trophic level do you think is the most important for the ecosystem and why?
8. What type of Ecological Pyramid would be obtained with the following data?
Secondary consumer: 120g
Primary consumer: 60g
Primary producer: 10g
 - a. Pyramid of energy
 - b. Upright pyramid of numbers
 - c. Upright pyramid of biomass
 - d. The inverted pyramid of biomass
9. In this energy pyramid, which organisms have the most energy available?
 - a. Producers
 - b. Carnivores
 - c. Herbivores
 - d. Top Predator



1.3. Human and Animal

All animals and humans need food and nutrition for their growth and well-being. Nutrition is an essential component of a healthy lifestyle and it contributes to the better overall mental, emotional and social well-being of an individual. However, the nutrient requirement differs amongst the animals, and for different age groups.

Puberty is the beginning of adolescence. The onset of puberty brings a number of changes and all of these changes must be supported with adequate intake and healthy food choices. Healthy blood circulation is essential for the body for the transport of oxygen and nutrients to cells in different parts of the body.

Diet plays a vital role in blood flow. While certain foods can have a positive effect, others can have negative effects on circulation.

Understanding nutrition can help you make informed choices regarding food consumption and eating habits.

Competency

Explore nutrition by age and gender, puberty and different life processes (double circulation, reproduction) to relate their importance in proper growth and functioning of a body.

1.3.1 Nutrition

Scope: This topic deals with the dietary requirements of people of different age groups and gender. It also includes how to read the nutrition label and shelf life of foods in the market to be aware of healthy eating habits.

Learning Objectives:

- *Discuss the nutritional requirements of people in different age groups and gender.*
- *Explore the nutritional label and shelf life of processed food to understand the nutritional values.*
- *Relate our eating habits to physical, mental, emotional, and social well-being.*

Learning Experiences

The amount of each nutrient needed in the human body is called the nutritional requirement. Individual requirements of each nutrient are related to a person's characteristics such as age, gender, level of physical activity and state of health.

Eating habits impact the physical, mental, emotional and social well-being; hence, a healthy diet is crucial throughout your lifetime. All packaged foods come with a nutrition label meant to provide you with the information necessary to know exactly what you're eating. Understanding what's in the foods you eat helps you make healthier choices.

The learner reads through the information on nutrition requirements of people in different age groups and gender in the link: <https://bit.ly/3rKzI7I>, <https://bit.ly/3nRMy2Z> and using the information gathered, the learner conducts a small study in their locality or school on the nutritional requirements of people. Collects data on the eating habits of people of different age groups and gender. Next, the learner carries out data analysis and draws conclusions. The learner shares their findings with the class and invites discussions.

The learner responds to the following questions after the activity:

1. Why do people of different age groups have different nutritional requirements?
2. Is the nutritional requirement the same for a boy and a girl? Explain?
3. Are there other factors that influence the food choices and eating habits of people? Explain.

Next, the learners explore the video link <https://bit.ly/3sZvsDy> and the link: <https://bit.ly/3KcipoH> on the importance of reading the nutrition labels. The learners interpret labels on the packaged food and talk about its importance to the class and family so that they can make healthier choices of foods.

The learners answer the following questions as part of the follow-up activity.

1. Explain the importance of reading nutrition labels on food products.
2. How does understanding nutrition labels help you to make healthier food choices?

The learner explores relevant sources to gather information on how our eating habits affect the physical, mental, emotional and social well-being of an individual. Using the information gathered, the learner debates “Our eating habits affect our physical health only.”

After the activity the learners answer the following questions:

1. Explain how our eating habits affect our mental, emotional and social well-being.
2. Explain the physical benefits of eating right.
3. What have been the winning points in the debate?

The food we eat has a direct impact on our physical, mental, emotional and social well-being, hence it is important to adopt healthy eating habits to stay healthy. Checking food labels also makes it easy for you to compare the nutrient content of different options. The food label provides information on what you are putting into your body. Next time you go out to buy food, you should definitely check the nutrition labels.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner’s ability to discuss the different nutritional requirements of people with different age groups and gender, explain how our eating habits affect our physical, mental, emotional and social well-being and explain the importance of reading nutrition labels on food products.	<ul style="list-style-type: none">● Assess the learner’s questioning, recording, analysing skills and communication skills while carrying out the study and debate.	<ul style="list-style-type: none">● Assess the learner’s interest and curiosity in understanding the significance of reading the nutrition labels on food products.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Nutrition label video: <https://bit.ly/3sZvsDy>
6. Nutrition label notes <https://bit.ly/3KcipoH>
7. Age groups and nutrition: <https://bit.ly/3rKz17I>
8. Gender and nutrition: <https://bit.ly/3nRMy2Z>

1.3.2 Double Circulation

Scope: This topic introduces four chambers of heart, double circulation (pulmonary circulation and systemic circulation), and includes the directional flow of oxygenated blood and deoxygenated blood.

Learning Objectives:

- Explain the chambers of heart with the help of a labelled diagram.
- Explain double circulation with the help of a model.
- Explain the significance of double circulation in the human body.

Learning Experiences

The circulatory system is responsible for the transportation of oxygen and food through our body. The human circulatory system has three key components: blood vessels, blood and the heart. The system is also called the double circulatory system because blood passes through the heart twice per circuit. The oxygenated blood is pumped to all parts of the body and to the body cells, and the carbon dioxide is exchanged out of the cells. The blood becomes deoxygenated and returns to the heart and is pumped to the lungs to get oxygenated. Thus, the cycle continues for the survival of the organisms.

Learners observe and identify the diagram of a heart displayed on a chart. Learners observe and draw the human heart (right atrium, right ventricle, left atrium and left ventricle). Learners explore or watch the video from the given web link <http://surl.li/pwdtp> or any other relevant sources. Furthermore, learners observe the flow of blood in the pulmonary and systemic circulation, and answer the following questions:

1. Draw a diagram of the heart and label the parts.
2. Name the parts of the heart which carry deoxygenated and oxygenated blood?
3. What do you understand about double circulation?
4. With the help of a diagram show how blood flows in the pulmonary circulation and systemic circulation.
5. What would happen if double circulation does not take place in humans?
6. How do lungs support blood circulation?

The learner explores information on double circulation from the video link: <https://bit.ly/3sXmRRQ> or any other relevant sources and writes about the process of double circulation.

Then the learner in teams uses the information gathered from the video or any other sources and constructs a working model of a double circulation using the locally available materials. Finally, the team demonstrates their working model to the class. Then the learner answers the questions below.

1. Why does the blood go to the heart twice?
2. Compare and contrast arteries and veins based on their functions.
3. Why is it necessary to separate deoxygenated and oxygenated blood?

Now, go out of the class and feel your heart. Then, make a 100m run around. Feel your heart. What do you understand from this exercise?

Learners in teams complete the worksheet provided about the significance of double circulation in the human body present to the class.

The main function of the heart is to pump blood to all parts of the body. The blood acts as the transport system of the body. It carries food and oxygen to the body and wastes from the body. Without blood circulation, our body will not function.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's ability to explain double circulation with a working model.	<ul style="list-style-type: none">● Assess the learner's creativity in making the working model and analysing skills while presenting to the class.	<ul style="list-style-type: none">● Assess the learner's understanding of the significance of double circulation in the survival of an organism.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Double circulation: <https://bit.ly/3sXmRRQ>

1.3.3 Puberty

Scope: This topic introduces puberty, the physical and emotional changes that occur in males and females and ways to cope with the changes. It also includes the attributes of good touch and bad touch.

Learning Objectives:

- *List down the physical and emotional changes occurring during puberty.*
- *List down ways to cope with physical and emotional changes.*
- *Advocate on good touch and bad touch to create a safe social environment and living.*

Learning Experiences

Our body goes through many changes from the time of our birth till our death. A child's body begins to develop and change as they become an adult. The average age for girls to begin puberty is 11, while for boys the average age is 12. After one attains puberty, one should be cautious. They should be aware of good touch and bad touch so that they can take care of themselves and take necessary precautions. Why is attaining puberty important and, yet risky?

The learner explores the physical and emotional changes that occur in a boy and a girl during puberty from the video links <https://bit.ly/3mXwpss> and <https://bit.ly/3sW9bqo>.

Learners in the team discuss and make comparisons of the changes happening to a boy and a girl.

Next, they work in teams and suggest ways to cope with the changes happening during puberty. Present the ideas in charts to share to the class.

The learner responds to the following questions to check their understanding.

1. Compare and contrast the physical and emotional changes happening to a boy and a girl during puberty.
2. Suggest some ways to cope with the changes happening during puberty.
3. Do all children attain puberty at the same time? Why?

The learner watches the video on good touch and bad touch in this video link <https://bit.ly/3mUOmba> and prepares an awareness poster with illustrations on good touch and bad touch. Displays posters around the school at strategic places.

The learner also prepares a speech on good touch and bad touch and delivers it in the morning assembly to create awareness among others.

To check their understanding of the lesson, the learner answers the following questions.

1. Explain in your own words, why it is important to know about good touch and bad touch?
2. What should you do if someone touches you?
3. What are some of the effects of good and bad touches on the victim?
4. What advice do your parents and teachers give you on touch?

Explore news on teenage pregnancy or sexual abuse. To understand better the causes and effects, write 5 to 6 questions to gather more information.

Changes happen to all and it is completely normal for us to undergo these physical and emotional changes. It is wise to talk to our parents and school counsellor if one cannot handle the emotions related to the changes. One should always be aware of the good touch and bad touch and be informed of the consequences. One should not just be aware but must be mindful not to use bad touch on others too.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">Assess the learner's ability to explain the physical and emotional changes that occur during puberty to a boy and a girl.	<ul style="list-style-type: none">Assess the learner's critical thinking skills while making the awareness poster and communication skills while delivering the speech on good touch and bad touch.	<ul style="list-style-type: none">Assess the learner's interest in understanding the difference between good touch and bad touch and always being mindful about their own actions as well to show respect and concern for all.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

- Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
- National School Curriculum Framework for Science
- REC repository
- Science Class SIX (2020), REC
- Changes during puberty part 1: <https://bit.ly/3mXwpss>
- Changes during puberty part 2: <https://bit.ly/3sW9bqo>
- Good touch, bad touch: <https://bit.ly/3mUOmba>

Challenge Your Thinking

- Identify the incorrect statement about double circulation-
 - occurs only in mammals
 - occurs in all vertebrates
 - is composed of systemic circulation
 - is composed of pulmonary circulation
- If an organism has a double circulatory system, it means that:
 - they have a 2-chambered heart.
 - their blood circulates fast at twice the rate.
 - their circulatory system has twice the volume of blood.
 - they have two circuits, one for oxygenated blood, and one for deoxygenated blood.
- The period of life, when the body undergoes changes leading to reproductive maturity is called
 - old age.

- b. grown-up.
 - c. childhood.
 - d. adolescence.
4. Reproductive age in women starts when
- a. menstruation starts.
 - b. body weight increases.
 - c. body height increases.
 - d. breasts start developing.
5. Why is it important to check the nutrition labels before buying packaged food products?
6. What happens to the blood circulation when you are standing and sitting for too long?
7. Tshering has just started menstruating and she is too shy to talk to her parents. What would you do to help her as her friend?
8. 'Boys should talk to their father, and girls should talk to their mother regarding their problems'. Argue on this statement.
9. Why should we report abuse cases to relevant people?
10. If you have difficulty dealing with your emotions in school, would you like to visit your school counsellor or any other teacher you trust to talk about it? Give reasons to support your answer.

1.4. Green Plants

Plants require nutrients in order to grow and develop. These nutrients come from the soil and are absorbed. Each nutrient has its unique function, level of requirement, and characteristics. Plants' nutritional requirements rise as they grow, and deficits or excesses can have an impact on their health. Nitrogen (N), phosphorus (P), and potassium (K) are the primary nutrients for plants.

A flower is a plant's reproductive organ. Pollination is the process by which pollen grains are transferred from the male to the female part of a flower. Seeds and fruits are developed after pollination, through the process of fertilisation. Plants have an important part in the ecosystem as primary producers. They also regulate the amount of oxygen and carbon dioxide in the atmosphere.

Competency

Explain nutrients and different life processes (photosynthesis, and reproduction) in plants to understand their significance in growth and continuity of plant life.

1.4.1 Nutrition

Scope: This topic introduces the primary nutrients- Nitrogen, Phosphorus, and Potassium [NPK] and their roles and deficiency symptoms in plants.

Learning Objectives:

- *Explain primary nutrients and its significance in plants.*
- *Identify the roles of primary nutrients in plants.*
- *Analyse the deficiency symptoms and effects of primary nutrients on the health of plants through observation.*

Learning Experiences

Growth and development in plants are affected by various conditions and nutrients. Nitrogen, Phosphorus and Potassium are primary nutrients which are required by plants in large amounts, besides other types of nutrients. What roles do nitrogen, phosphorus and potassium play in plants?

The learner explores the roles of the primary nutrients and their deficiency symptoms from the web link <https://bit.ly/31ZnUFT> or from other relevant sources and fills in the table given below:

Table 1. *Nutrients and their importance*

Nutrient	Roles	Deficiency symptoms

The learner then visits the school agriculture garden or the nearest agriculture field to observe deficiency symptoms of NPK in plants. The learner recalls three important nutrients and completes the table given below:

Table 2. *Nutrient deficiency symptoms*

Plant	Symptoms	Nutrient Deficiency
1.		
2.		

At the end of the field trip, the learner answers the following questions:

1. Which nutrient will provide green colour to plants?
2. What will happen to plants if there is no potassium in the soil?
3. What roles does phosphorus play in the growth of plants?
4. Identify the advantages and disadvantages of the use of NPK in school gardens.

Therefore, nitrogen, potassium and phosphorus are primary nutrients which play a significant role in the growth and development of plants.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner’s understanding of the roles and deficiency symptoms of primary nutrients. 	<ul style="list-style-type: none"> Assess the learner's ability to observe and identify the symptoms of primary nutrient deficiency in plants. 	<ul style="list-style-type: none"> Assess the learner’s critical analysis on the significance of primary nutrients in plants.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Roles and deficiency symptoms of NPK: <https://bit.ly/31ZnUFT>

1.4.2 Photosynthesis

Scope: This topic begins with the introduction of chlorophyll, photosynthesis and its equation (word and chemical) and significance.

Learning Objectives:

- *Explain the role of chlorophyll in photosynthesis.*
- *Describe photosynthesis using the essential elements required for this biological process.*
- *Justify the importance of photosynthesis for the survival of organisms.*

Learning Experiences

Plants are the ultimate producer of food for all life forms. Plants are autotrophic that prepare food through the process of photosynthesis. Photosynthesis takes place with the help of sunlight, water, carbon dioxide and chlorophyll. Plants prepare food in their leaves. Hence, leaves are called ‘food factories. What makes leaves green?

The learner watches a video clip on chlorophyll from the web link <https://bit.ly/3qtmXz4> or from other relevant sources.

The learner designs an experiment to test the presence of chlorophyll in leaves responsible for photosynthesis. The learner identifies the variables and conducts the experiment. Observes the colour changes in the leaves and draw conclusions and present them to the class.

The learner watches a video clip on photosynthesis from the web link <https://bit.ly/3t6tKAt> or from other relevant sources and describes the process of photosynthesis with equations and its importance.

The learner then answers the following questions:

1. Identify the raw materials plants need for photosynthesis.
2. What are the products of photosynthesis?
3. What is the importance of photosynthesis?
4. Explain photosynthesis with the help of chemical equations.

Finally, learners have a flow chart poster competition to advocate the importance of photosynthesis for the survival of organisms, and the need to refrain from polluting the environment.

Photosynthesis holds the source of food for all. It also provides oxygen and helps in cleaning the air.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner's conceptual understanding of chlorophyll and photosynthesis. 	<ul style="list-style-type: none"> Assess the learner's ability to test the presence of chlorophyll in leaves. 	<ul style="list-style-type: none"> Assess the learner's understanding of the significance of photosynthesis in plants.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Chlorophyll: <https://bit.ly/3qtmXz4>
6. Photosynthesis: <https://bit.ly/3t6tKAt>

1.4.3 Reproduction

Scope: This topic begins with the concept of pollination, pollinating agents [wind, water and animals] and the characteristics of flowers to be pollinated. It also includes the formation, dispersal, and germination of seeds.

Learning Objectives:

- Explain pollination and its significance in plants.
- Identify the agents of pollination and the characteristics of flowers for pollination.
- Explain the formation of seeds
- Identify the agents for seed dispersal
- Explain the term germination and the importance of seed in plants.
- Investigate germination and the factors affecting it.
- Explain the impacts of climate change on germination

Learning Experiences

The stamen consisting of an anther and filament make the male part of the flower. The female part of a flower is called the carpel which is made up of a stigma, style and ovary. The pollination process takes place between the stamen and the carpel. Have you ever wondered why bees visit flowers? When you play with flowers, your hands collect yellow dust. What is it called?

The learner goes around the school campus and observes insects visiting flowers. The learner carefully examines the yellow substances on the body of insects and describes what these substances are.

The learner then gathers information on pollination, agents of pollination, fertilisation and the characteristics of flowers for pollination from the web link <https://bit.ly/3n1PucU> or from other relevant sources.

Based on these experiences, answers the questions given:

1. Explain pollination.
2. What are the agents of pollination?
3. What are the characteristics of flowers required for pollination?

The learner watches a video clip on fertilisation from the web link <https://bit.ly/3f3gmoo> or from other relevant sources. Make a presentation with ICT to explain the process of fertilisation.

The learner then in a team closely observes an ovary from a flower, and cuts a thin section of the ovary for observation with a hand lens. The learner examines and makes a labelled illustration.

After the experiment, the learner answers the following questions:

1. What are those round structures observed?
2. Explain fertilisation and its importance.

The learner watches a video clip on formation seed from the web link <https://www.youtube.com/watch?v=8Y5BRMCo-00> and answer the following questions.

1. What leads to seed formation?
2. What is the process of the formation of a seed?
3. Which part of the flower develops into fruit?
4. Which part of the flower develops into a seed?
5. What is the significance of seed in the life of a plant?

The learner studies the seed dispersal and the factors responsible for it from the web link <https://bit.ly/3q4NdiZ> or from other relevant sources.

Answers the questions that follow:

1. What are the ways by which seeds are dispersed?
2. Why do you think some seeds have hooks on them?

The learner then collects different types of seeds. Observes and draws them and discusses how they are dispersed. As a follow-up activity, the learner completes the table given below:

Table 3. *Identifying Agents of Seed Dispersal*

Seed	Agents of seed dispersal
Seed 1	
Seed 2	
Seed 3	

The learner explores the parts of a seed from the web link <https://bit.ly/3zSqUjL> or from other relevant sources and draws a labelled diagram of the seed. The learner then in a team observes a soaked bean seed and identifies the structures: seed coat, cotyledon and embryo.

Finally, the learner answers the questions provided below:

1. What is the function of cotyledon?
2. What role does the seed coat play?
3. Which part of the seed grows into a new plant?
4. How would seeds become a plant?

The learner explores the concept of germination from the web link <https://bit.ly/3K5VivI> or from other relevant sources. Discusses what germination is.

The learner in a team then designs and conducts experiments to investigate the germination of seeds. The learner maintains daily observation records and eventually presents the findings to the class.

Based on the presentation, the learner answers the following questions:

1. What are the conditions necessary for germination?
2. Is the position of the seed important for germination? Why?
3. Would the container in which the seed is germinated make a difference in the germination?

The learners in teams discuss impacts of climate change on germination and share them with the class.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's conceptual understanding of pollination and germination.	<ul style="list-style-type: none">● Assess the learner's ability to investigate ovules, and the conditions necessary for the germination of a seed.	<ul style="list-style-type: none">● Assess the learner's critical analysis on the significance of pollination, seed dispersal and germination in plants.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Pollination: <https://bit.ly/3n1PucU>
6. Seed dispersal: <https://bit.ly/3q4NdiZ>
7. Fertilisation: <https://bit.ly/3f3gmoo>
8. Parts of a seed: <https://bit.ly/3zSqUjL>
9. Germination: <https://bit.ly/3K5VivI>

Challenge Your Thinking

1. Students on their field trip to a farm observed that all the potato leaves have turned yellow. What advice will you give to the farmer?

2. People in the olden times used manure in their gardens. However, with the development of the country, many farmers now use chemical fertilisers. Do you think Bhutanese farmers should be encouraged to use it? Give reasons.
3. Explain what would be life like on the Earth without photosynthesis?
4. A student wants to perform an iodine test to determine the presence of starch in the leaf where photosynthesis takes place. What are the variables used?
5. In some plants, thousands of seeds are scattered in different places, yet only a few of them germinate. What could be the reasons?
6. A student sets up an experiment using two potted plants in the same type of soil. The student kept one plant in the garden, while the other was in a dark room, and both plants are watered equally. After five days, the student observed that the plant in the darkroom dies, while the other plant in the garden appears healthy. What is the likely reason for this observation? What are the variables used in this fair test experiment?

2. Materials and their Properties

2.1. Classifying Materials

All the things around us can be pure substances or mixtures. Pure substances are further classified into elements and compounds based on the type of atoms present in them. Elements are made up of only one type of atom, whereas compounds are made up of more than one type of atoms. The atomic symbols and chemical formulae are used to clearly distinguish between elements and compounds.

The substances we use can be classified into acids and bases based on their properties.

Competency

Study symbols and molecular formulae of elements and compounds, and categorise acids and bases, to understand their uses in daily situations.

2.1.1 Elements and Compounds

Scope: This topic consists of names and symbols of common elements such as carbon, hydrogen, oxygen, nitrogen, iron, gold, silver, copper, magnesium, lead, zinc, aluminium, sodium, chlorine, iodine, fluorine, etc. In addition, students explore the concept of molecules and the names and chemical formulae of common elements and compounds [C, O₂, H₂, CO₂, H₂O, NaCl, and C₁₂H₂₂O₁₁ etc.]. It also includes differences between atomic symbols and molecular formulae.

Learning Objectives:

- Explain elements, compounds and molecular formulae with examples.
- Identify elements and compounds using atomic symbols and molecular formulae.
- Develop a model of simple molecules and describe their atomic composition.

Learning Experiences

An atom is the smallest particle of an element which may or may not exist freely. Elements have the same type of atom and are represented by symbols. When different types of atoms combine together, it forms a compound. One or more atoms of the same element, or of different elements combine together to form a molecule. For example, an oxygen molecule (O₂) is formed by combining two atoms of oxygen. Molecules are represented by their chemical formulae that consist of atomic symbols of different elements present. Do you know what H and H₂ represent? Or do you think they are the same?

Learners explore the concept of atoms, elements, compounds and their symbols and formulae using the web link <https://rb.gy/grkofg> and discuss the differences of atoms, elements, molecules, and compounds. Learners share their understanding with the class and also answer the following questions.

1. How can you differentiate between elements and compounds?
2. Why is it important to represent elements and compounds with their symbols and formulae?

The learner watches the video from the web link <https://tinyurl.com/mthdy23d> and <https://tinyurl.com/2p93jv4> to understand the methods of assigning symbols to the elements. Based on the understanding, write symbols for other elements.

The learner answers the following questions:

1. List different ways of assigning symbols to the elements.

2. Explain the symbol assigned to silver, carbon and helium.

Next, the learner explores the following weblink <https://tinyurl.com/2p85a2cn> to understand the differences between atomic symbols and molecular formulae and answers the following questions:

1. Explain atoms and molecules based on your understanding.
2. Explain the atomic symbol and molecular formula of nitrogen, iron and sodium.

The teacher provides learners with the set of symbols and formulae of substances to be identified into the elements and compounds. The learners in the group identify the elements and compounds based on their symbols and formulae and list them accordingly. Learners answer the following questions:

1. Why is Ca(OH)_2 called compound?
2. Why are Ag, Hg, Al, and Au elements?
3. Identify the elements present in the compound, CaCO_3 ?

The learner explores the following weblink <https://tinyurl.com/mry5ckkx> to understand the development of models of molecules. Develops models of simple atomic and molecular structures. Finally, the learner displays the models of simple molecules with explanations in the class.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner's conceptual understanding of assigning symbols for different elements, molecules and molecular formulae. 	<ul style="list-style-type: none"> Assess the learner's ability to differentiate atomic symbols and molecular formulae and model-making for simple molecules. 	<ul style="list-style-type: none"> Assess the learner's ability to identify elements and compounds that are used in our everyday lives.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Symbols of elements: <https://tinyurl.com/mthdy23d>
6. Symbols of elements: <https://tinyurl.com/2p93jiv4>
7. Symbols and formulae: <https://tinyurl.com/2p85a2cn>
8. Molecular models: <https://tinyurl.com/mry5ckkx>

2.1.2 Acids and Bases

Scope: This topic introduces acid and bases with its properties such as taste and pH. Furthermore, the students test acid and base using different indicators like litmus, universal indicator, methyl orange, and phenolphthalein.

Learning Objectives:

- Explore acid and base based on their properties.
- Classify substances into acids and bases using different indicators.
- Prepare indicators using the locally available materials to test acid and base.
- Explain the importance of acid and base in daily life.

Learning Experiences

Some foods that we eat taste differently, either sweet, sour, or bitter. For example, fruits like lemon, unripe orange, mango, etc. taste sour, and medicine and vegetables taste bitter. This indicates that different foods contain different chemicals in it. Have you ever wondered what makes this food taste sour or bitter?

The learner explores acids and bases from the given web links <https://tinyurl.com/yzx3vsrf> or <https://tinyurl.com/2p87bvce> and lists different properties of acids and bases. Based on the information gathered, answer the following questions:

1. Explain the properties of acids and bases and provide examples.
2. The pH of vegetable soup was found to be 6.5. How is this soup likely to taste?
3. Why are acids and bases good conductors of electricity?
4. Which bases are called alkali? Give an example.
5. Classify the following items into acid, base or neutral:
[water - pH 7, lemon juice -pH 2, soda water -pH 4, toothpaste - pH10, lime water -pH12]

Learners in a team, share their everyday experiences of using acids and bases and list them down for sharing with the class.

Learner explores more about indicators from the web link <https://tinyurl.com/2p84wpnd>. Based on the information gathered, the learner designs and carries out experiments using indicators such as litmus, methyl orange, universal indicator and *phenolphthalein* to test unknown substances such as acid or base. Record the observations in table form.

Based on the understanding of indicators, explore ways of making indicators by gathering ideas from relevant resources. Prepare an indicator using locally available materials and test acidity and basicity, and present it to the class.

Check your understanding by answering the following questions:

1. Mention the conditions required for preparing an indicator.
2. Analyse the advantages and disadvantages of making local indicators and their application.
3. List some examples of acidic and basic substances identified by using your indicators.

The learners in a group discuss the importance of acid and bases in our daily life. And list some common household acid and base, their uses in daily life and fill up the following table.

Common household acids	Uses	Common household bases	Uses
Vinegar	Used in cooking	Baking soda	Baking breads and cakes.

Learners then, answers the following questions:

1. Analyse the advantages and disadvantages of acids and bases in everyday life.
2. Name the acid produced by the stomach. How does it help in the digestion of food?
3. What would happen to our body if there were no acids and bases in it?
4. Why do we take antacids containing alkali when we suffer from stomach ache?
5. What home remedies do we use when we are stung by a honey bee?
6. Acids are those substances that taste sour and have pH values of 1 to 6. Bases are those that have a bitter taste with a soapy nature and pH values of 8 to 14. And any substance having pH 7 is considered neutral.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner's conceptual understanding of acid and base, and indicator to test acid and base. 	<ul style="list-style-type: none"> Assess learners on making an indicator to test acid and base. 	<ul style="list-style-type: none"> Assess the learner's ability to realise the significance of acids and bases in day-to-day life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Acids and bases: <https://tinyurl.com/2p87bvce>
6. Acids, Bases and Salts: <https://tinyurl.com/yzx3vsrf>

7. pH Indicators: <https://tinyurl.com/2p84wpnd>

Challenge Your Thinking

1. Why do we use symbols for elements?
2. What is the difference between the symbol and molecular formula of an element?
3. Name at least five elements or compounds that we use in our daily life. Write their symbols and formulae.
4. The pH of a solution is one. Is it acidic or basic?
5. Analyse the advantages and disadvantages of acids and bases in everyday life.
6. If you are provided with an onion, how will you prepare a local indicator?
7. 'A' and 'B' are two mystery solutions. Using a strip of blue litmus paper, how will you identify which of the mystery solutions is acidic?
8. Universal indicator is mostly preferred over litmus indicator. Why?
9. Sonam found the unknown substance in the bottle and was curious to know whether it is acid or base. Suggest the best way for Sonam to identify the substances.

2.2. Materials and Change

Substances that we use in our everyday life undergo changes. These changes happen under the effects of different conditions and forces. Changes can be human-made or natural. Changes brought about by the application of heat, cooling, adding water or using force are human-made. Ripening of fruits, rusting, and fading the colour of objects are natural changes. Have you wondered why things change over time?

Competency

Examine the features of chemical changes, as well as distinction between hard water and soft water in order to discern their significance within the natural environment.

2.2.1 Chemical Change

Scope: This topic will cover the concept of chemical change, its properties, and its significance.

Learning Objectives:

- Explain chemical change with examples.
- Investigate the characteristics of a chemical change.
- Justify the significance of chemical changes in everyday situations.

Learning Experiences

Did you know that things around you keep changing? For example, the trees shed their leaves in autumn, an egg hatches into a chick and a seed grows into a plant. All these changes can be broadly categorised into two types - physical and chemical change. These two changes have distinctive characteristics. Do you know what a chemical change is?

To learn about the concept and the properties of a chemical change, use the web link <https://tinyurl.com/3z6hxyhy>.

The learner in the teams' designs and conduct an experiment to study the characteristics of chemical change and note the changes taking place while conducting the experiment. Then the learner answers the following questions:

1. Explain the chemical change in your own words.
2. Elaborate on one significant characteristic of chemical change.
3. Explain the importance of chemical change with the help of an example.

The learner then observes things around them and the changes in process in nature and discusses them with the class.

Justify the significance of chemical changes in everyday situations.

Learners watch a video on “chemical changes: exploring everyday transformations” from the link <https://shorturl.at/qrCP7>, and read the article on “examples of chemical changes in everyday life” from the link <https://shorturl.at/lpEL1> to understand the significance of chemical changes in everyday situations. Learners then complete the table given below.

Examples of chemical change in everyday life	Significance
1.	
2.	
3.	

Learners answer the following questions.

1. Can you identify potential advantages or disadvantages linked to chemical changes in our daily experiences?

The change in which new substances are formed and the identity of the original substance are lost is called a chemical change. For example, when the wood has burned completely, ashes are left behind. Ash is a new substance formed due to the burning of another substance, wood.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> ● Assess the learner's conceptual understanding of chemical change. 	<ul style="list-style-type: none"> ● Assess the learner's ability to design the experiment to identify the properties of chemical change. 	<ul style="list-style-type: none"> ● Assess the learner's understanding of the significance of chemical changes.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Physical and Chemical change, and their properties: <https://tinyurl.com/3z6hxyhv>

2.2.2 Hard Water and Soft Water

Scope: This topic covers the concept of soft water and hard water with their distinctive characteristics followed by a process to remove hardness of water through distillation and boiling. Also study the advantages and disadvantages of hard water and soft water.

Learning Objectives:

- *Explore the characteristics of soft water and hard water.*
- *Carry out an experiment to remove the hardness of water.*
- *Evaluate the advantages and disadvantages of hard water and soft water.*

Learning Experiences

Water is a transparent, tasteless, odourless, and nearly colourless chemical compound. Water is the main constituent of the Earth. It is vital for all known forms of life, though it provides neither energy nor organic nutrients. Water is considered a universal solvent because it dissolves almost all the substances on the Earth.

Water pollution by humans and nature alter the constituents of the water. Based on the chemical properties of water, it can be categorised into two types: hard water and soft water. You may wonder what determines the hardness or softness of water. Which type of water is healthier or safer to drink? Have you experienced any difference in the taste of water from different sources? Why do you think it is easier to wash clothes during summer than during winter?

The learner explores the concept and characteristics of hard water and soft water from the weblink <https://tinyurl.com/5yt4nfnzf> and <https://tinyurl.com/48d932a4>.

The learner explores the suggested web link <https://tinyurl.com/2p9243kx> to understand the differences between hard water and soft water and notes the important points.

Then, the learner answers the following questions:

1. What makes water hard?
2. Write at least three differences between hard water and soft water.

The learner collects water samples from different sources and investigates the hardness and softness of water by carrying out experiments using soap solution. Answer the following questions:

1. Which water sample forms the most lather?
2. Which water sample forms the least lather?
3. Identify independent, dependent and controlled variables in the experiment.
4. How did you make this experiment a fair test?
5. What conclusion can you draw from the experiment?

The hardness or softness of water is determined by the mineral content of both the calcium and magnesium. Hard water produces less lather with soap while soft water produces more lather. Both hard water and soft water have advantages as well as disadvantages for us.

The learner carries out an experiment to show that the hardness of water is due to the presence of magnesium salt and the learner answers the following questions:

1. In which test tube, the water forms more lather? why?
2. Adding magnesium salt to one of the test tubes makes water hard. Is this a physical or a chemical change? Justify your answer.
3. Identify independent, dependent and controlled variables in the experiment.
4. How did you make your experiment a fair test?
5. Write your conclusion.

In this experiment, we can conclude that the water in the test tube where magnesium salt is added forms less lather than the other test tube. This shows that the presence of magnesium salt makes water hard.

The learner explores the weblinks <https://tinyurl.com/pba3wke2> and <https://tinyurl.com/ya3b9e47> to remove the hardness of the water.

After identifying different ways of removing the hardness of water from the above sources, the learner carries out an experiment to show that boiling and distillation can remove the hardness of the water. Then the learner answers the following questions:

1. In which test tube, the water produces more lather? Why?
2. In one of the test tubes, the boiling or distillation makes the water soft. Explain whether it is a physical or chemical change.
3. Identify the independent, dependent and controlled variables in this experiment.
4. Which is the control set-up used in this experiment?

The learners in a group read the case study handout provided by the teacher to understand the advantages and disadvantages of hard water and soft water. Based on the above case study, answer the following questions:

1. Outline some of the advantages and disadvantages of hard water.
2. Outline some of the advantages and disadvantages of soft water.
3. Differentiate soft water and hard water with examples.
4. Which water would you prefer to consume? Why?

The learners in a group make a presentation to the class. The teacher provides feedback as required.

The boiled water or the distilled water forms more lather with soap because the mineral salts present in the water are removed by boiling and distillation.

Assessment and Reporting

The teacher may use rubrics, checklists or any other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
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<ul style="list-style-type: none"> ● Assess the learner’s conceptual understanding of characteristics of hard water and soft water. Also, assess their ability to differentiate between hard water and soft water and to identify the advantages and disadvantages of hard water and soft water. 	<ul style="list-style-type: none"> ● Assess the learner’s ability to investigate hard water and soft water, and ways to remove the hardness of the water. 	<ul style="list-style-type: none"> ● Assess the learner’s ability to relate the importance of hard water and soft water in their daily lives.
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For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC.
2. National School Curriculum Framework in Science
3. REC Repository.
4. Science Class SIX (2020), REC.
5. Soft water vs Hard water: <https://tinyurl.com/5yt4nfzf>
6. Soft water and hard water: <https://tinyurl.com/48d932a4>
7. Differences between hard and soft water: <https://tinyurl.com/2p9243kx>
8. Removal of the hardness of water: <https://tinyurl.com/pba3wke2>
9. Water softening: <https://tinyurl.com/ya3b9e47>

Challenge your Thinking

1. Explain why chemical change is an irreversible change.
2. Chemical change can be both harmful and useful. Mention some examples to support your answer.
3. Is rainwater hard water or soft water? Explain your answer.
4. Can filtration remove the hardness of water? Justify your answer.
5. Which type of water will you prefer for washing clothes? Why?
6. People of Pasakha face difficulty in washing their clothes because the water doesn’t form a lather easily. What could be the reason for this problem? What ways would you suggest to the people there to overcome this problem?
7. Phuntsho takes 2mL of distilled water in four test tubes marked A, B, C and D. Then he adds sodium chloride solution to test tube A, calcium chloride solution to test tube B, hydrochloric acid to test tube C and magnesium chloride solution to test tube D. In which test tube(s) will the leather be formed with detergent? Justify your answer.
8. Compare physical and chemical changes with some examples.
9. Dorji and Pema are washing two similar pieces of clothes in water from two different sources. Dorji needed 10gm of soap but Pema needed 15.5gm. Which water is harder than the other? Identify important variables in such a comparison.

2.3. Separating Mixtures

We use different things in our daily life. There are varieties of mixture formed depending on its constituents. In some cases, pure substances are needed for specific purposes. So, in order to acquire pure substances, separating those mixtures becomes crucial.

Competency

Examine the concept of solutions, liquid-liquid mixtures and techniques of separating them according to their characteristics for appropriate use in daily life.

2.3.1 Mixtures in Liquids

Scope: Mixtures in liquids focus on the concept of solute, solvent, solution and solubility. Additionally, this topic includes the exploration of soluble solids and separation using the process of evaporation and distillation, immiscible and miscible liquids, and ways of separating these types of mixtures [using separating funnel for immiscible liquids and distillation for miscible liquids]

Learning Objectives:

- Explain solute, solvent, solution and solubility with examples.
- Classify liquid-liquid mixtures into miscible and immiscible liquids based on their solubility.
- Demonstrate the methods of separating soluble solid from solution, and miscible and immiscible liquid mixtures.
- Justify the importance of separating liquid mixtures in real life situations.

Learning Experiences

Solid-liquid refers to the mixture formed when a solid is mixed with a liquid. And liquid-liquid mixtures are formed when two or more liquids are mixed. In some cases, pure substances are more useful than in a combined state. E.g.: For we all love butter. We use it for different purposes as pure butter. Butter is separated from the milk by churning the milk. Likewise, how would you separate sugar from sugar solution? What process would you apply to separate mixtures of oil and water?

The learner explores the solute, solvent and solution from the web link <https://youtu.be/ktnhZPUsqIE> or <https://tinyurl.com/wbbkfbrn> and identifies solute, solvent and solution with a few examples.

Then the learner demonstrates the process of evaporation to separate soluble solids from a solution. Based on the understanding the learner answers the following questions:

1. What will happen to salt when it is added to water?
2. You are preparing coffee. You took a cup of hot water. Then, one spoonful of sugar and coffee powder is added to the water. What would happen to sugar and coffee powder added to water? Identify solute, solvent and solution from the situation above.

The learner explores the miscible and immiscible liquids from the web link <https://youtu.be/TIJJ5xTnX-M> or any other relevant sources and identifies miscible and immiscible liquids with a few examples.

Then the learner gets into a team and uses different liquids such as water, oil, alcohol, milk, kerosene, petrol, etc. to prepare the liquid solutions. The learner in the team mixes any two liquids and finds out whether they are miscible or immiscible and records the observations accordingly. The learner in the team records the observation and the team shares the findings in the class for feedback and comments.

Table 4. Classification of liquids into miscible and immiscible

Miscible	Immiscible

Then the learner explores methods to separate miscible and immiscible liquids from the link <https://youtu.be/iGMMISsDLco> and answer the following questions:

1. Why do we use a separating funnel instead of a filter funnel in separating immiscible liquids?
2. Why is it possible to separate a mixture of two liquids with different boiling points by distillation?
3. People do not use water to adulterate oil, while water is commonly used to adulterate milk. Give reasons.

The learner designs an experiment and carries out an investigation to separate miscible and immiscible liquids. The learner in the team records the observation and the team shares the findings and makes PowerPoint presentations in the class for feedback and comments.

The learners read the case study on “Optimizing Liquid Separation in a Beverage Manufacturing Plant” and answer the following questions:

1. What are the benefits of liquid separations mentioned in the text?
2. Which specific separation techniques are mentioned in the case study to address the challenge of undesirable sediments in the fruit-flavoured drink?
3. How does the implementation of liquid separation methods contribute to product quality and consistency in the beverage manufacturing process?

Separation of soluble solids is possible using the process of evaporation and simple distillation. Miscible and immiscible liquids can be separated by the process of simple distillation and using separating funnels respectively in order to obtain the pure state. Therefore, it is important to learn various separating methods and apply these methods accordingly in a real-life setting.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner’s conceptual understanding of 	<ul style="list-style-type: none"> Assess the learner's ability to demonstrate 	<ul style="list-style-type: none"> Assess the learner’s realisation on the importance

the miscible and immiscible liquids and methods of separating mixture by process of distillation and using a separating funnel.	these methods of separation and separating soluble solids using the process of evaporation and simple distillation.	of separating mixture and its application in everyday life.
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For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020).
2. National School Curriculum Framework in Science
3. REC repository.
4. Science Class SIX (2020), REC.
5. Solute solvent solution: <https://youtu.be/ktnhZPUsqIE>
6. Mixtures and solutions: <https://tinyurl.com/wbbkfbrn>
7. Miscible and immiscible liquids: <https://youtu.be/TIJJ5xTnX-M>
8. Separating miscible liquids: <https://youtu.be/iGMMISsDLco>

Challenge Your Thinking

1. How can you separate the soluble solids from a solution?
2. What would happen if evaporation does not take place in nature?
3. How will you separate alcohol from water?
4. Is rainwater distilled water? Justify.
5. You are provided with a mixture of water and sugar. Name an appropriate process which can be used to separate them without wasting any of them.
6. Beaker A contains a mixture of kerosene and water. Beaker B contains the salt solution. What separation methods will you use to separate these mixtures?
7. What happens if we continuously add soluble solids to the solution? Pema dissolved salt in the water to prepare a solution. Is it a physical or chemical change? Justify.

3. Physical Processes

3.1. Forces and Motion

Everything thrown up falls down. The force with which the Earth pulls everything towards its centre is called Earth's gravity. This pull of the Earth is called gravitational force. It was first discovered by the scientist Isaac Newton.

In solid and liquid, the particles are closely packed and are denser compared to gas. Some objects float and some objects sink in the liquid depending on the density of the object and the liquid. The object with the lesser density compared to the density of liquid floats on it

Competency

Explain mass, weight, gravity, and gravitational force, density, their relationships, and analyse their effects in nature and human's life.

3.1.1 Gravity and Factors

Scope: This topic begins by introducing the concept of mass, weight, gravity, and gravitational force. Further the relationship between mass and gravity, mass and weight, altitude and gravity shall be discussed in this topic.

Learning Objectives:

- Explain mass, weight, gravity and gravitational force.
- Investigate the effects of mass on gravitational force to understand the impact of gravity on daily activities.
- Explore the relationships between mass, weight and gravity.
- Investigate the effects of altitude on gravitational force to understand the impact of gravity on daily activities.

Learning Experiences

Drop an object, and it falls to the floor. It is pulled down by an invisible force called gravity. The gravitational force differs from place to place of varying altitudes. Why is gravity important? How do mass and altitude affect gravitational force?

Explore the web link <https://go.nasa.gov/3tAykHw> or <https://bit.ly/3FBLfLG> to understand gravity. Further, the learner explores the web link <https://bit.ly/3rwhKWF> or watches the video from the web link <https://bit.ly/3nHYCUC> and notes the difference between mass and weight.

The learner may use balls of different sizes and masses to investigate the effect of gravitational force on the mass. Use the given link <https://urlshortner.org/ghItb> or <https://urlshortner.org/XYIqy> to understand the effects of gravitational force with variation in altitude.

Based on the findings, the learner explains the effects of gravitational force due to variations in mass and altitude. The learner makes a PowerPoint presentation and presents it in the class.

Table 5. *Variation of gravitational force with varying mass and altitude*

variables	Predict	Observe	Explain
Mass			
Altitude			

Then, the learner answers the following questions:

1. What causes gravity?
2. Why is gravity important?
3. How are altitude and gravitational force related?
4. Why is the pull of gravity more at the poles than at the equator?
5. What helps the heavenly bodies to stay in their orbit?
6. How does the mass of heavenly bodies affect the gravitational force?

Learners carry out the following activities to understand the relationship between mass, weight, gravitational force and their applications in daily life. Learners first try to derive the relation between mass, weight and gravity with the help of a worksheet. Then, the teacher reiterates the relation as $w = mg$, followed by some numerical questions. Finally, learners analyse the effect of altitude on gravitational force.

Based on the understanding from the web link, the learner first predicts how gravitational force varies with variations in mass and altitude. Then the learner in the team designs an experiment to investigate the effects of mass and altitude on the gravitational force. First, the learner predicts and writes what happens to gravity as you increase or decrease the mass and altitude. Then the learner conducts the experiment and records the observation.

Gravity plays a major role in sustaining life on Earth. Objects with greater mass that are closer to each other have a stronger force of gravity between them. The effect of gravity pulls on the mass of an object is weight. Therefore, mass remains constant everywhere, whereas the weight of an object is different at different altitudes. Gravitational force holds the planets in their orbit around the Sun and also keeps the Moon in its orbit around the Earth.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner's conceptual understanding of gravity, gravitational force, and effects of mass and altitude on the gravitational force. 	<ul style="list-style-type: none"> Assess the learner's ability to design and carry out an experiment to investigate the effect of gravitational force due to variations in mass, altitude and location. 	<ul style="list-style-type: none"> Assess the learner's understanding on the importance of gravity on sustaining life on earth.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Acceleration due to gravity: <https://urlshortner.org/ghItb>
6. Effect of variation in mass and altitude on gravity (Simulation): <https://urlshortner.org/XYIqy>
7. Gravity: <https://go.nasa.gov/3tAykHw>
8. Gravity: <https://bit.ly/3FBLfLG>
9. Mass and weight: <https://bit.ly/3rwhKWF>
10. Differences between mass and weight: <https://bit.ly/3nHYCUC>

3.1.2 Floating and Sinking

Scope: This topic deals with the comparison of the density of a solid with that of density of different liquid, importance of floating and sinking.

Learning Objectives:

- Conduct an experiment to compare the density of solid in different liquids.
- Recognise the importance of floating and sinking objects in liquid.

Learning Experiences

Some objects float in liquids, while others sink. This depends on the densities of floating objects and the liquids. Denser the liquid, the more the objects float. If we drop a wood block and a metal pin of the same mass in water, what will happen?

The learner in teams designs an experiment to compare the densities of solid and liquid using different solids and different liquids. The learner first predicts whether the solid sinks or floats in the liquid and then conducts the experiment and records the observations. Finally, the learner draws the generalisation of sinking and floating in relation to the density of objects and liquids. The team presents the findings to the class.

For further understanding, the learner watches the video from the link <https://youtu.be/2dyCe1GPage> to understand why objects float and sink, or <https://bit.ly/3GJ4uUN> to understand more about density. Answers the following questions:

1. Solids are generally denser than liquids. Justify.
2. Will mercury float in water? Why?
3. Which is denser, 1 kg of water or 10 kg of water? Why?

Learners are sent to the IT room or outside the classroom to explore on their own about the importance of floating and sinking objects in liquid in people’s life.

They browse the internet or ask anyone they meet about the importance of floating and sinking in people’s life. Learners present their findings to the class in the next period.

Solids are generally denser than liquids, whether solid sinks or floats in a liquid depends on the density of both. Thus, different solids behave differently in different liquids.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner's conceptual understanding of the density of liquids 	<ul style="list-style-type: none"> Assess the learner's ability to design and carry out an experiment to investigate the sinking and floating of different solids when placed in different liquids with different densities. 	<ul style="list-style-type: none"> Assess the learner's realisation of the significance of gravitational force in everyday life.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Density: <https://bit.ly/3GJ4uUN>
6. Floating and sinking: <https://youtu.be/2dyCe1GPage>

Challenge Your Thinking

1. Why does a ball moving upward in the air slow down and finally fall back?
2. What happens to the gravitational force, if the mass of one of the bodies is larger?
3. When a marble and a sharpener are dropped at the same time from the same height, which one will hit the ground first? Why?
4. The weight of a sack of potatoes in Gelephu is 50 kg. Will the weight increase or decrease in Lingzhi? Why?
5. Why does an object weigh more on the Earth than on the Moon?
6. The reading on a spring balance for the same mass is not the same everywhere. Why?
7. What will happen if there is no gravitational pull on the Earth?
8. Two candles of the same mass are immersed, each in a beaker containing different liquids. In one of the beakers, the candle floats whereas the candle in the other beaker sinks. What could be the reason behind this?

3.2. Energy

In your lower class you have learnt that energy can neither be created nor destroyed, but changes from one form to another. Potential and kinetic energy are two forms of energy. An object can store energy as a result of its position. This stored energy due to the position of the object is referred to as potential energy. Kinetic energy is the energy due to the momentum of an object.

Competency

Investigate potential energy and kinetic energy, factors affecting potential energy and kinetic energy to understand their application in life.

3.2.1 Forms of Energy

Scope: This topic introduces potential and kinetic energy, investigation and factors influencing potential and kinetic energy.

Learning Objectives:

- Explain potential and kinetic energy with examples from the surrounding.
- Investigate the factors affecting potential energy and kinetic energy.
- Relate the significance of PE and KE to our daily activities.

Learning Experiences

Potential, or stored, energy comes from the position of an object. For example, a rock on top of a hill has potential energy because it could roll down the hill. When the string of a bow is stretched, it has energy stored in it. This stored energy is called potential energy. Potential energy is stored energy, which is due to the position or condition of an object.

Kinetic energy comes from the motion of an object. For example, once the rock starts rolling down the hill it gains kinetic energy. How can we explain that these energies are affected by different factors?

The learner watches the video from the given web links <https://bit.ly/3IfSryG> and <https://bit.ly/3nH1TTZ> or other relevant sources to understand the concept of potential and kinetic energy.

After watching videos, the learner in a team discusses identifying some more examples of objects that have potential energy and kinetic energy. Share their findings with the class.

The learner demonstrates the transformation of potential energy to kinetic energy through simple experimentations.

Learners in teams carry out various activities to investigate the factors affecting potential energy and kinetic energy. Then answer the following questions based on experiments.

1. What are the factors on which the potential energy depends?
2. What are the factors on which the kinetic energy depends?
3. What will happen to the kinetic energy if speed is increased 3 times?
4. What will happen to the potential energy if the mass of the object is increased?
5. What will happen to the kinetic energy if the mass of an object is increased?

The learner in the team prepares a presentation using ICT or chart paper which includes the following points:

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- Concept of potential energy and kinetic energy.
- The factors on which potential energy depends.
- Relationship between potential and kinetic energy.
- Significance of potential and kinetic energy in our life.

The learner answers the following questions.

- What is the common factor that affects both potential and kinetic energy?
- Less pain is experienced if you happen to fall from a lesser height. Why?
- Explain which has a greater impact on the kinetic energy of an object, its mass or the speed?

Learners explore how kinetic energy and potential energy apply to everyday life and share to the class.

Potential energy is affected by the mass and height of the objects. A raised object has potential energy and it can do work. Kinetic energy is also known as the energy of motion. The kinetic energy is affected by the mass and speed of the moving objects.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">Assess the learner's ability to understand the concept of potential and kinetic energy and explain the factors affecting potential and kinetic energy.	<ul style="list-style-type: none">Assess the learner's ability to investigate the potential and kinetic energy through activities and presentations to the class.	<ul style="list-style-type: none">Assess the learner's understanding of the applications and importance of kinetic and potential energy in one's own life.

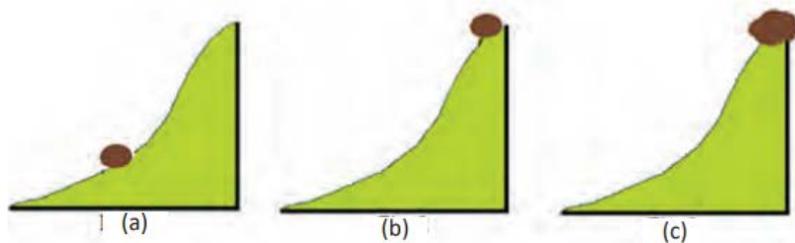
For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

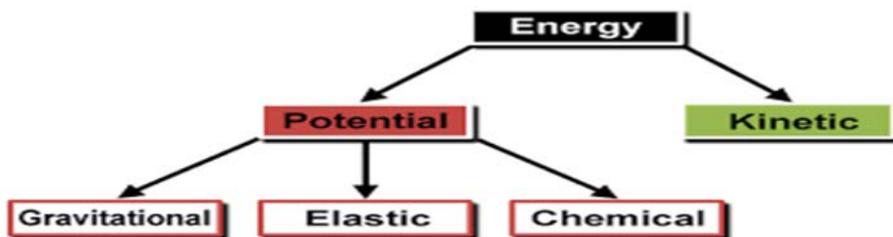
- Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
- National School Curriculum Framework for Science, (2022)
- REC repository
- Science Class SIX (2020), REC
- The difference between Kinetic & Potential Energy: <https://bit.ly/3IfSryG>
- PHET Interactive simulation: <https://urlshortner.org/2GSOi>

Challenge Your Thinking

- Compare kinetic energy and potential energy.
- Study the diagram below and answer the following questions.



- a. Which rock has the minimum potential energy? Why?
 - b. Which rock has the maximum potential energy? Why?
3. Explain the energy transformation based on the flow chart given below.



4. Explain the significance of potential energy and kinetic energy in our life.
5. Give an example in which a body possesses both kinetic energy and potential energy in day-to-day life.
6. Name two kinds of energy that potential and kinetic energy can produce.
7. Explain how speed and mass affect kinetic energy.

3.3. Electricity and Magnetism

Electricity is an important form of energy that is used for many purposes. It is the flow of electric current through the conductor. Do you know that a streak of lightning in the sky is also electricity? We cannot see the current but we can feel it and even measure it. Electric current is measured in a unit called ampere (A).

We see magnets all around us; refrigerators, magnetic locks, magnetic play boards, pin holders, etc. For centuries, the magnetic compass has been used by travellers for navigation. Large-scale applications include the cranes that are used to carry scrap metals in industries and scrapyards. Have you ever wondered how magnets can be made so strong that they can be used to lift very heavy objects?

Competency

Construct a parallel circuit in contrast to a series circuit and explore methods of preparing permanent, temporary magnets, and enhancing the electromagnetic power to improve functionality in home appliances.

3.3.1 Circuits

Scope: This topic focuses on the construction of a parallel circuit and its comparison with a series circuit. Further it includes identifying types of circuits at home and school and understanding the advantages of using circuits.

Learning Objectives:

- Explore the characteristics of parallel circuits in contrast to a series circuit.

- Construct a parallel circuit using available resources and compare it with the series circuit.
- Explore the advantages of parallel circuits in comparison to series circuits.
- Examine the types of circuit used at home or school, and justify its appropriateness.

Learning Experiences

An electric circuit provides the path for an electric current to flow through it. Do you wonder what makes an electric bulb, refrigerator, fan, or computer work? Do you have a cell phone? Listen to the radio? Watch television? All of these have electric circuits. Electric circuits are in all the devices that are used in everyday life. Did you observe the circuit connection in school or at home and have you ever thought about what type of circuit it is?

The learner uses the link <https://bit.ly/3HHniUK> or <https://bit.ly/3f29Pul> or other relevant sources to understand parallel and series circuits. Observe the circuit connection in school or at home. Make a drawing of the circuit that you observed. Then the learner presents their work to the class.

The learner constructs a parallel circuit using the locally available materials and compares it with the series circuits learnt in lower classes. The learner compares the circuit constructed by them with the electric circuit used at home with the appropriate justification of its uses at home.

The learner answers the following questions based on the circuit they have constructed.

1. What are the main differences you have found between the series and parallel circuits?
2. What kind of circuit is used at homes, schools and other offices? Why?
3. Analyse the advantages and disadvantages of the parallel circuit.

Electric circuits are generally of two types, namely parallel and series circuits. When one electrical component is connected one after the other forming a single path for the flow of current, it is called a series circuit. However, if electrical components are connected across each other to form more than one path for the flow of electricity, it is called a parallel circuit.

Learners explore the advantages of parallel circuit over series circuit and share to the class.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> ● Assess the learner's conceptual understanding of parallel and series circuits and their differences. 	<ul style="list-style-type: none"> ● Assess the learner's skills in constructing parallel circuits using locally available materials. 	<ul style="list-style-type: none"> ● Assess the learner's understanding of preference of the kind of electrical circuit used at homes and its appropriateness.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Types of circuits: <https://bit.ly/3HHniUK>
6. Types of electric circuits: <https://bit.ly/3f29Pul>

3.3.2 Magnet

Scope: This topic focuses on preparing temporary magnets and ways of increasing the strength of a magnet. Further it also deals with study of magnetic field, shapes of magnet and use of magnets in various home appliances.

Learning Objectives:

- *Explore the concept of temporary and permanent magnets, magnetic strength, and magnetic field.*
- *Carry out an experiment to demonstrate the magnetic field of a magnet.*
- *Prepare temporary magnets using available resources.*
- *Identify the uses of magnets in everyday life.*

Learning Experiences

Magnets come in different shapes, sizes and strengths. Can you think of a few different shapes of magnets you see around? Draw and describe them.

Some magnets are strong while others are weak. Some magnets are temporary while other magnets are permanent. The strength of the temporary magnets can be increased using suitable methods. The learner watches the video from the link <https://bit.ly/3pQthAx> and <https://youtu.be/uj0DFDfQajw> and <https://youtu.be/LIiPh4sqa0> and <https://youtu.be/0Zufndp7SbY> to understand the concept of temporary magnet and magnetic fields.

The learner conducts an experiment to demonstrate the magnetic field of a magnet. Draw the representation of magnetic fields and display them in the class. Then, bring another magnet and align it with the earlier one. Make an illustration of what you saw.

Explore ideas on the internet or other resources to make temporary magnets by using locally available resources. Explore its use. Describe what you did in making it.

Further, the learner makes temporary magnets and suggests ways to increase the strength of the temporary magnet. The learner answers the following questions to check their understanding.

1. Explain ways of increasing the strength of the temporary magnet. Make an illustration of them.
2. What are the differences between the permanent magnet and the temporary magnet?

Learners explore the given link [What are 5 uses of magnets?](#) And [What Are Some Everyday Uses of Magnets? - Twinkl Homework Help](#). After having read the uses of magnets, learners engage in group discussion. For further deepening of learners' learning experience, the teacher poses following questions:

1. How magnetic needle is used in showing the direction?
2. How can magnets help in preventing corrosion in a water heater?
3. Complete the worksheet <https://www.liveworksheets.com/rh951297bq>
4. Design simple devices that make use of magnets.

Magnets exert force by creating magnetic fields around them. Magnetic fields always run from the north pole to the south pole. Magnetic fields cannot be seen, however, with the help of iron filings and magnets, one can observe the magnetic field lines around the magnet.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> Assess the learner's conceptual understanding of the magnetic field, permanent and temporary magnets and strength of magnetic fields. 	<ul style="list-style-type: none"> Assess the learner's skills in conducting an experiment to demonstrate the magnetic field of the magnet and drawing the diagrams to represent the magnetic field around the magnet. 	<ul style="list-style-type: none"> Assess the learners' understanding of the uses of magnets in different appliances.

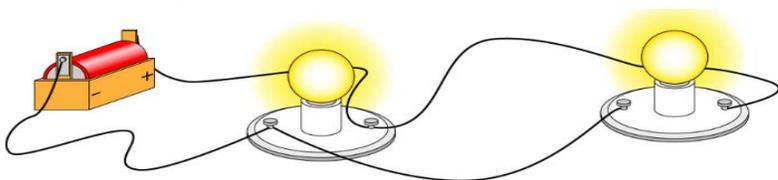
For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. What is a magnetic field? <https://youtu.be/uj0DFDfQajw>
6. Magnetic Field Lines: <https://youtu.be/LIiPh4sqa0>
7. Magnets: <https://youtu.be/0Zufndp7SbY>
8. Temporary and Permanent magnets: <https://bit.ly/3pQthAx>

Challenge Your Thinking

1. Why are magnets made in different shapes and sizes?
2. Draw an arrow to indicate the direction of magnetic lines of force.
3. Study the diagram below and answer the questions that follow.



1. What will happen to the brightness of one bulb if the other bulb is removed from the circuit?
2. If one of the bulbs does not work, what will happen to the other bulb? Why?
3. What type of circuit is it?
4. Too many electrical components should not be connected to a single electrical point? Why?
5. Sometimes you observe that the electric bulb at our home glows very dimly. Explain why?
6. What is the use of magnets in a refrigerator?
7. You are in a scout camp in a forest. How can you find directions back to your base camp?

3.4. Light and Sound

White light is composed of seven different colours. Colours are visible when white light passes through different media of varying densities. But have you ever thought of what makes it possible for light to split into seven different colours? Similarly, have you thought about whether or not a sound can travel through different media? Do you know that light travels at a speed of 100, 00, 00, 00 m/s in the air while sound travels at a speed of approximately 343 m/s in the air?

Competency

Demonstrate refraction of light and propagation of sound through different media to understand their significance in our daily life.

3.4.1 Properties of Light

Scope: The topic explains the concept of reflection, refraction, and explores experiments on bending of light.

Learning Objectives:

- Explain the phenomenon of reflection and refraction of light.
- Design an experiment to investigate refraction of light.
- Explain the significance of refraction of light in our daily life.

Learning Experiences

Light travels in a straight line. But what happens when light passes from one medium to another? Why does a person look shorter in water than he/she usually is? Why does a pencil look bent when dipped in a glass of water? Have you ever thought of all these?

Learners explore about the reflection of light by visiting the links, [Reflection of Light | Don't Memorise](#) and [Mirror and Reflection of Light](#).

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The learner watches the video from the following web link <https://rb.gy/mfh07y> to find out what happens when light travels from one medium to another. Based on the information from the video, the learner in teams designs an activity to confirm the effects of refraction of light and demonstrates it in the class.

The learner then answers the following questions:

1. Explain your experiment in detail.
2. What is responsible for the bending of light when it travels from one medium to another?
3. Why does the speed of light change when it travels from one medium to another?

Learners visit the web link [15 Uses Of Refraction: Detailed Analysis - LAMBDATEEKS](#) to understand the uses of refraction in our everyday life. Learners in groups select one application of refraction and discuss their significance. After the discussion, learners take turns to share their findings to their friends. Teacher would constantly give feedback and do necessary corrections whenever required.

Refraction occurs when light travels from one medium to another. From the formation of rainbows to making objects under a water surface appear closer than they really are, refraction is responsible.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none">● Assess the learner's ability to explain the refraction of light and how it happens.	<ul style="list-style-type: none">● Assess the learner based on the ability to design the activity to confirm the effects of refraction of light.	<ul style="list-style-type: none">● Assess the learner's ability to explain the importance of refraction in our lives.

For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Refraction of light: <https://rb.gy/mfh07y>

3.4.2 Properties of Sound

Scope: This topic explains how sound travels through different media. [Solid, liquid, and gas]. Variation of pitch and volume in different media.

Learning Objectives:

- *Explore the propagation of sound through different media.*

- *Design and carry out an experiment to demonstrate how pitch and volume of the sound changes in different media.*
- *Explain the significance of sound in our daily life.*

Learning Experiences

Sound, unlike light, needs a medium to travel through. Sound travels at different speeds in different media. Why do you think sound travels at varying speeds?

The learner watches the video from the link <https://rb.gy/qiekp1> and answers the following questions:

1. In which medium does the sound travel the fastest? Why?
2. Can you hear the sound, if there is no medium?
3. Why does the pitch of sound change in different media?
4. How can we increase or decrease the pitch of sound in different media?
5. Do all vibrations produce sound? Explain.

The learner watches the video on volume and pitch from the web link <https://rb.gy/jnq8aq>. Based on the information, the learner in teams designs a few musical instruments and demonstrates them to the class.

The learner then answers the following questions:

1. How can the pitch of a musical instrument be increased?
2. Does volume affect pitch? Explain.

Learners would sit in groups and write a brief script to enact a short play of a deaf person and the world. Learners are given some time to prepare their play. The teacher would provide necessary support and feedback to make it lively and educational. Based on the play enacted by the learners, they delve into writing brief reflections on the importance of sound in our everyday life.

You hear sounds from different sources with a low or high pitch. The sound of a whistle is different from the sound of a drum. The whistle makes a shrill sound compared to the sound made by the drum.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> ● Assess the learner's conceptual understanding of the relation between the speed of sound and medium. 	<ul style="list-style-type: none"> ● Assess the learner based on designing and conducting experiments to demonstrate the change in pitch and volume of sound when it travels through different media. 	<ul style="list-style-type: none"> ● Assess the learner's ability to work and contribute during teamwork.

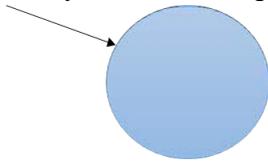
For recording and reporting, refer to the National School Curriculum Framework in Science.

Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science
3. REC repository
4. Science Class SIX (2020), REC
5. Speed of sound in different media: <https://rb.gy/qiekp1>
6. Volume and Pitch: <https://rb.gy/jnq8aq>

Challenge Your Thinking

1. How would life be if there were no light and sound in the world?
2. Why are we not able to hear the sound properly as we move further away from the source of the sound?
3. Study the water drop. Complete the ray diagram with white light dispersed into colours.



4. Where would sound travel faster: on top of Jomolhari or in Phuntsholing? Justify your answer in relation to the particle theory of matter.
5. Study the diagram.



- a. How can you increase the pitch of the sound?
 - b. How can you increase the volume or loudness of the sound?
 - c. Where do you use this idea at home?
6. Your school drummer wants to increase the pitch of the drum during the march past. What would you suggest to him/her?
 7. Your brother/sister who is in class V puts a pencil in a glass of water and cries seeing the pencil bent/broken. How would you explain that the pencil is not bent/broken and why it looks the way it is?

3.5. The Earth and Beyond

The Solar System consists of the Sun, planets and other smaller objects that move around it. Apart from the Sun, the largest members of the Solar System are the eight major planets. Nearest to the Sun are four fairly small, rocky planets - Mercury, Venus, Earth and Mars revolving around the Sun. The Sun is a star like any other star in the sky, and it is the primary source of energy. Other stars are very far away, so they look tiny. Have you ever gazed at the sky on a clear night? What do you see?

Competency

Explain the equator, poles of earth and eclipses to understand the Earth's features, climate, and their roles in our daily life.

3.5.1 Solar Eclipse and Lunar Eclipse

Scope: This topic introduces poles, polar days and night and equator of earth. It also includes the causes and formation of solar and lunar eclipse.

Learning Objectives:

- *Explore the concepts of poles, polar days, polar night and equator of earth.*
- *Construct a model to demonstrate and explain the causes of solar and lunar eclipses.*
- *Compare the scientific causes of solar and lunar eclipse with local belief of the community.*

Learning Experiences

The Earth has imaginary lines of latitudes and longitudes. It is divided into the Northern Hemisphere and Southern Hemisphere by a horizontal line through the middle of the Earth known as the equator. The length of day and night is equal for the whole year on the equator.

The formation of solar and lunar eclipses is based on the principle of the formation of shadow. The Earth and the Moon are non-luminous bodies. When the Earth and moon revolve around the Sun, either the shadow of the moon falls on the Earth, or the shadow of the Earth falls on the Moon. They have specific conditions to occur, and scientists can predict the exact date and time of the occurrence of the eclipse. Have you ever heard of or witnessed solar and lunar eclipses in your life?

Explore about poles, polar days, polar night and equator of the Earth from relevant sources or the web link <https://bit.ly/32X1mWP> and https://youtu.be/XY_g5JXvC1M. Based on the information gathered from the videos, answer the following questions.

1. Explain the Equator and the poles of the Earth in your own words.
2. Explore and explain the climate on the equator and poles of the Earth.
3. What are the facts about polar day and polar night?
4. How does polar night affect people who live in these regions?

Based on the information gathered from different sources, construct a model of the Earth showing the poles, equator, axis, and hemispheres. Display your work with explanations in class.

Then, watch the video from the web link <https://bit.ly/3mRVi8F> to understand solar and lunar eclipses and their causes. The learners then draw the solar and lunar eclipses and answer the following questions:

1. Why does the sun appear to be moving from east to west?
2. What are the causes of solar and lunar eclipses?
3. Explain with scientific reasoning to change the people’s perception of local narratives about solar and lunar eclipses.
4. If the Equator divides the world into Northern and Southern Hemispheres, what is the name of the line that divides it into Eastern and Western Hemispheres?

Eclipses are caused when the sun, moon and the Earth come in a straight line. In a solar eclipse, the moon comes in between the sun and the Earth, whereas in a lunar eclipse, the Earth comes in between the sun and the moon.

Assessment and Reporting

The teacher may use rubrics, checklists or other assessment tools to assess the learner in the following three domains.

Scientific knowledge	Working scientifically	Scientific values and attitudes
<ul style="list-style-type: none"> ● Assess the learner’s conceptual understanding of the formation and causes of eclipses. 	<ul style="list-style-type: none"> ● Assess the learner’s ability to plan and design a model of the Earth and identify the poles, equator and hemispheres. 	<ul style="list-style-type: none"> ● Assess the learner’s understanding of causes of eclipses based on the scientific reasoning to overrule the local beliefs and myths about eclipses.

For recording and reporting, refer to the National School Curriculum Framework in Science.

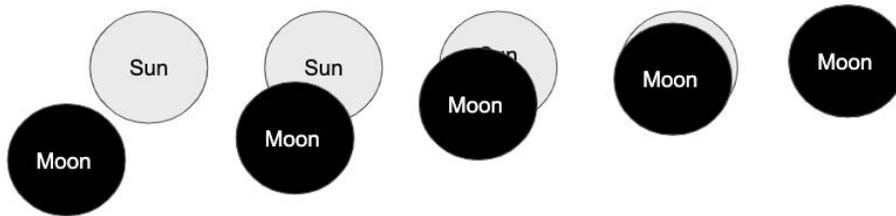
Resources:

1. Continuous Formative Assessment Guide, Classes PP-VI (2020), REC
2. National School Curriculum Framework for Science, (2022)
3. REC repository
4. Science Class SIX (2020), REC
5. Dividing the Earth: <https://bit.ly/32X1mWP>
6. Eclipses of the Moon and the Sun: <https://bit.ly/3mRVi8F>
7. Types of Eclipses: <https://bit.ly/31Clz3E>

Challenge Your Thinking

1. Find out what your elders think about the lunar eclipse and solar eclipse. Do you agree with them? Why?
2. Why is it not advisable to look at the Sun directly during solar eclipses?
3. Why are the North Pole and the South Pole covered with ice throughout the year?
4. Do solar and lunar eclipses occur every year? Why?
5. Why can’t we see solar eclipses of other planets from the Earth?
6. You are given an apple, an orange, a piece of grape and a thread. Explain the solar system by using these materials.

7. Why are lunar eclipses more common than solar eclipses?
8. You are gazing at the globe whose diameter is 1 kilometre. If you cut it open to spread it flat on the ground. Describe what you would observe.
9. Why do the northern and southern parts of Earth have contrasting winter and summer, while areas close to the equator do not?
10. In the diagram, the moon is slowly moving in front of the sun. What does this diagram represent?



11. Describe an experiment to use shadow to find the time of the day.

Appendices I: Assessment

Assessment

Assessment in science involves testing of scientific knowledge, skills, values and attitudes. The assessment should be able to diagnose the learning progress or gap of the learner in terms of expected core competencies and learning outcomes. Consequently, it is imperative to use appropriate assessment techniques and tools to provide relevant feedback to the learners and to assess the impact of teaching-learning processes. Holistic assessment entails assessing all three domains of learning: cognitive, psychomotor and affective. Thus, the assessment practice in science assesses the Scientific Knowledge (SK), Working Scientifically (WS), and Scientific Values and Attitudes (SV) of the learners.

Purpose of Assessment

Assessment is used to

- i. inform and guide the teaching and learning process.
- ii. gauge the efficacy of the teaching and learning process.
- iii. assess the relevance of curriculum materials.
- iv. help learners set learning goals.
- v. monitor learners' progress in achieving learning outcomes.
- vi. generate reports on learners' performance.

Areas of Assessment

The assessment in science focuses on the three domains of learning reflected as scientific knowledge (cognitive), working scientifically (psychomotor) and scientific values and attitudes (affective) as detailed below:

- i. **Scientific Knowledge (SK):** The learner meets the requirements reflected in the learning objectives and expected learning outcomes under each unit, chapter, and topic. The learner is able to provide expected scientific information through various ways such as presentation, questioning, test, concept mapping, journals/scrapbook, projects, etc.
- ii. **Working Scientifically (WS):** The learner demonstrates scientific skills such as observing, predicting, inquiring, questioning, investigating, experimenting, measuring, classifying, recording, analysing, inferring, communicating, etc. and explain how science works.
- iii. **Scientific Values and Attitudes (SV):** The learner exhibits interest, curiosity, intellectual drive, creativity, exploring possibilities, inquisitiveness, finding facts, coherent presentation of ideas, reasoning skills, collaborative skills, respect and concern for all, etc.

Benchmarking Learning Achievements

Learning achievements are measured through benchmarks based on measurable standards against the subject learning competencies or outcomes and goals. Benchmark assessment is a technique used worldwide to evaluate learners' competency and performance in a specified area of study. Using this method, teachers identify individual learner behaviours and learning styles and implement the best guidance, learning techniques, and teaching styles to accommodate the learners' needs. It allows educators to identify learners'

strengths and weaknesses, which can then inform future instruction. The benchmarking informs teachers on how best to interact with and help in their assigned groups.

Performance levels of learners are graded by using an “Absolute grading” grade based on the predetermined cut-off levels. Each point value is assigned a letter grade. It is based on a fixed percentage scale that may be constraining for learners who all receive a high grade or a low grade. For instance, an absolute grading system assigns an “A” for marks 90-100, a “B” for marks 80-89, and so on.

In the current Continuous Formative Assessment (CFA) for classes PP - 3, the competencies of learners are benchmarked in Five Levels, namely Beginning, Approaching, Meeting, Advancing and Exceedingly as means of grading learners. These levels correspond to five groups of scores from 0-19, 20-39, 40-59, 60-79 and 80-100. These groups of scores are assigned letter grades of A to E and numerical score points of 0-4. For alignment to the international benchmarking and equivalency, the learner pass mark and grading system, and the number of instructional hours along with other factors is used to calculate the Grade Point Average (GPA).

The learner pass mark and grading system is as provided in the Table given below.

Learner Competencies

Competency Level	Percentage Score (Range)	Grade	Score Points (GPA)	Description of the competency achievement level
Exceeding	80 -100	A	4	The learner has extensive knowledge and understanding of the content and can readily apply this knowledge at any given time. In addition, the learner has achieved a very high level of competency in the processes and skills and can apply them in new situations. The learner has achieved a high level of critical thinking, and creativity, and is able to communicate and collaborate effectively in all situations. Further, the learner is culturally and spiritually sensitive and responsive through one’s behaviour and conduct in society.
Advancing	60 - 79	B	3	The learner has a thorough knowledge and understanding of the content and a relatively high level of competency in the processes and skills. In addition, the learner is able to apply this knowledge and these skills in most situations. The learner displays critical thinking, and creativity, and communicates and collaborates appropriately in almost all situations. Further, the learner is socially sensitive to one’s behaviour and conduct in society.
Meeting	40 - 59	C	2	The learner possesses foundational and functional knowledge and understanding of the main areas of academic content with an adequate level of competency in the processes and skills. The learner possesses a certain degree of critical thinking, and

				creativity, and able to communicate and collaborate in most situations. Further, the learner is sensitive to one's behaviour and conduct in the society.
Approaching	20 - 39	D	1	The learner possesses basic knowledge and understanding of the academic content and has achieved a limited level of competency in the processes and skills. The learner is able to collaborate with close friends and has limited communication skills. Further, the learner has limited awareness of one's behaviour and conduct in the classroom.
Beginning	0 - 19	E	0	The learner possesses limited basic knowledge and understanding in a few areas of the content; has achieved very limited competency in most of the processes and skills. The learner possesses limited communication and collaboration skills. Further, the learner is aware of oneself with limited sensitivity to others.

Assessment Modalities

The assessment focuses on diagnosing the learning gap through Continuous Formative Assessment (CFA), Continuous Summative Assessment (CSA) and Summative Assessment (SA) using appropriate assessment tools. At the end of each quarter, the teacher consolidates the continuous summative assessment records maintained using different assessment modalities (assignment, class activities, test, project work, scrapbook/journal), and records the cumulative marks of the learners as given in the assessment matrix.

Specifically, the assessment is carried out in the following ways:

- i. **Assignment:** It includes extended learning activities such as homework, model making, preparing materials for presentation etc. which encourages independent learning and responsibility to complete the task. The task is assigned only to topics that require extra time and energy. It is assessed using appropriate assessment tools such as rubrics, rating scales, and checklists.
- ii. **Class Activities:** It is a hands-on experience given to the learner to test, develop, and apply scientific theories. It includes learning activities such as group discussions, experiments, presentations, individual work etc. which are carried out during class hours. It enhances a deeper understanding of scientific ideas which culminates in the development of scientific skills, temper and positive attitudes, and values. It can be assessed using appropriate assessment tools.
- iii. **Scrapbook:** Scrapbook is a collection of pictures, specimens, photographs, etc. related to scientific concepts and ideas along with a brief description and the learner's personal expression of feelings. It is aimed at instilling a scientific attitude: such as creativity, critical thinking, and self-reflection in learners of classes IV to VI. The scrapbook is maintained throughout the academic session with quarterly assessments. An exercise book is maintained by each learner to make a minimum of 12 entries with 3 entries per quarter. The following are the suggested entries, but NOT limited to

- clippings from newspapers, magazines, comics, newsletters, fliers, pamphlets, and even downloads from the internet.
- specimens may include dry leaves, cereals, pulses, dyes, bird feathers, grains, the exoskeleton of insects, dried flower petals, nuts, plant parts, etc. with a few statements of the learner’s reflection.
- write up on any interesting scientific events and natural patterns like rainbows, clouds, bird nests, leaf patterns, insect homes, bird sounds, streams, animal tracks, animal bones, animals caring for their young ones, and animal teeth with learners' personal thoughts and reflections.
- report on any experiment or research work that the learners have conducted during the school science activities or science exhibition. The learner has to write about, how it has been done, why it is important and how it can benefit his or her life. While making entries, learners are expected to follow the common format provided below:
 - Date and time for each of the entries.
 - The sources of the entries.
 - Description of the entries.
 - Learners’ personal expression.

Domains	Key Areas	Performance Rating				
		Exceeding	Advancing	Meeting	Approaching	Beginning
SV	Cover Design	Cover has title, student’s name, grade, well designed	Contains any three elements	Contains any two elements	Contains any one element	Does not contain any element
SK	Format	Work contains the date, source, place of collection, and name of the entry	Work contains any three elements	Work contains any two elements	Work contains one element	Is not in the format at all
SV	Entries (samples/ specimens/ pictures/ photographs/ scrap works, etc)	Shows exceptional progression based on the feedback	Shows appreciable progression based on the feedback.	Shows minimal progression based on the feedback	Shows little progression	No entries or irrelevant entries
WS	Presentation	Ideas are well written and organized.	Ideas are well written but organized.	Ideas are poorly written and not organized.	Ideas are not organized.	The ideas mentioned are not sufficient at all
WS	Expression	Scrapbook entries contain personal expression, imaginative, creativity, and scientific ideas.	Contains any three elements	Contains any two elements	Contains one element	None of the expressions make sense.

- iv. **Project work:** It is an opportunity for the learner to learn and explore the basics of science through the scientific process of observation, investigation, analysis, and synthesis to generate scientific knowledge and understanding. The learner chooses one topic based on their interest in the beginning of the academic session which has to be completed in one academic session with quarterly assessment. It is mandatory to assess both the process and product of the project work.

The process for the project work write-up must include the scientific process of **observation, questioning, hypothesis, background information, design, data collection, analysis, conclusion and sharing.**

The product of the project work must be inclusive of write-ups, illustrations, models or collections of real objects.

The teacher may design their own rubrics or use the sample rubrics provided to assess the project work.

Do mai ns	Key Areas	Performance Rating				
		Exceeding	Advancing	Meeting	Approaching	Beginning
SV	Observe	Phenomena observed is systematic, objective and verifiable?	The phenomena observed are systematic, and objective but not verifiable.	The phenomena observed are objective but not systematic and not verifiable.	The phenomena observed are subjective and not verifiable.	the Phenomena observed are not reflected at all
SV	Question	Clearly stated, focused, and relates to variables	Loosely stated, focused, and relates to variables	Loosely stated and relates to variables	Loosely stated and does not relate to variables	No question or not explorable
SK	Hypothesis	Feature variables and predict the relationship between variables with explanation	Predict the relationship between variables with explanation	Feature the variables are explained	Variables are not explained	Makes no sense
WS	Design	Procedure is detailed and sequential.	The procedure is not detailed and sequential.	Lack detailed and sequential procedure	Procedure mentioned is insufficient	Procedure is not shown
	Collect data	Appropriate method, relevant and sufficient data	Appropriate method, relevant but not sufficient data	Inappropriate method, sufficient but irrelevant data	Inappropriate method, insufficient and irrelevant data	Data is not recorded at all
	Analyse	Appropriate mathematical procedures or appropriate charts with clear interpretation	Appropriate mathematical procedures or appropriate charts but no clarity in interpretation	Inappropriate mathematical procedures or charts but no clarity in interpretation	Inappropriate mathematical procedures or charts and unclear no interpretation	Analysis is not clear and insufficient

	Conclude	Restate the hypothesis, supports or refutes it, and explain the role of the test in making the decision.	Restate the hypothesis, supports or refute it,	Supports or refute the hypothesis	Restate the hypothesis	No conclusion is drawn
	Share	Focus on communicating the central idea, using evidence in the logical format	Focus on communicating the central idea with evidence	Focus on the central idea with some evidence	Focus on a central idea without any evidence	No focus on central idea

- v. **Test and Examination:** It is a procedure intended to establish the quality, performance, or reliability of a learner's learning. It is used to test the conceptual understanding and competencies of learners in subject matters. Tests are generally administered at the end of every chapter while the examinations are conducted at the end of each term.

Appendices II: Assessment Tools

Assessment Tools

It is important to use appropriate assessment criteria and tools to obtain the right information on the progress of the learners. This is because the quality of information acquired through assessment is determined by the tools and descriptors chosen for assessment. The assessment tools and samples are given below:

- i. **Checklist:** It offers a ‘yes’ or ‘no’ format in relation to the achievement of specific criteria by a learner. It can be used for recording observations of an individual, a group, or the whole class.

Sl. No.	Domain s	Criteria										Teacher 's Feedback
		SV	SK	SK	WS	WS	WS	SV	SV	SK	WS	
	Key Areas Name	Req uire d mat erial s are take n	Relev ant infor mation is read prior to the field trip	Kno w the expec ted lear ning outc ome	Ask rele van t que stio ns	Rec ord the info rma tion	De mon strat e obs erva tion skill s	R es pe ct ot he rs vi ew	Ens ure safe ty of self, othe rs and envi ron men t	Dra ws pro per con clus ion	Comm unicate the ideas	
1	Ram											

2	Dorji											
3	Dechen											

- ii. **Rating scale:** It allows teachers to indicate the degree or frequency of the behaviours, skills, and strategies displayed by the learner. It has scale-based criteria to describe the quality or frequency of the work with precise and reliable descriptive words. The teachers can use it to record observations and the learners can use it for self-assessment.

Domain s	Criteria	Performance Rating					Remarks
		Exceedin g	Advan cing	Meeti ng	Appro aching	Begin ning	
WS	Carry out the activity						
	Explore different ways of conducting the experiment						
	Innovate new ideas to carry out the assigned task						
	Follow experimental procedures						
	Interpret the information collected from the experiment						
SK	Provide justification for the findings						
	Deduce conclusion						
WS	Communicate the findings						
SV	Show collaborative skills						

- iii. **Anecdotal Record:** It helps to record specific observations of a learner based on behaviour, skills, and attitudes in relation to the expected learning outcome. It provides cumulative information and direction for further instruction. It can be used for ongoing observations.

Anecdotal Records are detailed, narrative descriptions of an incident involving one or several learners. They are focused narrative accounts of a specific event. They are used to document the unique behaviours and skills of a learner or a small group of learners. Anecdotal Records may be written as the behaviour occurs or at a later time and must have the following components:

Anecdotal Record Format

Anecdotal Record Developmental Domain:

Learner’s Name:

Learner’s Age:

Time:

Observer:

Setting:

Anecdotal:

(Describe exactly what you see and hear; do not summarize behaviour. Use words conveying exactly what a learner said and did. Record what the learner did when playing or solving a problem. Use specific language to describe what the learner said and did including facial expression and tone of voice; avoid interpretations of the learner’s behaviour; For example, “He put on a firefighter’s hat and said, “Let’s save someone!” or “He looked towards the puzzle piece and then looked toward the puzzle. He put the puzzle piece on the puzzle and turned the piece until it fit. He took the puzzle piece out”. Avoid using judgmental language).

Interpretation:

(What specific inferences can you make from this anecdotal record? What does it tell you about this learner’s growth and development? The inferences must be directly related to the domain designated in the anecdote and refer to a specific aspect of the domain.)

Implication for Planning:

(Give a specific activity that you would incorporate into curriculum planning as a result of what you learned about this learner. Be sure the plan is directly related to the area of development described in the anecdote. Be sure the activity is a different activity than the one in the anecdote. Include a brief explanation of why you would create the specific activity.)

Sample Anecdotal Record

Anecdotal Record Developmental Domain: *Cognitive*

Learner’s Name: Kinley

Date: 22/8/2020

Learner’s Age: 10

Time: 2:00 pm

Observer: Mrs Dema

Setting: *Experiment on floating and sinking in the science room.*

Anecdotal: *Kinley entered the science room with a notebook in his hand. He sat next to Dorji near the door. He put his pencil in a bucket of water which was kept on the table. With a smile on his face, he told Dorji, ‘Look my pencil did not sink in the water’.*

Interpretation: *Kinley is curious and enjoys exploring new things. He has some ideas on objects that float and sink.*

Implication for Planning: *In the next lesson, Kinley will be provided with enough materials to find out objects that sink and floats. This would deepen his understanding of the concepts of sinking and floating.*

- iv. **Rubric:** It presents a set of criteria with a fixed measurement scale and a detailed description of each level of performance. It helps to increase the consistency and reliability of scoring.

a. Presentation

Do mai n	Key Areas	Criteria					Remarks
		Exceeding	Advancing	Meeting	Approaching	Beginning	

SK	Preparedness	Demonstrate the clear and logical flow of ideas supported by relevant visual aids.	Contains any three components	Contains any two components	Contains any one component	Not ready at all with no confidence	
	Content	Present variety of ideas that are relevant to the topic.	Presents some ideas that are relevant to the topic.	Presents limited ideas that are relevant to the topics.	Could not present the ideas on the topic clearly	Presents ideas that are not relevant to the topic.	
WS	Presentation skills	Communicate the ideas, attain to all the audiences, uses proper gestures and complete within time.	Contains any three components	Contains any two components	Contains any one component	Could not communicate or present at all	
SV	Collaboration	Seek suggestions, responds to the queries and shows positive learning attitude.	Contains any three components	Contains any two components	Contains any one component	Could not display any of the stated components	

b. ICT Integration

Domains	Key Areas	Criteria					Remarks
		Exceeding	Advancing	Meeting	Approaching	Beginning	
SK	Concept	Demonstrate exceptional understanding of the concept from the video	Demonstrate clear understanding of the concept from the video	Demonstrate partial understanding of the concept from the video	Demonstrate vague understanding of the concept from the video	Irrelevant to the concept	

WS	Interpretation	Identify the message, interprets it clearly in their own words and relates to some principles and processes.	Identify the message and interprets it clearly in their own words	Identify the message and interpret it with limited clarity.	Identify the message but cannot interpret it.	Does not contain the message or interpretation	
WS	Conclusion	Draw an appropriate conclusion and communicate it by relating to some principles or processes.	Draw an appropriate conclusion and communicate it with some reasoning.	Draw appropriate conclusions and communicate it.	Draw an appropriate conclusion but cannot explain.	No unsubstantiated conclusion is drawn	
SV	Values	Actively participate in the discussion, answer questions and respect others' opinions.	Missing one	Missing two	Tried to display the mentioned components fairly	Missing almost all	

c. Science Fair/Exhibition/Model Making

Domains	Key Areas	Criteria					
		Exceeding	Advancing	Meeting	Approaching	Beginning	Remarks
SK	Concept	The ideas are shown					
		The ideas are consistent and relevant					

		The principle has been portrayed well						
	Information	Enough information is provided by the model/display.						
WS	Display and explanation	The model/display illustrates aspects of the principle						
SV		The originality and quality are visible						
WS	Presentation	Communicates the ideas coherently						
SK	Conclusion	Draws clear conclusion						

d. Debate

Domain	Key Areas	Performance Rating					Remarks
		Exceeding	Advancing	Meeting	Approaching	Beginning	
WS	Presentation	Organized, relevant, confident and clear.	One missing	Two missing	Three missing	Not able to present the idea clearly	
WS	Argument	4 or more arguments presented to support proposition	3 arguments presented to support proposition	2 arguments presented to support proposition	1 argument presented to support proposition	No arguments were included	
SK	Evidence	Offers 4 pieces of evidence based on argument to refute opposing points.	Offers 3 pieces of evidence based on argument to refute opposing points.	Offers 2 evidence based on argument to refute opposing points.	Offers 1 evidence based on argument but refutes opposing points.	No evidence to support the points put forward	
SV	Body language	Eye contact, intonation, gesture and persuasion were used.	One component is missing	Two components missing	Three components are missing	No gesture shown during the presentation	

e. Home Work

Criteria	Performance Rating
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Do mai ns		Exceeding	Advancing	Meeting	Approaching	Beginning
SV	Completion	All of the assigned work is complete	Most of the assigned work is complete	Some of the assigned work is complete	Little or a few of the assigned task is complete	The assigned task is not done at all
SK	Accuracy	All of the answers are correct	Most of the answers are correct	Some of the answers are correct	Little or a few of the answers are correct	Not his or her genuine work
WS	Presentation	Work is neat, error-free and legible with relevant illustrations	One component is missing	Two components are missing	Three components are missing	Missing almost all the required components
WS	Originality	Display of original and creative ideas.	Partial display of original and creative ideas.	Little display of original and creative ideas.	Contains creativity but could communicate	No display of original and creative ideas.
SV	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	Not submitted at all

Appendices III: Assessment Matrix

Assessment Matrix for Science (Key Stage II, Class IV -VI)							
Terms	CFA (In all the lessons for feedback and support)	CA (Scheduled performance level assessment) 50%				SA (Examination) 50%	CA+SA
	Technique	Technique	Domain			Total	
			SK	WS	SVA		
Term I	Assignment, Class activity (Practical work, Experiment, etc.) Project work, Scrapbook, test, etc.	Assignment	1	4	2	25	50
		Class activity	3	5	3		
		Project work	1	2	1		
		Scrapbook	1	1	1		
Term II	Assignment, Class activity (Practical work, Experiment, etc.) Project work, Scrapbook, test, etc.	Assignment	1	4	2	25	50
		Class activity	3	5	3		
		Project work	1	2	1		
		Scrapbook	1	1	1		
Grand Total			12	24	14	50	100

Note: Scientific Knowledge (SK), Working Scientifically (WS), Scientific Values and Attitude (SVA)

Appendices IV: Disciplinary Core Idea Wise Weighting and Instructional Time for Class IV

Strand	Core Concept	Time Allocation (Mins)	Weighting (%)
Life Processes	1. Classification and Variation	520	4
	2. Living Things and their Environment	800	6
	3. Human and Animal	720	6
	4. Green Plants	520	4
Materials and their Properties	1. Classifying Materials	560	4
	2. Materials and Change	520	4
	3. Separating Mixtures	520	4
	1. Force and Motion	360	3

Physical Process	1. Energy	240	2
	2. Electricity and Magnetism	600	6
	4. Light and Sound	560	5
	5. The Earth and Beyond	280	2
Total		6200	50

The actual teaching 6200 minutes or 155 periods of 40 minutes in a period

Appendices V: Disciplinary Core Idea Wise Weighting and Instructional Time for Class V

Strand	Core Concept	Time Allocation (Mins)	Weighting (%)
Life Science	1. Classification and Variation	200	3
	11. Living Things and their Environment	520	5
	12. Human and Animal	960	7
	13. Green Plants	480	5
Materials and their Properties	1. Classifying Materials	240	3
	2. Materials and Change	920	6
	3. Separating Mixtures	280	3
Physical Process	1. Force and Motion	480	4
	2. Energy	360	3
	3. Electricity and Magnetism	840	5
	4. Light and Sound	600	4

	14. The Earth and Beyond	360	2
Total		6240	50

The actual teaching 6240 minutes or 156 periods of 40 minutes in a period

Appendices VI: Disciplinary Core Idea Wise Weighting and Instructional Time for Class VI

Strand	Core Concept	Time Allocation (Mins)	Weighting (%)
Life Science	1. Classification and Variation	320	4
	2. Living Things and their Environment	560	4
	3. Human and Animal	760	6
	4. Green Plants	680	6
Materials and their Properties	1. Classifying Materials	680	4
	2. Materials and Change	520	4
	3. Separating Mixtures	440	4
Physical Process	1. Force and Motion	440	4
	2. Energy	280	2
	3. Electricity and Magnetism	520	4
	4. Light and Sound	640	5
	5. The Earth and Beyond	480	3
Total		6320	50

The actual teaching is 6320 minutes or 158 periods of 40 minutes in a period