SCIENCE

TEACHING & LEARNING SYLLABUS

Primary Three to Six
Standard / Foundation

Implementation starting with
2023 Primary Three Cohort

Updated October 2022

Ministry of Education
SINGAPORE

PREAMBLE

This Primary Science Syllabus is a foundation for scientific studies at higher levels. The syllabus has also taken into consideration the desired outcomes of education for our primary students as well as the national education emphasis.

This syllabus is based on the revised ***Science Curriculum Framework*** which encapsulates the thrust of Science education in Singapore to provide students with a strong foundation in Science for life, learning, citizenry, and work. The vision of Science Education in Singapore represented by the three "IN"s—*Inspire, Inquire and Innovate,* can be achieved through developing in students a strong grounding in scientific knowledge, practices and values.

The aims spelt out in the syllabus provide the guiding principles for the suggested teaching approaches and evaluation methods. Teachers are advised not to follow the syllabus too rigidly but to exercise their professional judgement in implementing it. Schemes of work should be developed with the interests and abilities of the students uppermost in mind. Teachers are encouraged to use a variety of approaches in their teaching and incorporate ideas and materials from various sources in order to enhance the learning of Science.

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SECTION 1: INTRODUCTION

Science Curriculum Framework
21st Century Competencies

1. INTRODUCTION

1.1 Science Curriculum Framework

The revised Science Curriculum Framework (see **Figure 1**) encapsulates the thrust of Science education in Singapore to provide students with a strong foundation in Science for life, learning, citizenry, and work.

Science for Life and Society in the centre circle captures the essence of the goals of Science education.

Figure 1: The Science Curriculum Framework

Our students are diverse, with different needs, interests, and aptitudes for Science. Given the diversity of our students and the needs of our country, the twin goals of Science education are to:

- Enthuse and nurture all students to be scientifically literate, so that they are able to make informed decisions and take responsible actions in their daily lives; and
- Provide strong Science fundamentals for students to innovate and pursue STEM for future learning and work. Surrounding the centre circle are the three “IN”s —

Inspire, *Inquire* and *Innovate*—which represents the vision for Science Education and encapsulates the overall experience of our students in Science education:

(a) INspired by Science. Students enjoy learning Science and are fascinated by how everyday phenomena have scientific connections and how Science helps solve many of our global challenges. They regard Science as relevant and meaningful, appreciating how Science and Technology have transformed the world, and improved our lives. Students are open to the possibility of pursuing Science-related careers as a viable profession to serve the good of society.

(b) INquire like Scientists. Students have strong fundamentals in Science and possess the spirit of scientific inquiry. They are able to engage confidently in the *Practices of Science*, grounded in the knowledge, issues and questions that relate to the roles played by Science in daily life, society and the environment. They can discern, weigh alternatives, and evaluate claims and ideas critically, based on logical scientific evidence and arguments, and yet be able to suspend judgement where there is lack of evidence.

(c) INnovate using Science. Students apply Science to generate creative solutions to solve real-world problems, ranging from those affecting everyday lives to complex problems affecting humanity. It is envisaged that there will be a strong pipeline of students who can contribute towards STEM research, innovation, and enterprise.

The outer ring represents the domains that make up the strong science fundamentals: *Core Ideas* of Science, *Practices* of Science and the *Values, Ethics & Attitudes* in Science.

- *Core Ideas of Science*. The *Core Ideas* are the distilled ideas central to Science. The *Core Ideas* help students see the coherence and conceptual links within and across the different sub-disciplines of Science (i.e., Biology, Chemistry, and Physics). The *Core Ideas* also provide a framework to make visible students' progression in Science understanding across the different levels of education.

- *Practices of Science*. The *Practices* consist of three components:

  (a) Demonstrating Ways of Thinking and Doing in Science (WOTD);
  (b) Understanding the Nature of Scientific Knowledge (NOS); and

(c) Relating Science, Technology, Society and Environment (STSE).

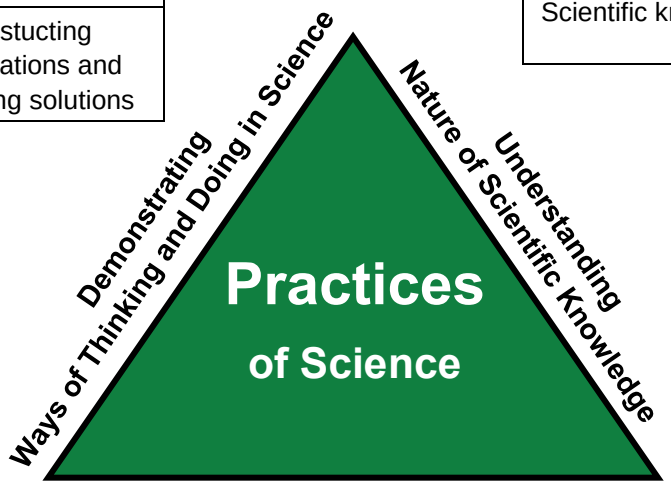
They represent the set of established procedures and processes associated with scientific inquiry, what scientific knowledge is and how it is generated and established, and how Science is applied in society respectively. The *Practices* serve to highlight that the discipline of Science is more than the acquisition of a body of knowledge (e.g., scientific facts, concepts, laws, and theories); it is also a *way of thinking and doing*. It is important to appreciate that the three components representing the cognitive, epistemic, and social aspects of the *Practices* are intricately related (see **Figure 2**).

- *Values, Ethics and Attitudes in Science.* Although Science uses objective methods to arrive at evidence-based conclusions, it is in fact a human enterprise conducted in particular social contexts which involves consideration of values and ethics. The intent of fostering an awareness and appreciation of values in the curriculum is to sensitise our students to the ethical implications of the application of Science in society. Thus, Science education needs to equip students with the ability to articulate their ethical stance as they participate in discussions about socio-scientific issues that involve ethical dilemmas, with no single right answer.

The pair of hands represents the roles of students *as inquirers* , supported by *teachers and partners as facilitators* of the students' learning experiences. The partnership of learning and teaching goes beyond the students and teachers to include other partners who can facilitate learning in various contexts to help students appreciate the application of Science in their daily lives, society, and the environment.

Demonstrating WOTD		
Investigating	**Evaluating and Reasoning**	**Developing and Evaluating Solutions**
Posing questions and defining problems	Communicating, evaluating and defending ideas with evidence	Using and developing models
Designing investigations	Making informed decisions and taking responsible actions	Constructing explanations and designing solutions
Conducting experiments and testing solutions		
Analysing and interpreting data		

Understanding NOS
Science is an evidence-based, model-building enterprise to understand the real world.
Science assumes natural causes, order and consistency in natural systems.
Scientific knowledge is generated through established procedures and critical debate.
Scientific knowledge is reliable, durable, open to change in light of new evidence.



Relating
Science-Technology-Society-Environment

Relating STSE
There are risks and benefits associated with the applications of Science in society.
Applications of Science often have ethical, social, economic and environmental implications.
Application of new scientific discoveries often drive technological advancement while advances in technology enable scientists to make new or deeper inquiry.

Figure 2: The Practices of Science

1.2 21st Century Competencies

The Framework for *21st Century Competencies and Student Outcomes* (see **Figure 3**), helps us prepare our students to be confident people, self-directed learners, concerned citizens, and active contributors – attributes we strive to develop in students to thrive in and contribute to a fast-changing and globalised world of the 21st century.

Figure 3: Framework for 21st Century Competencies and Student Outcomes

This framework identifies the core values, social and emotional competencies, as well as competencies necessary for the globalised world we live in. In totality, these are referred to as 21st Century Competencies (21CC).

Supporting the development of 21CC through Science

Science education plays an important role in helping our students understand and address many of the local and global challenges we face in the 21st century. These challenges include climate change, depletion of natural resources, disruptive innovations in technology and artificial intelligence as well as feeding an increasing global population. To navigate these challenges, we need to develop scientifically literate citizens who:

- Possess mindsets and practical knowledge of Science and its applications to make informed decisions and responsible actions in their daily lives.
- Appreciate Science as humanity's intellectual and cultural heritage, the beauty and power of its ideas, as well as participate in socio-scientific issues ethically and in an informed manner.
- Apply scientific knowledge and skills, as well as adopt scientific attitudes and mindsets to innovate and push new frontiers.

In this respect, the development of scientific literacy helps support MOE's efforts in the development of students' 21CC. As discussed in section 1.1, the development of scientific literacy hinges on equipping students with strong Science fundamentals in three interrelated domains - *Core Ideas*, *Practices* and *Values, Ethics and Attitudes*. The subsequent paragraphs illustrate ideas on how 21CC can be developed through the Science curriculum.

Developing 21CC through Science

<u>Civic Literacy, Global Awareness and Cross-Cultural Skills (CGC)</u>

For students to actively contribute to the community and nation, and develop an awareness of and the ability to analyse global issues and trends, they can be given opportunities to:

- Explore how Science and Technology contribute to society, globally and in Singapore (e.g., how applications of new scientific discoveries inspire technological advancement while advancement in technology motivates scientists to ask new questions and/or empower scientists in their inquiry).
- Work together with people from diverse backgrounds and engage in socio-scientific issues. Students can participate in discussions that require them to exercise open-

mindedness when weighing differing perspectives and develop in them care and responsibility for mankind and the environment.

Critical and Inventive Thinking (CIT)

For students to develop the ability to generate novel and useful ideas to address issues and solve problems, exercise sound reasoning, use metacognition to make good decisions, and manage complexities and ambiguities, they can be given opportunities to:

- Engage in scientific inquiry, set in authentic contexts where possible. Such activities allow students to appreciate the creative yet logical nature of scientific inquiry. Students can exercise creativity as they raise questions about the natural world, develop multiple ways to observe and collect evidence, propose inferences, suggest predictions, and explore more than one explanation that could be justified by their evidence. At the same time, students get to appreciate the differences between scientific evidence and those in other disciplines; to exercise healthy scepticism in questioning the assumption and uncertainty in their evidence and evaluate how these assumptions can influence their explanations.
- Recognise that Science is an evidence-based, model-building enterprise concerned with understanding the natural world through exploring how and why scientific models evolve over time in light of new evidence.

Communication, Collaboration and Information Skills (CCI)

For students to be able to communicate information and ideas clearly, collaborate effectively and manage information thoughtfully, ethically, and responsibly, they can be given opportunities to:

- Communicate their ideas clearly and persuasively using the language of Science. Students can engage in activities that allow them to appreciate the importance of having scientific standards and terminology in Science.
- Understand how Science is presented in various forms (e.g., oral, written, visual) and media (e.g., print media, social media) and evaluate the effect these forms of communication have on the audience (e.g., explore the lack of integrity and objectivity in fake news reports).
- Collaborate with other students in knowledge construction. Just as professional scientists, students can present their work and ideas to others and have healthy discussion and critique as part of the Science community.

SECTION 2: CONTENT

Aims of Primary Science Syllabus
Syllabus Framework

2. CONTENT

2.1 Aims of Primary Science Syllabus

The Primary Science Syllabus aims to provide students with experiences/ opportunities to:

- Build on their interest and stimulate their curiosity about themselves and their environment.
- Acquire basic scientific concepts to help them understand themselves and the world around them.
- Develop skills, dispositions, and attitudes for scientific inquiry.
- Apply scientific concepts and skills in making responsible decisions.
- Appreciate how Science influences people and the environment.

2.2 Syllabus Framework

The Primary Science Syllabus comprises the *Core Ideas*, *Practices* and *Values, Ethics and Attitudes*.

Core Ideas

The *Core Ideas* in this syllabus are organised as themes, which students can relate to in their everyday experiences, and to the commonly observed phenomena in nature. The aim is to enable students to appreciate the links between different themes/topics and thus allow the integration of scientific ideas. The five themes chosen are: ***Diversity, Cycles, Systems, Energy,*** *and* ***Interactions***. These themes encompass a core body of concepts in both the life and physical Sciences. This body of concepts has been chosen because it provides a broad-based understanding of the environment, and it will help build a foundation upon which students can rely on for further study.

Although the content of the syllabus is organised into five themes, the topics under each theme are not to be viewed as compartmentalised blocks of knowledge. In general, there are no clear boundaries between these themes. There may be topics common to different themes. Hence, a conscious effort is needed to demonstrate the

relationship between themes whenever possible. To help teachers and students appreciate and understand the themes, essential takeaways and key inquiry questions are included for each theme. These essential takeaways and questions can guide teachers and engage students in uncovering the important ideas at the heart of each theme. They can also use these questions to raise more specific questions for the respective topics under each theme.

Another feature of the syllabus is the spiral approach. This is characterised by the revisiting of concepts and skills at different levels and with increasing depth. The spiral approach allows the learning of scientific concepts and skills to match students' cognitive development. It therefore helps students build upon their existing understanding of concepts and facilitates the gradual mastery of skills.

The focus of each theme is given below.

Diversity

There is a great variety of living and non-living things around us. Organising this diversity of things helps us better understand the world in which we live. There are common threads that connect all living things and unifying factors in the diversity of non-living things that help us classify them. This theme helps us appreciate the importance of maintaining diversity. The essential takeaways and key inquiry questions for "Diversity" are:

Essential Takeaways	Key Inquiry Questions
• There is a great variety of living and non-living things around us. • We classify living and non-living things based on their similarities and differences. • Maintaining the diversity of living and non-living things is important for survival.	• What can we observe around us? • How can we classify the great variety of living and non-living things? • Why is it important to maintain diversity?

Cycles

There are cycles or repeated patterns of change in nature. Understanding cycles, such as life cycles and the water cycle, helps us predict events and processes and to appreciate the Earth as a self-sustaining system that supports life. The essential takeaways and key inquiry questions for “Cycles” are:

Essential Takeaways	Key Inquiry Questions
• There are repeated patterns of change around us. • Understanding cycles helps us to make predictions about events and processes around us.	• What makes a cycle? • How does a cycle help us predict events and processes? • Why are cycles important to life?

Systems

A system is a whole consisting of parts that work together to perform function(s). There are systems in nature such as plant and human systems; as well as man-made systems such as electrical systems. Understanding these systems allows us to appreciate how parts influence and work together to perform function(s). The essential takeaways and key inquiry questions for “Systems” are:

Essential Takeaways	Key Inquiry Questions
• A system is made of different parts. Each part has its own unique function. • Different parts of a system influence and work together to perform function(s).	• What is a system? • How do different parts / systems work together to perform function(s)? • Why is it important to understand how parts/ systems work together?

Interactions

Interactions are the actions between and within living and non-living systems in the environment. Understanding these interactions helps us see relationships between the factors/variables in the environment. We can also appreciate the consequences of our actions and play our part in conservation. The essential takeaways and key inquiry questions for “Interactions” are:

Essential Takeaways	Key Inquiry Questions
• There are interactions among us, living and non-living things in the environment. • Interactions within the environment can have positive or negative impacts. • Conservation is important to ensure continuity of life and availability of resources.	• What are the types of interactions around us? • How do interactions affect the environment and us? • Why is it important for us to conserve the environment?

Energy

Energy is required for things to work in everyday life. We use various forms of energy for many different purposes. All living things obtain energy and use it to carry out life processes. Understanding this theme allows us to appreciate the importance and uses of energy and the need to conserve it. The essential takeaways and key inquiry questions for “Energy” are:

Essential Takeaways	Key Inquiry Questions
• Energy is required for things to work. • There are various forms of energy and they can be converted from one form to another. • Some sources of energy can be depleted and we play an important role in energy conservation.	• What are the different forms of energy around us? • How is energy used in everyday life? • Why is it important to conserve energy?

Practices

Teachers are encouraged to engage students in the *Practices of Science* and help them understand how scientific knowledge is developed through inquiry. One of the components of *Practices of Science* is the *Ways of Thinking and Doing*. It supports students in learning Science as inquirers and involves various skills and processes. For example, the skill of generating possibilities can be used when students are engaged in posing questions and defining problem or when they are constructing explanations and designing solutions.

There is no one definite sequence of priority among the *Ways of Thinking and Doing*. For instance, posing questions and defining problems may arise when one is analysing and interpreting data or conducting investigations.

Table 1 below describes each *Way of Thinking and Doing* and its progression for students by the end of Primary 4 and Primary 6. The progression provides a coherent and systematic development of skills and processes across levels.

Ways of thinking and doing		**By the end of P4, students should be able to:**	**By the end of P6, students should be able to:**
Posing questions and defining problems	This involves asking questions to make sense of the world (students themselves and the environment) around them.	• Ask questions out of curiosity or to deepen understanding. • Ask questions which can be investigated.	
Designing investigations	This involves formulating questions or hypotheses and designing fair tests to find out answers to the questions or to verify the hypotheses.	• Recognise a fair test (changed/ unchanged variables).	• Design a fair test (changed/ unchanged variables).

Ways of thinking and doing		By the end of P4, students should be able to:	By the end of P6, students should be able to:
Conducting investigations and testing solutions	This involves conducting investigations to gather data through making observations using our senses or instruments. This also involves knowing the functions and limitations of various apparatus, developing the ability to select and handle them appropriately for various tasks.	• Use senses, apparatus, and equipment to gather data. • Investigate to find out answers to questions (guided investigations). • Record and/or compare observations/ data with suggested scaffolding.	• Use and select appropriate apparatus and equipment to gather data. • Investigate to find out answers to questions (guided and open investigations). • Record and/or compare observations/ data using a variety of forms e.g., notes, drawings, and charts.
Analysing and interpreting data	This involves identifying and explaining the parts of objects, information (presented in different forms), as well as the patterns and relationships between these parts.	• Simple analysis of data and information in representations (e.g., tables, bar and line graphs, charts, and diagrams) to infer patterns and relationships or explain findings.	• Analysis of data and information in representations (e.g., tables, bar and line graphs, charts, and diagrams) to infer patterns and relationships or explain findings.

Ways of thinking and doing		By the end of P4, students should be able to:	By the end of P6, students should be able to:
Communicating, evaluating and defending ideas with evidence	This involves receiving and presenting information and ideas in various forms. This also involves assessing the reasonableness, accuracy and quality of information and ideas.	• Communicate (e.g., written, verbal, pictorial, tabular or graphical) clear explanation and reasoning. • Seek clarification to deepen understanding.	
Making informed decisions and taking responsible actions	This involves establishing and applying criteria to select from among seemingly equal alternatives. The process of establishing criteria involves consideration of the consequences and values.	• State or select options based on appropriate criteria with reasons.	
Using and developing models	This involves using multiple representations to describe, explain and predict phenomena.	• Use multiple representations (e.g., pictures, charts, diagrams, tables, graphs) to explain concepts, describe and predict phenomena.	

Ways of thinking and doing		By the end of P4, students should be able to:	By the end of P6, students should be able to:
Constructing explanations and designing solutions	This involves generating ideas and justifying them to remedy or alter a problem situation.	• Construct possible explanations and generate ideas.	

Table 1: Ways of Thinking and Doing

Values, Ethics and Attitudes

In learning Science, the adoption of certain mental attitudes such as *Curiosity, Creativity, Integrity, Objectivity, Open-mindedness, Resilience, Responsibility and Healthy Scepticism* is advocated.

- *Curiosity*
  Desiring to explore the environment and question what is found.

- *Creativity*
  Seeking innovative and relevant ways to solve problems.

- *Integrity*
  Handling and communicating data and information with honesty.

- *Objectivity*
  Seeking data and information to validate observations and explanations without bias.

- *Open-mindedness*
  Accepting all knowledge as tentative and suspending judgement. Tolerance for ambiguity. Willingness to change views if the evidence is convincing.

- *Resilience*
  Not giving up on the pursuit for answers/ solutions. Willingness to take risks and embrace failure as part of the learning process.

- *Responsibility*
  Showing care and concern for living things and awareness of our responsibility for the quality of the environment.

- *Healthy Scepticism*
  Questioning the observations, methods, processes, and data, as well as trying to review one's own ideas.

Table 2 shows an overview of the topics found in the Primary Science Syllabus. The topics are organised in levels to ensure a coherent and meaningful development of concepts as students progress from Primary 3 to Primary 6.

Levels	**P3**	**P4**	**P5**	**P6**
Themes	**Diversity . Cycles . Systems . Interactions . Energy**			
Topics	• Diversity of living and non-living things (General characteristics and classification) • Diversity of materials • Cycles in plants and animals (Life cycles) • Interaction of forces (Magnets)	• Plant system (Plant parts and functions) • Human system (Digestive system) • Cycles in matter and water (Matter) • Energy forms and uses (Light) • Energy forms and uses (Heat)	• Cycles in plants and animals (Reproduction) • Cycles in matter and water (Water) • Plant system (Respiratory and circulatory systems) • Human system (Respiratory and circulatory systems) • Electrical system	• Energy forms and uses (Photosynthesis) • Energy Conversion • Interaction of forces (Frictional force, gravitational force, elastic spring force) • Interactions within the environment

Topics which are underlined are not required for students taking Foundation Science.

Table 2: An Overview of the topics in the Primary Science Syllabus

SECTION 3: PEDAGOGY

Teaching and Learning of Primary Science
Students as Inquirers
Teachers as Facilitators

- Singapore Teaching Practice
- e-Pedagogy

3. PEDAGOGY

3.1 Teaching and Learning of Primary Science

We envision students to enjoy learning Science and to value Science in their everyday lives (e.g., to make informed decisions and take responsible actions, such as in personal health and caring for the environment).

We believe that all students are curious and want to explore and learn about things around them. The Science Curriculum seeks to nurture students as inquirers by providing opportunities for them to explore and to appreciate the role of *Science for Life and Society*.

To nurture students as inquirers, teachers are key in facilitating a variety of learning experiences to support students in understanding *core ideas*, developing *practices* and cultivating *values, ethics, and attitudes*. These learning experiences can be situated in various authentic contexts in both formal and informal settings. The experiences should inspire students to inquire and innovate. Teachers can better design and enact engaging learning experiences by drawing on the Knowledge Bases (for subject matter and goals, refer to sections 1 and 2) and Pedagogical Practices in the Singapore Teaching Practice.

3.1.1 Students as Inquirers

Learning takes place with the development of skills and dispositions in our students. The Primary Science Curriculum seeks to leverage students' interest and stimulate their curiosity about themselves and their environment. They can be provided with learning experiences that allow them to pose questions, be involved in discussions on socio-scientific issues or be engaged in problem solving, with the use of authentic contexts. Through these learning experiences, students are likely to:

- Ask questions as they engage with an event, phenomenon, problem, or issue. They can ask questions which they are interested to find out. The questions can guide the design of investigations (e.g., to find out how shadows are formed) so that they can draw valid conclusions and solve problems.

- Gather evidence in response to their questions. They can gather evidence through observations and/or use of simple equipment to collect either qualitative or quantitative data. After the data collection, they can present the evidence gathered in appropriate forms (e.g., in tables, charts, graphs) to facilitate the analysis of patterns and relationships.
- Formulate explanations based on the evidence gathered. They can explain using their own words using the evidence gathered (e.g., qualitative descriptions of observations or quantitative data collected over a time interval).
- Connect their explanations to various contexts. They can explain how the concepts are related or applied in various examples and contexts around them and in the environment. This helps them to appreciate how Science is relevant in everyday life.
- Communicate and justify their explanations. They can communicate using various types of representations. For example, they can use texts, drawings, charts, tables or graphs or a combination of representations to support their explanations.
- Reflect on their learning and progress. They can reflect on their learning (e.g., what they have learnt, how they would like to improve, what they are curious about) in different ways (e.g., asking questions, journalling). These reflections help them to take greater ownership of their own learning and develop deeper conceptual understanding.

Learning takes place individually and collaboratively, as students construct and co-construct meaning from knowledge and experiences. In the learning of Science, students should have opportunities to:

Learn with Others. In understanding and applying concepts and skills, students can be engaged in pair, group or whole class interactions. For example, they can share their prior knowledge on what they know about shadows in pairs. Students then acquire new knowledge about shadows through exploration in a collaborative hands-on learning experience. Students can also relate to the natural phenomena and applications of light in everyday life through whole class sharing.

Learn using Different Resources. Students can also learn through various print resources (e.g., stories in textbooks, experiments in activity books) and online resources (e.g., animations, interactive objects, and videos in the Singapore Student Learning Space (SLS)). They can also use everyday materials to test ideas and create products (e.g., making their own toys).

Learn in Various Environments. Students can observe and/or collect data to understand their environment. For example, they can visit nature parks and the zoo to observe the diversity of plants and animals. They can also conduct simple experiments (e.g., to find a material which can be used to make a bottle to keep the drink warm for a longer time).

The end goal is to have students who enjoy Science and value Science as an important tool in helping them explore their natural and physical world.

3.1.2 Teachers as Facilitators

In the teaching and learning process, teachers play an important role in stimulating students' curiosity about themselves and their environment, as well as encouraging students to see the value of Science and its applications in their everyday lives.

To do these, teachers should ensure that the learning experiences provided for students go beyond learning facts and outcomes of scientific investigations. Teachers should play the role of facilitators to support students as inquirers by providing learning experiences that vary between guided and open inquiry.

As facilitators, teachers should:

- Provide students with opportunities to ask questions about events/ phenomenon/ problems/ issues that are related to their daily lives, society, and environment.
- Support students in gathering and using evidence.
- Encourage students to formulate and communicate explanations based on evidence gathered.
- Encourage students to apply concepts learnt in understanding daily events/phenomenon, finding solutions to problems/issues, and creating products.
- Check on students' understanding to ascertain if learning has taken place and provide appropriate and meaningful feedback to address students' learning gaps.

Singapore Teaching Practice

Learning takes place in a caring and safe environment. It is important to build positive teacher-student relationships to maximise effective teaching and learning (refer to the Singapore Teaching Practice OPAL Page on *Understanding Teaching* for more information).

The Pedagogical Practices (PP) as shown in **Figure 4** comprise four fundamental teaching processes that epitomise good teaching.

Positive Classroom Culture. Teachers can create a conducive environment that supports student questioning and interactions by building rapport and trust. They can set clear expectations and articulate students' roles to facilitate student group work. They can also introduce classroom routines to maximise student participation in whole class interactions (e.g., use of small white board for each student to reflect on individual responses) and provide opportunities for individual student reflection (e.g., using "exit cards" to reflect on a learning point) as this develops metacognition and empowers students to take ownership of their own learning.

Lesson Preparation. Teachers can collaborate in lesson planning. For example, they can plan and sequence learning experiences for each topic to ensure coherent development of conceptual understanding and application of concepts to various contexts. For each lesson, teachers can also explore key questions, instructional strategies and resources to use, based on students' conceptions, profiles and needs.

Lesson Enactment. Teachers can use suitable instructional strategies to elicit students' prior knowledge (e.g., find out what students know and want to know) and capture their interest (e.g., through a story) at the start of a lesson. To continue engaging students and maintaining the momentum of the lesson, teachers can use questions to scaffold or deepen student understanding in either whole class interaction or group work. It is also important to consolidate students' learning when concluding the lesson.

Assessment and Feedback. When facilitating students' learning, teachers can check for students' understanding and provide feedback to address their alternative conceptions. They can also design meaningful assignments for students to reflect on their own learning, as well as to show and apply their understanding in various contexts. Assessment and Feedback will be elaborated in the section on Assessment.

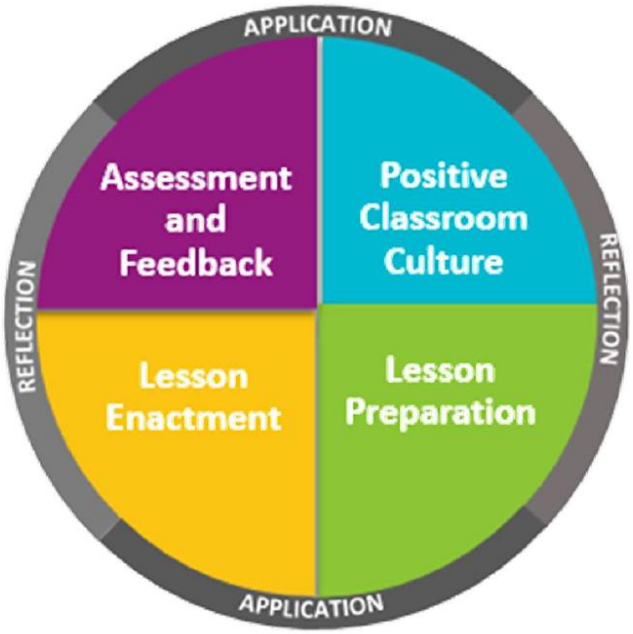


Figure 4: Pedagogical Practices

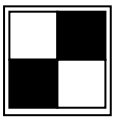
Teachers need to exercise professional judgement in enacting the four teaching processes. They can use a variety of instructional strategies to design meaningful learning experiences in various authentic contexts to support students as inquirers. A brief description of each of these instructional strategies is also given below:

Concept Cartoon
In concept cartoons, minimal language is used. Visual images are used to present concepts or questions relating to one central idea or word.

Field Trip
A field trip is any outdoor learning experience which provides opportunities for students to explore, discover and experience Science in everyday life.

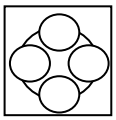
Concept Mapping

Concept mapping presents meaningful relationships among concepts. Concept maps are useful in organising and linking concepts or ideas.



Games

Games engage students in play or simulations for the learning of concepts or skills. This is useful in helping students to visualise or illustrate objects or processes in the real world.

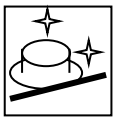


Cooperative Learning

In cooperative learning, activities are structured such that each student assumes certain responsibilities and contributes to the completion of tasks. In working with others, students are exposed to different points of views and solutions in accomplishing a common goal.

Investigation

In scientific investigation, students engage in experiences that mirror how scientists think and do in a decision-making process, such as observing, posing questions and planning or designing investigations.

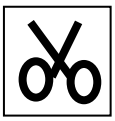


Demonstration

Demonstration is commonly used to scaffold the learning process. This approach is recommended when the learning experience is not safe or too complex for students to set up on their own.

Problem Solving

Problem solving engages students in finding solutions to problems by applying scientific concepts and skills.



Projects

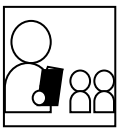
Projects allow students to show understanding and application of concepts and skills through creating and making.

Role Play, Drama, Dance and Movement

Role play, drama, dance and movement allow students to deepen and express their understanding of scientific concepts and processes in creative ways.

Questioning

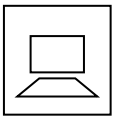
Questions are useful tools in the learning process. Both teachers and students should engage in cycles of questions-answers-questions throughout the learning process.



Stories

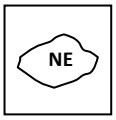
Stories of Science in everyday life and of scientists can capture students' interest and engage them in talking about Science. Either the teacher or students can be the story creator or teller.

Teachers are also encouraged to leverage the planned learning experiences to infuse Information and Communication Technology (ICT) and National Education.



Information and Communication Technology

ICT supports the students as inquirers and facilitates student collaboration and self-directed learning.



National Education

National Education is infused into the curriculum to allow students to see how scientific phenomena and developments can contribute to or affect the nation.

Where appropriate, students can be provided with opportunities to cultivate values, ethics and attitudes which are relevant to the study of Science. Teachers are also encouraged to incorporate the ethical aspect of Science wherever possible throughout the syllabus.

Values, Ethics and Attitudes

The adoption of certain mental attitudes such as Curiosity, Creativity, Objectivity, Integrity, Open-mindedness, Resilience, Responsibility and Healthy Scepticism is advocated. Students can also discuss the ethical implications of Science and Technology.

In the teaching and learning of Science, teachers are encouraged to use a mix and match of instructional strategies. Each instructional strategy is not limited to a teaching process in STP. For example, questioning is relevant in the four teaching processes, as illustrated below.

- *Positive classroom culture:* Teachers create a safe environment for students to ask questions.
- *Lesson preparation:* Teachers plan key questions that encourage student thinking and discussion.
- *Lesson enactment:* Teachers exercise flexibility in asking further questions to address alternative conceptions or elicit alternative perspectives.
- *Assessment and feedback:* Teachers use students' responses to identify alternative conceptions or plan for the next learning experience.

e-Pedagogy

Science teaching and learning can also be enhanced with technology. Technology can transform the culture of learning to be more participative, reflective, and connected by enhancing student engagement, deepening learning, and giving greater student agency and ownership of learning. Teachers can adopt e-Pedagogy to design a range of learning experiences for students to develop the knowledge, skills, and dispositions.

Teachers can tap on the Key Applications of Technology (KAT), as shown in **Figure 5**, to select appropriate technological tools based on their pedagogical affordances and apply technologies to support student-student interactions and active learning in Science. For example, online collaboration tools can be used by teachers to facilitate students' co-construction of knowledge through scientific experimentation/ investigations (inquiry-based learning) or discussion of application of Science in everyday contexts. More information can be found on the e-Pedagogy one-stop site.

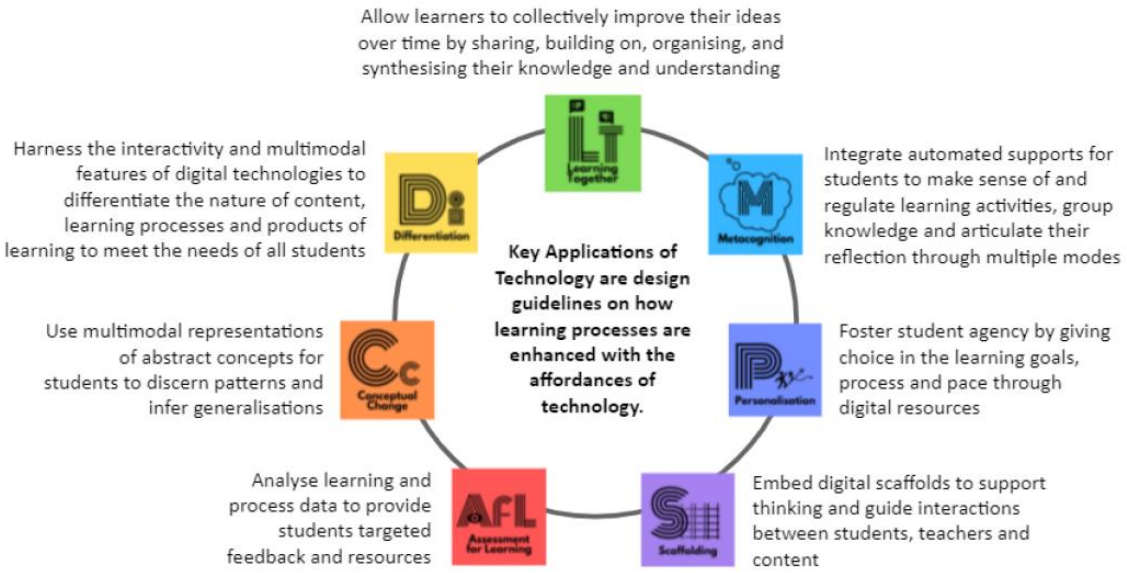


Figure 5: Key Applications of Technology

SECTION 4: ASSESSMENT

Assessment and Feedback

4. ASSESSMENT

Assessment is integral to teaching and learning process. In designing assessments, teachers need to have clarity of purpose. It involves gathering and analysing evidence about students' learning through various assessment techniques and making appropriate educational decisions for teaching and learning. Assessment provides teachers with information about students' progress and development in relation to the learning objectives. With this information, teachers make informed decisions about what should be done to enhance the learning of the students and to improve teaching methods.

4.1 Assessment and Feedback

Why Assess?

Assessment measures the extent to which desired knowledge, skills and attitudes are attained by students. It can serve different purposes in the school and classroom. Having clarity of purpose is essential for understanding the strengths and limitations of using a particular source of assessment information for decision-making. While it complements the teaching and learning process, it also provides formative and summative feedback to students, teachers, schools, and parents. A balanced assessment system consists of both Assessment of Learning as well as Assessment for Learning. Assessments can provide both quantitative and/or qualitative descriptions of learner performance that give feedback for improving future practices.

- Assessment provides feedback to ***students***, allows them to understand their strengths and weaknesses. Through assessment, students can monitor their own performance and progress. It also points them in the direction they should go to improve further.

- Assessment provides feedback to ***teachers***, enables them to understand the strengths and weaknesses of their students. It provides information about students' attainment of learning outcomes as well as the effectiveness of their teaching.

- Assessment provides feedback to ***schools***. The information gathered facilitates the placement of students in the appropriate course, and the promotion of students

from one level to the next. It also allows the schools to review the effectiveness of their instructional programmes.

- Assessment provides feedback to ***parents***, allowing them to monitor their child's progress through the information obtained.

What and How to Assess?

The aims of the Primary Science Syllabus are for students to acquire Science concepts, develop skills and cultivate values, ethics and attitudes and apply them in authentic, relevant daily life contexts. The assessment objectives of the syllabus are aligned to the three domains in the Science curriculum framework.

As assessment serves many purposes, it is important to match the type of assessment to the specific purpose for which it is intended. Before making an assessment about a certain aspect of students' performance, teachers should ensure that the assessment mode used will generate information that reflects accurately the aspect of performance teachers intend to assess.

In the teaching and learning of Science, assessment can take many forms. In addition to the written tests, teachers can also conduct performance-based assessment using the following modes:

- Checklists
- Debates
- Drama / Show and Tell
- Games and Quizzes
- Learning Trails
- Model-making
- Posters
- Practicals
- Projects
- Reflections / Journals
- Teacher Observations

Teachers can also assess students' learning using portfolios. It is a systematic and purposeful collection of students' work and provides a comprehensive picture of their development and progress in the acquisition of knowledge, understanding of scientific

concepts, application of skills, and development of attitudes. Students can select the pieces which will go into the portfolio which provides opportunity for the students to have self-evaluation and reflections by revisiting their own portfolio of their work.

The assessment modes listed above are by no means exhaustive. Adopting a variety of assessment modes enables the teachers to assess different aspects of teaching and learning.

SECTION 5:
SYLLABUS
LEARNING OUTCOMES

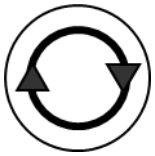
5. SYLLABUS LEARNING OUTCOMES

 **About Diversity:** There is a great variety of living and non-living things around us. Organising this diversity of things helps us better understand the world in which we live. There are common threads that connect all living things and unifying factors in the diversity of non-living things that help us classify them. This theme helps us appreciate the importance of maintaining diversity.	**Essential Takeaways:** • There is a great variety of living and non-living things around us. • We classify living and non-living things based on their similarities and differences. • Maintaining the diversity of living and non-living things is important for survival. **Key Inquiry Questions:** • What can we observe around us? • How can we classify the great variety of living and non-living things? • Why is it important to maintain diversity?

Diversity of Living and Non-Living Things (General characteristics and classification) (P3)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Describe the characteristics of living things. - Need water, food and air to survive - Grow, respond and reproduce • Recognise some broad groups of living things based on similarities and differences. - Plants (flowering, non-flowering) - Animals (amphibians, birds, fish, insects, mammals, reptiles) - Fungi (mould, mushroom, yeast) - Bacteria *Note:* - *Recall of names of specific living things (e.g., guppy) and their characteristics (e.g., give birth to young alive) is not required.*	• Observe a variety of living and non-living things and infer differences between them. • Classify living things into broad groups (in plants and animals) based on similarities and differences of common observable characteristics.	• Show curiosity by questioning and exploring the surrounding living and non-living things. • Show care and concern by being responsible towards living things.

Diversity of Materials (P3)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Relate the use of various types of materials (wood, metal, ceramic, rubber, glass, plastic, fabric) to their physical properties.	• Compare physical properties of materials. - Strength - Flexibility - Ability to float/sink in water - Waterproof - Transparency *Note:* - *The focus is on how the properties of materials are used.* - *The "strength" of a material is its ability to be subjected to loads without breaking.* - *The "flexibility" of a material is its ability to bend without breaking.* - *The "ability to float on water" refers to whether an object is able to stay on or near the surface of water and not sink. (The concept of density is not required.)* - *A material is "waterproof" when it does not absorb water.*	• Show objectivity by using data and information to validate observations and explanations about the properties and uses of materials.

Diversity of Materials (P3)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
	- *The "transparency" of a material refers to whether the material allows most/ some or no light to pass through. (The use of terms – transparent/ translucent/ opaque is not required.)*	



About Cycles:

There are cycles or repeated patterns of change in nature. Understanding cycles, such as life cycles and the water cycle, helps us predict events and processes and to appreciate the Earth as a self-sustaining system that supports life.

Essential Takeaways:

- There are repeated patterns of change around us.
- Understanding cycles helps us to make predictions about events and processes around us.

Key Inquiry Questions:

- What makes a cycle?
- How does a cycle help us predict events and processes?
- Why are cycles important to life?

Cycles in Plants and Animals (Life Cycles) (P3)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Show an understanding that different living things have different life cycles. - Plants - Animals	• Observe and compare the life cycles of plants grown from seeds over a period of time. *Note:* - *The focus is on the stages (seed, young plant, adult plant) of flowering plants. Processes in plant reproduction (pollination, fertilisation, seed dispersal and germination) are introduced in the topic of Cycles in Plants and Animals (Reproduction) in P5.* • Observe and compare the life cycles of animals over a period of time (chicken, cockroach, frog, grasshopper, beetle, butterfly, mosquito)	• Show curiosity by questioning and exploring the surrounding plants and animals. • Show care and concern by being responsible towards plants and animals.

Cycles in Plants and Animals (Reproduction) (P5 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Recognise that a cell is a basic unit of life. • Show an understanding that living things reproduce to ensure continuity of their kind and that many characteristics of an organism are passed on from parents to offspring. • Describe processes in the sexual reproduction of flowering plants. - Pollination - Fertilisation (seed production) - Seed dispersal - Germination *Note:* - *Fertilisation occurs when a male reproductive cell fuses with a female reproductive cell.*	• Investigate the ways in which plants reproduce. - Spores - Seeds *Note:* - *Vegetative propagation methods, such as stem cutting, are not required.*	• Show curiosity by questioning and exploring the surrounding plants and animals. • Show care and concern by being responsible towards plants and animals.

Cycles in Plants and Animals (Reproduction) (P5 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
- *The use of specific terms ("self-pollination" and "cross-pollination") to describe the pollination process is not required.* - *Knowledge of the pollen tube formation is not required.* - *The specific location where fertilisation takes place in the female reproductive system is not required.* • Recognise the process of fertilisation in the sexual reproduction of humans. *Note:* - *Fertilisation occurs when a sperm fuses with an egg.* - *The fertilised egg develops in the womb.* - *Students should know that ovaries produce eggs, and the testes produce sperms.*		

Cycles in Plants and Animals (Reproduction) (P5 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
- *Foetal development and the mechanism of obtaining air, food and water through the umbilical cord are not required.* • Recognise the similarity in terms of fertilisation in the sexual reproduction of flowering plants and humans.		

Cycles in Plants and Animals (Reproduction) (P5 Foundation)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• State the processes in the sexual reproduction of flowering plants. - Pollination - Fertilisation (seed production) - Seed dispersal - Germination *Note:* - *Fertilisation is the process that leads to the development of fruits and seeds.* - *The use of specific terms ("self-pollination" and "cross-pollination") to describe the pollination process is not required.* • State the process of fertilisation in the sexual reproduction of humans.	• Observe and compare the ways in which plants reproduce. - Spores - Seeds *Note:* - *Vegetative propagation methods, such as stem cutting, are not required.*	• Show curiosity by questioning and exploring the surrounding plants and animals. • Show care and concern by being responsible towards plants and animals.

Cycles in Plants and Animals (Reproduction) (P5 Foundation)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
Note: - *Fertilisation occurs when a sperm fuses with an egg.* - *The fertilised egg develops in the womb.* - *Students should know that ovaries produce eggs, and the testes produce sperms.* - *Foetal development and the mechanism of obtaining air, food and water through the umbilical cord are not required.*		

Cycles in Matter and Water (Matter) (P4)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• State that matter is anything that has mass and occupies space. • Differentiate among the three states of matter (solid, liquid, gas) in terms of shape and volume.	• Measure mass and volume using appropriate apparatus.	• Show curiosity in exploring matter in the surroundings and question what they find.

Cycles in Matter and Water (Water) (P5 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Recognise that water can exist in three interchangeable states of matter. • Show an understanding of how water changes from one state to another. - Melting (solid to liquid) - Freezing (liquid to solid) - Boiling/Evaporation (liquid to gas) - Condensation (gas to liquid) • Show an understanding of the terms melting point of ice (or freezing point of water) and boiling point of water. • Show an understanding of the roles of evaporation and condensation in the water cycle. • Recognise the importance of the water cycle.	• Compare water in 3 states. • Investigate the effect of heat gain or loss on the temperature and state of water. - When ice is heated, it melts and changes to water at 0^{o}C. - When water is cooled, it freezes and changes to ice at 0^{o}C. - When water is heated, it boils and changes to steam at 100^{o}C. - When steam is cooled, it condenses to water. • Investigate the factors which affect the rate of evaporation. - Wind - Temperature - Exposed surface area	• Show concern for water as a limited natural resource and be responsible in conserving.

Cycles in Matter and Water (Water) (P5 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Recognise the importance of water to life processes. • Describe the impact of water pollution on Earth's water resources.		

Cycles in Matter and Water (Water) (P5 Foundation)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Recognise that water can exist in three interchangeable states of matter. • State how water changes from one state to another. - Melting (solid to liquid) - Freezing (liquid to solid) - Boiling/Evaporation (liquid to gas) - Condensation (gas to liquid) • State the melting point of ice (or freezing point of water) and boiling point of water. • Recognise the changes in states of water in the water cycle. • Recognise the importance of the water cycle.	• Compare water in 3 states.	• Show concern for water as a limited natural resource and be responsible in conserving.

About Systems:

A system is a whole consisting of parts that work together to perform function(s). There are systems in nature such as plant and human systems; as well as man-made systems such as electrical systems. Understanding these systems allows us to appreciate how parts influence and work together to perform function(s).

Essential Takeaways:

- *A system is made of different parts. Each part has its own unique function.*
- *Different parts of a system influence and work together to perform function(s).*

Key Inquiry Questions:

- *What is a system?*
- *How do different parts/systems work together to perform function(s)?*
- *Why is it important to understand how parts/systems work together?*

Human System (Digestive System) (P4)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Identify the human systems in the body and state their functions (digestive, respiratory, circulatory, skeletal and muscular). *Note:* - *This learning outcome introduces students to an overview of human systems in the body. Detailed knowledge of the muscular and skeletal systems (such as names of the bones/muscles in the body and descriptions of how they work) are not required.* • Identify the parts in the human digestive system (mouth, gullet, stomach, small intestine and large intestine) and describe their functions.		• Show curiosity in questioning about the structures or functions of the body.

Human System (Respiratory and circulatory systems) (P5 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Recognise that air is made up of gases such as nitrogen, carbon dioxide, oxygen and water vapour. • Identify the parts of the human respiratory (nose, windpipe, lungs) and circulatory systems (heart, blood, blood vessels) and describe their functions. *Note:* - *Detailed knowledge of respiratory system (e.g., alveoli) and circulatory system (e.g., heart chambers and valves) is not required.* • Recognise the integration of the different systems (digestive, respiratory and circulatory) in carrying out life processes.	• Compare how plants, fish and humans take in oxygen and give out carbon dioxide. • Compare the ways in which substances are transported within plants and humans. - Plants: Tubes that transport food and water - Humans: Blood vessels that transport digested food, oxygen and carbon dioxide *Note:* - *The use of specific terms (xylem, phloem, stomata, artery, vein, capillary) is not required.*	• Show objectivity by seeking data and information to validate observations and explanations about the human body.

Human System (Respiratory and circulatory systems) (P5 Foundation)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Recognise that air is made up of gases such as nitrogen, carbon dioxide, oxygen and water vapour. • Identify the parts of the human respiratory (nose, windpipe, lungs) and circulatory systems (heart, blood, blood vessels) and state their functions. *Note:* - *Detailed knowledge of respiratory system (e.g., alveoli) and circulatory system (e.g., heart chambers and valves) is not required.*	• Compare how plants and humans take in oxygen and give out carbon dioxide. *Note:* - *The use of specific terms (xylem, phloem and stomata, artery, vein, capillary) is not required.*	• Show objectivity by seeking data and information to validate observations and explanations about the human body.

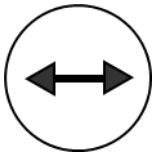
Plant System (Plant parts and functions) (P4)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Identify the different parts of plants and state their functions. - Leaf - Stem - Root *Note:* - *Food-carrying and water-carrying tubes in the plant transport system are introduced in the topic of Plant System (Respiratory and Circulatory Systems) in P5.*	• Observe plant parts.	• Show curiosity in exploring the surrounding plants and question what they find. • Show care and concern by being responsible towards plants.

Plant System (Respiratory and circulatory systems) (P5 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Identify the parts of the plant transport system and describe their functions. *Note:* - *Recall of the relative positions of water-carrying and food-carrying tubes is not required.* - *The use of specific terms (xylem and phloem) is not required.* - *The concept of transpiration pull is not required.*	• Investigate how food and water are transported in the plant.	• Show objectivity by seeking data and information to validate observations and explanations about plant parts and functions. • Show care and concern by being responsible towards plants.

Plant System (Respiratory and circulatory systems) (P5 Foundation)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Recognise how water is transported from the roots to other parts of the plant and how food is transported from the leaves to other parts of the plant. *Note:* - *Recall of the relative positions of water-carrying and food-carrying tubes is not required.* - *The use of specific terms (xylem and phloem) is not required.* - *The concept of transpiration pull is not required.*	• Observe how food and water are transported in the plant.	• Show objectivity by seeking data and information to validate observations and explanations about plant parts and functions. • Show care and concern by being responsible towards plants.

Electrical System (P5 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Recognise that an electric circuit consisting of an energy source (battery) and other circuit components (wire, bulb, switch) forms an electrical system. • Show an understanding that a closed circuit allows current to flow. • Identify electrical conductors and insulators.	• Construct simple circuits from circuit diagrams. • Investigate the effect of some variables on the current in a circuit. - Number of batteries (arranged in series) - Number of bulbs (arranged in series and parallel)	• Show concern for the need to conserve and to have proper use and handling of electricity.

Electrical System (P5 Foundation)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Recognise that an electric circuit consisting of an energy source (battery) and other circuit components (wire, bulb, switch) forms an electrical system. • State that a closed circuit allows current to flow. • Identify electrical conductors and insulators.	• Construct simple circuits from circuit diagrams. • Investigate the effect of some variables on the current in a circuit. - Number of batteries (arranged in series) - Number of bulbs (arranged in series)	• Show concern for the need to conserve and to have proper use and handling of electricity.



About Interactions:

Interactions are the actions between and within living and non-living systems in the environment. Understanding these interactions helps us see relationships between the factors/ variables in the environment. We can also appreciate the consequences of our actions and play our part in conservation.

Essential Takeaways:

- *There are interactions among us, living and non-living things in the environment.*
- *Interactions within the environment can have positive or negative impacts.*
- *Conservation is important to ensure continuity of life and availability of resources.*

Key Inquiry Questions:

- *What are the types of interactions around us?*
- *How do interactions affect the environment and us?*
- *Why is it important for us to conserve the environment?*

Interaction of Forces (Magnets) (P3)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Recognise that a magnet can exert a push or a pull. • Identify the characteristics of magnets. - Magnets can be made of iron or steel. - Magnets have two poles. A freely suspended bar magnet comes to rest pointing in a North-South direction. - Unlike poles attract and like poles repel. - Magnets attract magnetic materials. *Note:* - *Recall of magnetic materials such as nickel and cobalt is not required.* - *Magnetic shielding and magnetic induction are not required.* • Recognise uses of magnets in everyday objects.	• Compare magnets, non-magnetic materials and magnetic materials. • Make a magnet by the stroke method and the electrical method.	• Show curiosity in exploring the uses of magnets in everyday life.

Interaction of Forces (Frictional force, gravitational force, elastic spring force) (P6 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Identify a force as a push or a pull. • Show an understanding of the effects of a force. - A force can move a stationary object. - A force can speed up, slow down or change the direction of motion. - A force can stop a moving object. - A force may change the shape of an object. • Recognise and give examples of the different types of forces. - Magnetic force - Gravitational force - Elastic spring force - Frictional force	• Investigate the effect of frictional force on the motion of objects. • Investigate the effects of elastic spring force.	• Show objectivity by using data and information to validate observations and explanations about forces.

Interaction of Forces (Frictional force, gravitational force, elastic spring force) (P6 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
Note: - *Direction of frictional force for "rolling objects" such as wheels and balls is not required.* - *The use of specific terms such as 'air resistance' and 'water resistance' is not required.* • Recognise that objects have weight because of the gravitational force acting on the object.		

Interaction of Forces (Frictional force, gravitational force) (P6 Foundation)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Identify a force as a push or a pull. • State the effects of a force. - A force can move a stationary object. - A force can speed up, slow down or change the direction of motion. - A force can stop a moving object. A force may change the shape of an object. • Recognise and give examples of the different types of forces. - Magnetic force - Gravitational force - Frictional force *Note:* - *Direction of frictional force for "rolling objects" such as wheels and balls is not required.*	• Investigate the effect of frictional force on the motion of objects.	• Show objectivity by using data and information to validate observations and explanations about forces.

Interaction of Forces (Frictional force, gravitational force) (P6 Foundation)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
- *The use of specific terms such as 'air resistance' and 'water resistance' is not required.* • Recognise that objects have weight because of the gravitational force acting on the object.		

Interactions within the Environment (P6 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Identify the factors that affect the survival of an organism. - Physical characteristics of the environment (temperature, light, water) - Availability of food - Types of other organisms present (producers, consumers, decomposers) • Show an understanding of the effect on organisms when the environment becomes unfavourable (organisms adapt and survive; move to other places or die). • Show an understanding of the energy pathway from the Sun through living things and identify the roles of various organisms (producers, consumers, predators, prey) in a food chain and a food web.	• Observe, collect and record information regarding the interacting factors within an environment.	• Show care and concern for Man's impact on the environment by being respectful and responsible towards the environment.

Interactions within the Environment (P6 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Differentiate among organism, population and community. - An organism is a living thing. - A population is a group of organisms of the same kind, living and reproducing at a given place and time. - A community consists of many populations living together in a particular place. • Show an understanding that different habitats support different communities (garden, field, pond, seashore, tree, mangrove swamp).		

Interactions within the Environment (P6 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Show an understanding that adaptations serve to enhance survival and can be structural or behavioural. - Cope with physical factors - Obtain food - Escape predators - Reproduce by finding and attracting mates or dispersing seeds/fruits *Note:* - *Students are introduced to the types of dispersal methods and physical characteristics of different fruits and seeds in the theme of Cycles. The focus in this theme is to help students recognise that physical characteristics are the "structural adaptations" which help fruits and seeds in their dispersal.*		

Interactions within the Environment (P6 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Give examples of man's impact (both positive and negative) on the environment. *Note:* - *Positive impact [Conservation, Reforestation]* - *Negative impact [Depleting natural resources, deforestation, pollution (land/water/air), global warming]*		

Interactions within the Environment (P6 Foundation)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Identify the factors that affect the survival of an organism. - Physical characteristics of the environment (temperature, light, water) - Availability of food - Types of other organisms present (producers, consumers, decomposers) • Recognise the energy pathway from the Sun through living things and identify the roles of various organisms (producers, consumers, predators, prey) in a food chain. • Recognise that different habitats support different organisms (garden, field, pond, seashore, tree, mangrove swamp).	• Observe, collect, and record information regarding the interacting factors within an environment.	• Show care and concern for Man's impact on the environment by being respectful and responsible towards the environment.

Interactions within the Environment (P6 Foundation)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Recognise that adaptations serve to enhance survival and can be structural or behavioural. - Cope with physical factors - Obtain food - Escape predators - Reproduce by finding and attracting mates or dispersing seeds/fruits *Note:* - *Students are introduced to the types of dispersal methods and physical characteristics of different fruits and seeds in the theme of Cycles. The focus in this theme is to help students recognise that physical characteristics are the "structural adaptations" which help fruits and seeds in their dispersal.*		

Interactions within the Environment (P6 Foundation)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Give examples of man's impact (both positive and negative) on the environment. *Note:* - *Positive impact [Conservation, Reforestation]* - *Negative impact [Depleting natural resources, deforestation, pollution (land/water/air), global warming]*		

About Energy:

Energy is required for things to work in everyday life. We use various forms of energy for many different purposes. All living things obtain energy and use it to carry out life processes. Understanding this theme allows us to appreciate the importance and uses of energy and the need to conserve it.

Essential Takeaways:

- *Energy is required for things to work.*
- *There are various forms of energy and they can be converted from one form to another.*
- *Some sources of energy can be depleted and we play an important role in energy conservation.*

Key Inquiry Questions:

- *What are the different forms of energy around us?*
- *How is energy used in everyday life?*
- *Why is it important to conserve energy?*

Energy Forms and Uses (Light) (P4)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Recognise that an object can be seen when it reflects light or when it is a source of light. *Note:* - *The law of reflection is not required.* • Recognise that light travels in straight lines and thus a shadow is formed when light is completely or partially blocked by an object.	• Investigate the variables that affect shadows formed. - Shape, size and position of object(s) - Distance between light source-object and object-screen *Note:* - *The use of specific terms (transparent, translucent, opaque) is not required.*	• Show objectivity by using data and information to validate observations and explanations about light.

Energy Forms and Uses (Heat) (P4)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Identify some common sources of heat. • State that the temperature of an object is a measurement of its degree of hotness. • State that heat is a form of energy. • Differentiate between heat and temperature. • Show an understanding that heat flows from a hotter to a colder object/ region/ place until both reach the same temperature. • Relate the change in temperature of an object to the gain or loss of heat by the object.	• Measure temperature using a thermometer and a datalogger with temperature/heat sensors.	• Show objectivity by seeking data and information to validate observations and explanations about heat.

Energy Forms and Uses (Heat) (P4)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• List some effects of heat gain/loss in our everyday life. - Contraction / expansion of objects (solid, liquid and gas) - Change in state of matter • Identify good and poor conductors of heat. - Good conductors: metals - Poor conductors: wood, plastics, air, rubber *Note:* - *Recall of the rate of heat transfer of specific materials (such as different types of metals) is not required.*		

Energy Forms and Uses (Photosynthesis) (P6 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Recognise that living things need energy from respiration to carry out life processes. *Note:* - *The focus of respiration is on the release of energy from food.* • Recognise that the Sun is our primary source of energy (light and heat). • Differentiate between the ways in which plants and animals obtain energy.	• Investigate the requirements (water, light energy and carbon dioxide) for photosynthesis (production of sugar and oxygen).	• Show objectivity by using data and information to validate observations and explanations about photosynthesis.

Energy Forms and Uses (Photosynthesis) (P6 Foundation)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Recognise that the Sun is our primary source of energy (light and heat).	• Investigate the requirements (water, light energy and carbon dioxide) for photosynthesis (production of sugar and oxygen).	• Show objectivity by using data and information to validate observations and explanations about photosynthesis.

Energy Conversion (P6 Standard)		
Learning Outcomes		
Core Ideas	**Practices**	**Values, Ethics and Attitudes**
• Recognise that energy from most of our energy resources is derived in some ways from the Sun. • Recognise and give examples of the various forms of energy. - Kinetic energy - Potential energy - Light energy - Electrical energy - Sound energy - Heat energy *Note:* - *The use of specific terms (chemical potential energy, gravitational potential energy and elastic potential energy) is not required.*	• Investigate energy conversion from one form to another.	• Show care and concern by being responsible in conserving energy in our everyday life.

SECTION 6:
GLOSSARY OF TERMS

6. GLOSSARY OF TERMS

No.	Term	Description of meaning
1.	analyse	to identify the parts of objects, information or processes, and the patterns and relationships between these parts
2.	classify	to group objects or events based on common characteristics
3.	communicate	to transmit and receive information which is presented in various forms – written, verbal, pictorial, tabular or graphical
4.	compare	to identify similarities and differences between objects, concepts or processes
5.	construct	to put a set of components together, based on a given plan
6.	describe	to write (using diagrams where appropriate) the main points of a topic
7.	differentiate	to identify the differences between objects, concepts or processes
8.	evaluate	to assess the reasonableness, accuracy and quality of information, processes or ideas
9.	formulate hypothesis	to make a general explanation for a related set of observations or events. It is an extension of inferring
10.	generate possibilities	to explore all the alternatives, possibilities and choices beyond the obvious or preferred one
11.	identify	to select and/or name the object, event, concept or process
12.	infer	to explain or draw a conclusion based on observations, data or information
13.	investigate	to find out answers to the questions or to verify the hypotheses
14.	list	to give a number of points or items without elaboration
15.	make decisions	to establish and apply criteria to select from among seemingly equal alternatives. The process of establishing criteria involves consideration of the consequences and values
16.	measure	to obtain a reading from a suitable measuring instrument
17.	observe	to obtain information through the use of the senses

No.	Term	Description of meaning
18.	predict	to assess the likelihood of an outcome based on prior knowledge of how things usually turn out
19.	recognise	to identify facts, characteristics or concepts that are critical to the understanding of a situation, event, process or phenomenon
20.	relate	to identify and explain the relationships between objects, concepts or processes
21.	show an understanding	to recall information (facts, concepts, models, data), translate information from one form to another, explain information and apply information
22.	solve problem	to analyse a problem and choose a relevant and/or innovative solution in order to remedy or alter a problem situation
23.	state	to give a concise answer with little or no supporting argument
24.	use apparatus and equipment	to know the functions and limitations of various apparatus, and develop the ability to select and handle them appropriately for various tasks

SECTION 7: ACKNOWLEDGEMENT

7. ACKNOWLEDGEMENT

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