



Republic of the Philippines
Department of Education
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MATATAG CURRICULUM

SCIENCE GRADES 4 and 7

SCIENCE SHAPING PAPER

I. Introduction

The Science Shaping Paper is developed to provide the narrative for the development of the recalibrated Science Curriculum. It outlines the goals, theoretical and philosophical foundations, and rationale that shape the Science Curriculum. It presents the big ideas and cross-cutting concepts in Science to emphasize the development of durable understanding among learners as well as skills applicable in various contexts.

The Science Shaping Paper and the Science curriculum are based on the General Shaping Paper, taking into consideration the findings of the curriculum review conducted in 2019-2020. Furthermore, the Science curriculum draws on the goals of the 2016 Science K to 12 curriculum. Its new features include: (a) expanding technological literacy to technology and engineering literacy to enable learners to develop their ability to connect science content to real-world technological and engineering applications; (b) introduction of key stage and grade level standards to articulate expectations of what learners should be capable of doing at each key stage and grade level; and (c) developmental sequence of content in consideration of the prior learning of students and the cognitive and language demands of learning new science ideas. Specifically, in sequencing the science content, three *modes of thinking* have been considered, starting from the simplest level when a person reacts to the physical environment; is able to internalize actions through words and images, and the most complex level; and is already able to think using a symbol system such as written language and number systems.

The recalibration of the Science curriculum draws from and supports the DepEd MATATAG agenda, which sets the new direction in resolving basic education challenges through the four critical components:

- **MA**king the curriculum relevant to produce competent and job-ready, active, and responsible citizens;
- **TA**king steps to accelerate delivery of basic education facilities and services;
- **TA**king good care of learners by promoting learner well-being, inclusive education, and a positive learning environment; and
- **G**iving support to teachers to teach better.

It comes at a time when rapid changes and disruptions are happening. According to Marope, Griffin, and Gallagher (2017), in the face of such persistent and rapid changes, education, through its curricula, should serve as lifelong learning systems, demonstrating constant self-renewal and innovation.

The succeeding sections are organized as follows:

- The Shape of the Grades 3 to 10 Science Curriculum
- Development of the Curriculum
 - Curriculum Goals, Theoretical and Philosophical Bases, Curriculum Framework, Key Stage Standards, Grade Level Standards
- Elements Contributing to the Curriculum

- Big Ideas, Cross-cutting Concepts, Developmental Sequence of Concepts, Development of 21st Century Skills, Social Issues and Government Priorities, STEM, Pedagogies, Assessment, and Resources, Curriculum Organization.

The Shape of the Grades 3 to 10 Science Curriculum

The Science curriculum has been developed with the view that science is essential for Filipino learners in an increasingly scientific, technological, and challenging world.

Science offers systematic processes and practices to investigate the natural and man-made world and to innovate and to collaborate with other people to explore frontiers and challenges, and to look for solutions to real-world problems. It offers a well-established and reliable body of knowledge that is increasingly accessible to all and at a range of conceptual levels. Science offers unique ways of thinking and acting in everyday social settings, as well as in more technical and professional settings. It offers ways to exhibit values and attitudes to contribute to an improved world.

The Science curriculum supports Filipino learners to engage with science-related issues, and with the ideas of science, as a reflective citizen. It supports them to explain phenomena scientifically, evaluate and design scientific inquiry, and interpret data and evidence. It encourages and supports them to apply scientific, environmental, technological, and engineering knowledge, practices, and principles in the context of real-life situations.

II. Development of the Curriculum

A. Curriculum Goals

The overall goal of the Grades 3 to 10 Science curriculum is the achievement of scientific, environmental, and technology and engineering literacy of all learners.

On achieving the outcomes of the curriculum, learners will be ready to actively participate in local, national, and global contexts and make meaningful contributions to a dynamic, culturally diverse, and expanding world. By successfully completing the Science curriculum, Filipino learners will demonstrate capabilities as put forth in the Basic Education Development Plan (BEDP) 2030.

B. Theoretical and Philosophical Bases

The Science curriculum presents a modern outlook incorporating learning approaches drawn from an increasingly expanding body of worldwide education research and education experience that recommend that science curricula and the teaching and learning of science for the elementary and secondary years focus on engaging learners in scientific inquiry and the nature and practice of science.

The Enhanced Basic Education Act of 2013 (RA 10533), Section 5.e requires that the curriculum support and reflect universally recognized theories of learning, particularly *Constructivism*. Other theories contributing to the development of the Science curriculum include *Social cognition theory*, *Brain-based theories of learning*, and *Vygotsky's Zone of Proximal Development (ZPD)*.

The **Constructivist theory of learning** suggests that learners learn by expanding their knowledge based on their prior knowledge. One of the primary goals of using constructivist teaching is for learners to learn how to learn when they are trained to take the initiative for their own learning experiences. Therefore, learners learn best when they can construct a personal understanding based on experiencing things and reflecting on those experiences. Constructivism emphasizes the active role of learners in building their own understanding. Rather than passively receiving information, learners reflect on their experiences, create mental representations, and incorporate new knowledge into their schemas, thus promoting deeper learning and understanding.

The **Social Constructivist Theory** advocated by Vygotsky posits three important ideas on the processes of learning and development of an individual. First, these processes involve co-construction with others. Social interaction plays a key role in shaping what learners know (cognition). Second, language mediates the learning process as they communicate with others, which includes not only verbal but also non-verbal communication. Knowledge and concepts are conveyed in the language and modes of communication we use. And third, learning and development take place within cultural and historical contexts. This means that learners' participation in the classroom and in school is also influenced by other institutions in which they participate, such as their home and community. There is a need to accommodate learners' diverse backgrounds, acknowledging their development as whole persons and tapping into their everyday practices, emotions, and identities.

Vygotsky's Zone of Proximal Development (ZPD) refers to the difference between what a learner can do without help and what he or she can achieve with guidance and encouragement from a skilled partner. The term 'proximal' suggests that area where the learner is 'close' to grasping the knowledge or skills to be learned. It recommends that learning occurs best in the ZPD – the zone where instruction is the most beneficial – where the task is only just beyond the individual's capabilities. An important process: therefore, is for the teacher to identify what the learner already knows and can do so the teacher can provide the 'close to' environment. Successful scaffolding thus requires appropriate selections, thoughtful organization, and sensitive presentation of suitable tasks.

The Science curriculum acknowledges the learners' direct interaction to their environment through assimilation and reinforcement as a crucial factor in learning and knowledge acquisition. **The Social cognition learning model** suggests that "most human behavior is learned observationally through modeling," thus, learners can learn from observing others either as a live model, a symbolic model, or a verbal instructional model. This pedagogical theory explains as well how attention, retention of ideas, reproduction of skills, and motivation, are influenced by how learners observe others and their experiences as they interact in their social and media environment.

The **Brain-based learning theory** is a relatively new educational theory that puts premium on the recent research about cognitive and neurosciences on how the brain learns and how learners learn differently as they age, grow, and mature cognitively, emotionally, and socially. It strongly suggests that learning can be improved and accelerated if teachers structure educational experiences in the classroom to reflect conditions that facilitate learning and improve brain functions and health and deliver lessons based on the science of learning.

The **Cognitive load theory** is a theory of how human brains process, learn and store information. The theory suggests that working memory has a limited capacity and that overloading it reduces the effectiveness of teaching. Furthermore, Dylan William has described cognitive load theory as “the single most important thing for teachers to know” (William 2017). A large body of research evidence indicates that instruction is most effective when designed according to the limitations of working memory.

C. Curriculum Framework

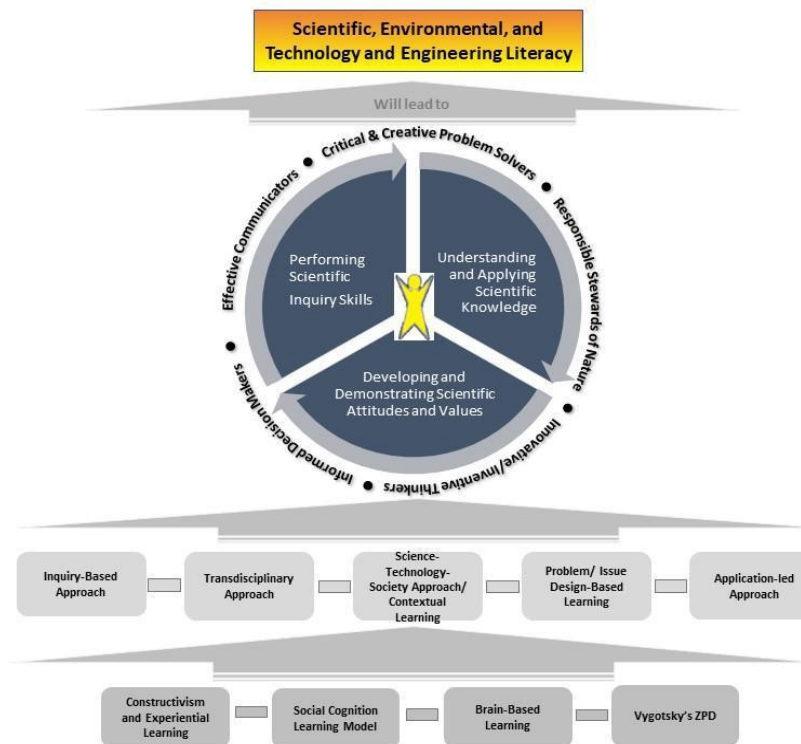


Figure 1. Science Curriculum Framework

A central feature of the Science curriculum is the balanced integration of three interrelated content strands:

- **Performing scientific inquiry skills;**
- **Understanding and applying scientific knowledge; and**
- **Developing and demonstrating scientific attitudes and values.**

This content is structured into a developmental sequence of science content, which progressively increases in conceptual demand. The design supports learners to engage with and learn in science appropriate to the expected prior experiences and learning.

To support the achievement of the developmental sequence, the Science curriculum has cross-disciplinary opportunities for learning built into learning competencies to reinforce the knowledge and understanding, skills and processes, and values and attitudes content included in the domains for a grade level or stage.

The learning of this content is principally facilitated using **the inquiry approach**, supported through approaches that challenge learners according to their prior learning and needs.

Participation in scientific inquiry enables students to develop ideas about science and how ideas are developed through scientific activity. The key characteristic of such activity is an attempt to answer a question to which students do not know the answer or to explain something they do not understand. The answer to some questions can be found by first-hand investigation, but for others information is needed from secondary sources. Therefore, capabilities involved in conducting scientific inquiry have a key role in the development of big ideas.

From Harlen, W. (Ed.) *Working with big ideas of science education*; (2015)

Other approaches that enhance inquiry learning and have also contributed to the curriculum design include:

- **applications-led learning,**
- **the science-technology-society approach,**
- **problem-based learning, and**
- **multi-disciplinary learning.**

The Science curriculum adopts in a developmental way the **Big Ideas** (Harlen, et al. 2015) and **Crosscutting Concepts of Science** (A Framework for the K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas, 2012), as well as integrates government priorities identified as appropriate to the science learning area.

The Science curriculum recognizes the place of science and technology in everyday human affairs. It integrates science and technology in the social, economic, personal, and ethical aspects of life. The science curriculum promotes strong links between science and technology, including indigenous know-how in the use of natural materials, thus contributing to the preservation of the country's cultural heritage.

The three areas of **knowledge and understanding, skills and processes,** and **values and attitude** are intertwined within the learning competencies in the Science curriculum as these are best learned in context. This reduces the load on the teacher to find matching skills, processes, and values and attitudes for the concepts to produce authentic activities.

Organizing the curriculum around situations and problems that challenge and activate learners' curiosity motivates them to engage and appreciate science as relevant and useful.

The intention of the curriculum is not to rely solely on textbooks, but to engage learners in science, as well as technological and engineering-related practices and processes and to incorporate varied hands-on and minds-on activities to develop learners' interest and encourage them to be active learners. Where learning competencies suggest engagement with and demonstrations of knowledge and understanding, this curriculum sets the expectation that learners will actively engage in locating and interpreting the relevant scientific facts, concepts, laws, and theories, and reinterpret or represent them as a deliberate learning strategy. This approach is strongly supported in brain-based learning, which suggests that teachers can promote higher learning through guidance with questions rather than by requiring learners to rote learn.

The Science curriculum is designed to be learner-centered and inquiry-based, emphasizing the use of evidence in constructing explanations and providing opportunities for collaboration, innovation, creative scientific exploration, and engineering design. The curriculum explicitly presents many learning competencies that require active learner participation and leadership. Thus, teachers should also deliberately look for opportunities to apply inquiry learning when addressing any learning competency, as this models the nature and practice of science in authentic scientific research and enterprise.

Assessment is an integral part of teaching and learning. The curriculum is designed to progressively introduce science concepts and skills and build towards learning of more conceptually complex content. For that reason, it is crucial that the prior experiences, knowledge, and understanding of learners are considered and assessed in formative ways to ensure that an accessible but challenging level of teaching and learning is offered to learners, maximizing the effectiveness of instruction (Vygotsky, 1978). Further information about assessment is described in the last part of this paper.

The Science curriculum provides learners with a repertoire of competencies for lifelong learning, for the world of work, and playing part in a well-informed society. It envisions learners with scientific, environmental, and technology and engineering literacy. Learners will be productive members of society because they are critical and creative problem solvers, responsible stewards of nature, innovative/inventive thinkers, informed decision makers, and collaborative and effective communicators.

The curriculum provides *Content standards* for each Domain and Grade to support teachers to identify the level of science knowledge, skills, and values to be taught and learned. It also clearly articulates *Performance standards* to support the teacher to assess the levels of knowledge, skills, and values that learners demonstrate in relation to the *Content* and *Learning Competencies* addressed during and at the end of each quarter of teaching and learning.

The Science curriculum is structured using the following organizers:

- **Content** – signaling the key areas of focus for a Quarter;
- **Content Standards** – indicating the conceptual level expected for the Quarter;
- **Learning Competencies** – identifying the specific aspects of content for learners to achieve;
- **Performance Standards** – providing a level for teachers to use to judge learner achievement at the end of each quarter; and
- **Performance Tasks** – samples of tasks where the learner applies their knowledge, understanding, skills and processes, values and attitudes, through which teachers can judge the levels of achievement of the performance standard for each quarter in the domain.

IV. Elements Contributing to the Science Curriculum

A. Big Ideas

The concepts and skills of Science are not taught in isolation, but rather in the context of big ideas in Science with increasing levels of complexity from one grade level to another in developmental progression, thus paving the way to a deeper understanding of core concepts. The integration across science domains leads to a meaningful understanding of interrelated concepts and their applications in real-life situations.

One of the reported findings from the curriculum review is that the curriculum is congested – that there is an unequal distribution of learning competencies across different cognitive demands and grade levels. Specifically, there are many learning competencies on the cognitive demands communicating understanding of science concepts and analyzing information and advance scientific arguments. To address this issue, the learning standards are redesigned with a focus on the Big Ideas, and the content standards are progressively appropriate for each grade level. Additionally, the learning competencies ensure a comparable distribution of cognitive demands across different cognitive domains and grade levels, for the learners to learn to perform basic procedures before undertaking the more cognitively demanding competencies.

A *Big Idea* is a statement of an idea that is central to learning – one that links numerous understandings into a coherent whole. It also represents a progression towards understanding key concepts in different learning areas (Charles, 2005). Grounding the learner’s content knowledge on a relatively few Big Ideas establishes a robust understanding of the learning area. The connection of Big Ideas to many other ideas allows the learner to see it as a set of interrelated concepts, skills, and facts thus, promoting memory and enhancing transfer.

B. Crosscutting Science Concepts

Crosscutting concepts are described as “dimensions that unify the study of science and engineering through their common application across fields.” (*A Framework for K-12 Science Education Practices, Crosscutting Concepts, and Core Ideas*, National Academy of Sciences, 2012)

Research suggests that learners, over multiple years of school, actively engage in science and engineering practices and apply crosscutting concepts to deepen their understanding of each field’s disciplinary core ideas.

The Science curriculum recognizes the importance of utilizing internationally accepted crosscutting ideas that recur across the different science domains and across grade levels. These crosscutting concepts include the following:

- *Structure and function,*
- *Stability and change,*
- *Systems and system models,*
- *Energy and matter: flows, cycles, and conservation,*

- *Scale, proportion and measurement,*
- *Patterns,*
- *Cause and effect, and*
- *The nature and practices of Science.*

Crosscutting concepts connect the small ideas in the different science domains as the learning areas are introduced in every quarter.

C. The Developmental Sequence of Concepts

The Science curriculum has been structured to progressively develop conceptual understanding of science ideas and practices by carefully paying attention to the introduction of new ideas. It is cognizant of the following important factors that influence students' readiness to learn science ideas and practices:

1. The experiences and expected prior learning of students;
2. The stages of development of students as described in educational research (that learners progress through *modes of thinking* from birth to adulthood: from *sensorimotor* to *iconic* to *concrete symbolic*, to *formal* and finally to *post-formal*.);
3. The cognitive demand of new science ideas for learners;
4. The language demands associated with new ideas in science; and
5. The need to reinforce new ideas within and across science domains in a consistent manner.

The Science curriculum for Grades 3 to 10 particularly responds to the first three *modes of thinking* to inform the sequencing of science content. The **Sensory-motor** mode identifies the developmental stage when a person reacts to the physical environment. For the very young child, it is the mode in which motor skills are acquired. In adult life, this mode is utilized as skills associated with sports and other physical activities that develop and evolve. The **Iconic** mode identifies when a person can internalize actions in the form of images. It is in this mode that the young child develops words and images that represent objects and events. For the adult, this mode of functioning assists in the appreciation of art and music and leads to a form of knowledge referred to as intuitive. The **Concrete symbolic** mode identifies when a person thinks using a symbol system such as written language and number systems. Thinking in this mode is reliant on a 'real-world' referent. This is the most common mode addressed in learning in the upper primary and secondary school (Biggs & Collis, 1982).

The design of the Science curriculum promotes interactive, concrete and hands-on instructional approaches in the early grades, especially in the introduction of more difficult concepts. The delivery of a lesson will call for activating prior knowledge in which new learning is built over prior learning. The presentation of content follows a progression from Grade 3 to Grade 10 towards scientific, environmental, and technology and engineering literacy of all learners.

a. Vertical Articulation

The various concepts, processes, and skills in the four domains of the Science curriculum are arranged in an increasing level of complexity from Grade 3 to Grade 10. It reinforces new ideas through the use of the development of key ideas towards the big ideas as described by Harlen, et al., (2015), and this learning is reinforced by integrating the crosscutting concepts of science developmentally through the various domains.

The progression of concepts across grade levels provides opportunity for the development of understanding of key science concepts. This is fundamental to the process whereby learners construct their understanding and skills. Since science is taught as a separate learning area from Grade 3, the learning standards leading to the acquisition of good health habits and development of curiosity about self and the environment using basic process skills in Grades 1 and 2 are articulated in other learning areas.

b. Horizontal Articulation

The learning of science is interconnected with other learning areas especially languages and mathematics. The foundational skills, especially literacy and numeracy, introduced in the other learning areas are paramount to the understanding and acquisition of concepts and skills in science. These basic skills, together with the other essential skills, such as communication, collaboration, and critical thinking, ensure not only the learning of science content but also address and establish connections and applications in other learning areas. Linking science with literacy and numeracy is vital to fill in the gaps where the learners' knowledge and skills may be inadequate.

The curriculum also makes use of the interconnection between science and the other learning areas such as Edukasyong Pantahanan at Pangkabuhayan/Technology Livelihood Education (EPP/TLE), Araling Panlipunan (AP), the language subjects, and Mathematics, among others. Analysis of factors affecting the Program for International Student Assessment (PISA) performance of Filipino learners has shown that the development of problem solving, critical thinking, and information literacy in subject areas such as Araling Panlipunan, English, and Filipino is related to the development of the same set of 21st century skills in Science.

D. Development of the 21st Century Skills

One of the daunting challenges of 21st century education is to respond to the needs and demands of this fast-paced dynamic world. Accelerated digitalization and artificial intelligence, shifting job market demands, information explosion, pressures of global competitiveness, and transforming scientific innovations and technological advancements redefine the knowledge, skill and competency sets that the next generation of learners must be equipped with to be adequately prepared.

The Department of Education (DepEd) recognizes and responds to these needs and demands through appropriate changes in the educational system. DepEd also continues to respond to the challenges through the refinement of the K to 12 curricula to produce holistically developed Filipino learners with essential 21st century knowledge and skills needed to participate in and provide significant contributions to the society and to nation-building.

21st Century Skills are the knowledge, skills, attitudes, and competencies that learners need to develop so that they can prepare for and succeed in work and life in the 21st century (DepEd Order No. 21, s. 2019). It also refers to the knowledge, skills and attitudes necessary to be

competitive in the 21st century workforce, participate appropriately in an increasingly diverse society, use new technologies and cope with rapidly changing workplaces (Binkley *et al.* 2012; Scoular and Care, 2018). These skills are transversal in nature and work in conjunction with foundational literacy and numeracy skills and discipline-specific competencies (e.g., scientific literacy).

Every K to 12 graduate is expected to be equipped with 21st Century Skills which include the following:

(a) Information, Media and Technology skills – the ability to gather, manage, evaluate, use, and synthesize information through media and technology. These skills allow learners to navigate a fluid and dynamic environment of knowledge creation and acquisition. Among the skills and competencies that the science curriculum emphasizes include *Visual, Information, Technology, and Digital literacies*.

(b) Learning and Innovation skills – the ability to think critically, analyze and solve problems, create and implement innovations, and generate functional knowledge. The science curriculum highlights *Creativity, Openness, Critical thinking, Problem-solving, and Reflective thinking*.

(c) Life and Career skills – prepares learners to make informed life and career decisions to enable them to become citizens that engage in a dynamic global community and to successfully adapt to meet the challenges and opportunities to lead in the global workforce. The science curriculum helps develop *Informed decision-making, Self-discipline, Future orientation, and Resilience and adversity management*.

(d) Communication skills – the ability to express oneself clearly and collaborate with others. The science curriculum puts premium on communication skills including all forms and context including but not limited to verbal and non-verbal, active listening, as well as the abilities to express feelings and provide feedback. The science curriculum focuses on the development of the sub-skills: *Teamwork, Collaboration, Intrapersonal skills, Interactive communication, and Communicating in a diverse environment*.

E. Social Issues and Government Priorities

The Science curriculum contributes to the achievement of government priorities to address current social issues by integrating developing learners' awareness in relation to those aspects of the content that are most applicable and provide authentic significance for learners. The common goal is achieved by bringing relevant issues and applications to curriculum learning contexts in science to support learners to develop their understanding, skills, and values and attitudes towards becoming responsible and productive citizens.

Science, as a discipline, puts premium on the investigation of natural phenomena and as such addresses and contributes to the goals of the many government priorities, which include the following:

- Reduction and management of risks and disaster;
- Fighting against climate change;
- Environmental protection and conservation;
- Sustainable development of resources and energy, including the Green economy, Renewable energy, Sustainable mining; and
- Comprehensive Sexuality Education (CSE).

F. STEM

Science, Technology, Engineering and Mathematics (STEM) is a government priority and is significant in the development of problem solvers, innovative thinkers, and entrepreneurs who can contribute to inclusive economic development. As depicted in the STEM Framework, this development is achieved through three learning areas in the K to 12 curriculum – Science, Mathematics, and Technology and Livelihood Education (TLE), which may collectively employ the Engineering Design Process (EDP) to attain curriculum goals. Though distinct and taught separately, these three learning areas are interrelated, and each contributes knowledge and skills for the solution to real-world problems. Figure 2 shows a diagrammatic representation of the STEM Framework.

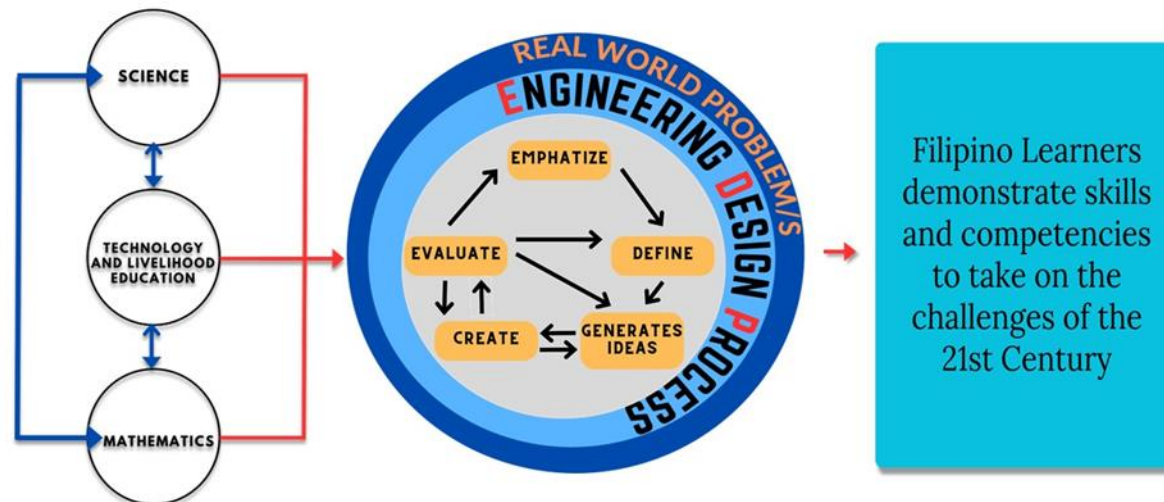


Figure 2. STEM Framework

Utilizing the EDP in the instruction allows learners to design solutions based on understanding the needs and contexts, build and test solutions, repeat steps as many times as needed to make improvements, learn from unsuccessful attempts, and discover different or novel design possibilities to arrive at optimal solutions. In the curriculum, EDP is exhibited through problem solving and investigative approaches where learners apply their mathematical, scientific, and technological understanding to formulate, conjecture, reason, create, and evaluate.

G. Pedagogies, Assessment, and Resources

The Science Curriculum Framework identifies the pedagogies that the curriculum embraces to improve learning in science for Filipino learners. These pedagogical approaches can be included appropriately by teachers in the delivery of science lessons to adapt to the learners' context and learning environment. These approaches are described below to guide teachers in using each pedagogical approach.

Inquiry-based learning approach puts a premium on questioning, investigating, proving, probing, explaining, predicting, and establishing connections of evidence (Calburn, 2020). Instead of a transmissive mode of teaching, this approach involves inquiry and sustained active engagement of learners. The approach is characterized in the classroom by questions and discussions. Inquiry allows learners to formulate questions and find solutions through learning real-life-based investigations and research projects. Concepts and specific scientific terms need to be explained in simple language. Applications and situations need to be explained in relevant contexts and are best explored through science activities. In this approach learners also engage in developing process skills, analyzing and evaluating evidence, experiencing and discussing, and talking to their peers about their own understanding (Suchman, 1964). Learners collaborate with others to make discoveries, solve problems, and plan investigations.

An ***applications-led approach*** suggests that it is useful to consider the application of the concept rather than of an approach based on the traditional logic of the discipline. Applications-led approach means that the science to be taught is determined by applications from life and NOT by the logic of the discipline of science. Although this curriculum does not suggest an applications-led approach for the entire curriculum, the inclusion in each quarter in each of the domains of learning of suggested Performance Tasks is intended to reflect the importance given to the expectation that the learners demonstrate how their learning can be applied to their everyday lives.

The Science Technology Society approach (STS) focuses on the societal role of science and technology in the contemporary and modern world. It provides a dynamic and interdisciplinary relationship of history, philosophy and sociology including cultural perspectives to answer and respond to current science concerns, issues and problems (Pritchard & Woollard, 2010). By using this approach, the learners expand their understanding of science across disciplines and holistically view problems by examining the consequences of science and technology.

Problem-based Learning approach (PBL) is the acquisition of knowledge and skills using critical thinking and creativity to solve real-life problems. In this approach, real-world problems motivate learners to seek out deeper understanding of concepts, design reasoned decisions and defend them, and collaborate among themselves (Duch et al., 2001). Through this approach, development of critical thinking, problem-solving abilities, and collaboration and communication skills, are essentially given a focus. An effective and versatile approach for PBL is design thinking or engineering design process, which can be used to generate solutions based on the needs of intended users.

A ***multidisciplinary (cross-disciplinary)*** design is built into the Science curriculum. A multidisciplinary approach is defined by UNESCO as “*curriculum integration which focuses primarily on the different disciplines and the diverse perspectives they bring to illustrate a topic, theme or issue. A multidisciplinary curriculum is one in which the same topic is studied from the viewpoint of more than one discipline.*” The Science curriculum lends itself to greater integration of disciplines as may be adopted in some schools. Similarly, UNESCO defines a ***transdisciplinary approach*** as “*an approach to curriculum integration which dissolves the boundaries between the conventional disciplines and organizes teaching and learning around the construction of meaning in the context of real-world problems or themes.*” An ***interdisciplinary approach*** is defined as “*An approach to curriculum integration that generates an understanding of themes and ideas that cut across disciplines and of the connections between different disciplines and their relationship to the real world. It normally emphasizes process and meaning rather than product and content by combining contents, theories, methodologies, and perspectives from two or more disciplines.*”

Assessment for the Science Curriculum

1. **Classroom Assessment** is an ongoing process of identifying, gathering, organizing, and interpreting quantitative and qualitative information about what learners know and can do (DepEd Order 31, s. 2020).

The alignment of assessment to curriculum and pedagogy ensures that assessments are fair, valid and reliable in judging, providing feedback, and adjusting for the cognitive progress of the learners. *Appropriate assessment shall be employed to holistically measure the learners' current and developing abilities while developing personal accountability in the process* (DepEd Order 8, s. 2015).

Assessment for the Science curriculum should be organized to:

- identify prior learning and to set goals for learning;
- support learners explicitly to take an active role in assessing and evaluating their learning; and
- judge the level of achievement of the learners against the content, performance and grade standards of the intended learning.

As instruction for the Science curriculum is expected to be inquiry-based, it is critical that before addressing the learning competencies for that quarter the teacher identifies what the learners already know and can do. This may or may not be through formal assessment tasks but should provide the information needed to properly plan learning activities for individual learners and the class overall. These types of assessment may be used any time during inquiry-based science instruction to check on understanding of scientific concepts, verify the development of scientific inquiry, and reiterate the Science process skills. Assessment to check on learners' learning also provides a process to provide feedback and adapt to the needs of the learner, thus allowing the teacher to adjust instruction to meet learners' ever-changing needs.

2. Performance Tasks and Standards

The Science curriculum requires learners to complete at least one substantial performance task for each quarter. These may be through independent or collaborative work. The curriculum provides Performance Standards along with sample tasks to guide teachers on the performance level expected. The levels of learner performance are judged using criteria suitable for the task.

The Performance standards, which are closely aligned with the Content Standards, provide a mechanism for teachers to make judgements on how well learners are applying science knowledge and understanding, skills and processes, and values and attitudes described in the curriculum content.

Performance Tasks and Standards assist the teachers and learners to answer the questions:

1. "What do learners do with what they know?"
2. "How well do learners demonstrate their learning?"
3. "How well do learners apply their learning in different situations, including in real-life contexts?"

4. “What tools and measures and values do learners use or draw on to demonstrate what they know?”

Resources and Technologies

The implementation of the Science curriculum can be delivered across available learning delivery resources. The teaching and learning process is not limited to face-to-face. The curriculum allows the adoption of a distance or blended learning approach. Teachers may need to change their usual practice of instruction – they would have to be familiar with the pedagogical and technological demands of these new learning approaches.

There are several innovative teaching methods and technological tools that should be introduced appropriately in basic science education. These emerging methodologies, strategies and tools should be appropriately chosen, and integrated into the science lessons to fit learners’ cognitive abilities and classroom contexts. Among these innovative teaching methods and tools which can be applied to science are design thinking and engineering design processes, robotics technology, mobile learning applications, learning analytics, games and gamification, and virtual and remote laboratories. Teaching methods and strategies should cater to the needs, skills and contexts of diverse learners. The Department of Education will continually assess and evaluate the applicability of these emerging approaches.

H. Curriculum Organization

The Science curriculum is organized into discipline-oriented domains.

The domains for Grades 3-6 are:

- *Materials*
- *Force, Motion, and Energy*
- *Living things; and*
- *Earth and space.*

The domains for Grades 7-10 are:

- *Science of Materials*
- *Force, Motion, and Energy*
- *Life Science; and*
- *Earth and Space Science.*

The learning competencies in the Science curriculum are written as statements of what learners know and can do. They signal learning activities that require active learner participation using an inquiry approach to deliver deep learning.

Teachers are encouraged to develop learning activities and opportunities that progressively build conceptual understanding, skills, values and attitudes within domain quarters by considering the learning competencies holistically, rather than as a list of things/content to cover.

Over a grade, teachers are encouraged to develop learning activities and opportunities that connect with and draw on content from other domain quarters.

The science curriculum provides cross-domain alignment of significant science knowledge, skills, processes and attitude-related contexts and competencies to allow learners to apply and reinforce learning in varying contexts throughout each year and key stage.

LEARNING AREA STANDARDS

Science Curriculum Overview

The Science curriculum provides learners with a repertoire of competencies important for lifelong learning and in the world of work in a skill-based society. It envisions the development of **scientifically, environmentally, and technology literate learners** who are productive members of society and who are *critical problem solvers, responsible stewards of nature, innovative and creative citizens, informed decision makers, and collaborative and effective communicators*.

A central feature of the Science curriculum is the balanced integration of three interrelated content strands:

- *Performing scientific inquiry skills,*
- *Understanding and applying scientific knowledge, and*
- *Developing and demonstrating scientific attitudes and values.*

It is designed and organized through the integration of the three interrelated content strands. The acquisition of these content strands is facilitated by drawing from the key pedagogical approaches: ***inquiry-based learning, applications-led approach, the science-technology-society approach, problem-based learning, and multi-disciplinary learning***. The approaches are based on sound and valued educational research and concepts including *Constructivism, the Social Cognition Learning Model, Brain-based Learning* and *Vygotsky's Zone of proximal development*.

The Science curriculum explicitly adapts in a developmental way *Big Ideas* (Harlen, et al., 2015) and Cross Cutting Concepts of Science (A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas, 2012), and integrates governmental thrusts of the Philippines identified as appropriate to the science learning area. The science curriculum recognizes the place of science and technology in everyday human affairs. It integrates science and technology in the social, economic, personal, and ethical aspects of life. The science curriculum promotes a strong link between science and technology, including indigenous technology, thus preserving our country's cultural heritage.

Science concepts and science processes are intertwined through the learning competencies in the Science G3 to G10 curriculum. A learner-centered and inquiry-based approach facilitates the acquisition of science concepts. Organizing the curriculum around situations and problems that challenge and stir up learners' curiosity motivates them to learn and appreciate science as relevant and useful. Rather than relying solely on textbooks, a variety of hands-on, minds-on, and hearts-on activities are advocated to develop learners' interest and lead them to becoming active learners to acquire deep knowledge for applying 21st Century Skills.

The Science curriculum emphasizes the use of evidence in constructing explanations and providing opportunities for collaboration, innovation, creative scientific exploration, and engineering design.

Concepts and skills in the learning domains are not taught in isolation, but rather in the context of important ideas in Science with increasing levels of complexity from one grade level to another in developmental progression, thus paving the way to a deeper understanding of core concepts. The integration across science topics and other disciplines will lead to a meaningful understanding of interrelated concepts and their applications in real-life situations.

Assessment is an integral part of teaching and learning. The curriculum is designed to progressively introduce science concepts and skills and build towards learning of more conceptually complex content. For that reason, it is crucial that the prior experiences, knowledge and understanding of learners are considered and assessed in formative ways. Doing so ensures that an accessible and engaging level of teaching and learning is offered to learners, hence maximizing the effectiveness of instruction (Vygotsky, 1978). Regular monitoring will ensure effectiveness of the implementation of the Science curriculum and its responsiveness to the needs of the learner and the demands of the highly globalized community.

I. Key Stage Standards

Key Stage 1 Standard

At the end of Grade 3, the learners acquire healthy habits and curiosity about self and their environment using basic process skills of observing, communicating, comparing, classifying, measuring, inferring, and predicting. This curiosity will help learners value science as an important tool in helping them continue to explore their natural and physical environment. This also includes developing scientific knowledge or concepts.

The specific objectives of Key Stage 1 are to ensure that the learners:

- a. understand the properties of objects around them;
- b. describe the basic needs of living things;
- c. demonstrate and practice basic science process skills to investigate scientifically; and
- d. exhibit curiosity and appreciation of the natural world.

Key Stage 2 Standard

At the end of Grade 6, the learners have the essential skills of scientific inquiry – designing simple investigations, using appropriate procedures and tools to gather evidence, observing patterns, determining relationships, drawing conclusions based on evidence, and communicating ideas in varied ways to make meaning of the observations and/or changes that occur in the environment. The content and skills learned will be applied to maintain good health, ensure the protection and improvement of the environment, and practice safety measures in daily activities.

The specific objectives of Key Stage 2 are to ensure that the learners:

- a. acquire knowledge and skills necessary to explain natural phenomena;
- b. understand and recall science concepts and connect them with new information;
- c. conduct investigations safely using appropriate equipment; and
- d. communicate scientific observations and ideas accurately.

Key Stage 3 Standard

At the end of Grade 10, the learners demonstrate scientific, environmental, and technological and engineering literacies that would lead to rational choices on issues confronting them. Having been exposed to scientific investigations related to real life, they recognize that the central feature of an investigation is that if one variable is changed, the effect of the change on another variable can be measured. The contexts of investigations can be problems at the local or national levels, and can encourage learners to communicate their findings to other people. The learners demonstrate understanding of science concepts and apply science inquiry skills in addressing real-world problems through scientific investigations.

The specific objectives of Key Stage 3 are to ensure that the learners:

- a. apply science concepts in designing scientific investigations and/or possible solutions to real-world problems;
- b. evaluate scientific evidence in drawing interpretations and conclusions;
- c. exhibit critical and analytical thinking in making decisions in scientific contexts; and
- d. demonstrate desirable attitudes and skills in conducting scientific investigations.

II. Grade Level Standards

Kindergarten – Grade 2

The grade level standards for Kindergarten, Grade 1, and Grade 2 form part of other curricula, including the English curriculum and the Mathematics curriculum. The content, including learning competencies for these grades, is not included in the Science curriculum; however, the content of other curricula has been used to develop the Science curriculum. The use of the Science curriculum should be built on and incorporate the content of other curricula especially in use with Grade 3 learners, where understanding of expected prior learning is essential.

Grade 3

At the end of Grade 3, learners demonstrate simple science process skills of observing, predicting, and measuring to explore common local materials, their physical properties, and how they have been used over hundreds of years. They locate and describe non-living things that produce useful materials. They observe, describe, and measure living and non-living things in their local environment. They describe the basic needs of living things and explain how their body parts allow them to carry out their daily activities. They recognize the need to protect the environment to ensure that the basic needs of living things can be met.

Learners use everyday language to explore, describe, and make suggestions about the simple movements of objects. They learn through guided activities to make safe and careful observations of natural objects in the sky and demonstrate scientific ways of recording observations to reveal patterns in nature. Learners identify and explore sources of light and sound in their local environment and suggest how to use them safely in their lives. They apply their curiosity in the world around them and their creativity to propose solutions to simple challenges. Learners demonstrate safe handling procedures in using equipment and materials.

Grade 4

At the end of Grade 4, learners describe chemical properties of materials and that changes to them are sometimes harmful. They identify that plants and animals have systems whose function is to keep them alive. They observe, describe, and create representations to show how living things interact with their habitat, survive, and reproduce. They use diagrams to show the feeding relationship among different organisms.

Learners use simple equipment to identify types of soil that hold water and support plant growth. Learners use simple equipment and processes to measure and record data about movement, and describe and predict how things around them move. They describe the concepts of speed and force. They recognize that science processes are used to gain deeper understanding about the properties of magnets, light, sound, and heat. Learners apply their developing observation skills and objectivity to identify where energy is evident in their local communities and how it is used by people. They use instruments and secondary sources to measure and describe the characteristics of weather and use the information to make predictions. Learners demonstrate appreciation for the dangers of extreme weather events and use safe practice to protect themselves. Learners use personal observations and reliable secondary information sources to describe the sun and explain its importance to life on Earth. They exhibit objectivity and open-mindedness in gathering information related to environmental issues and concerns in the community.

Grade 5

At the end of Grade 5, learners identify matter as having mass and taking up space and existing in three states based on the properties of shape and volume. They identify that heat is involved in changes of state. They plan and carry out a simple scientific investigation following appropriate steps and identifying appropriate equipment. Learners describe and create models of the body systems that represent how humans grow, develop, and reproduce. They use tables to group living things as plants, animals, or microorganisms. They use skills of observing, predicting, measuring, and recording to plan and carry out a simple activity to compare the life cycles of plants and animals. They plan and carry out valid and reliable scientific investigations to explore frictional forces by identifying and controlling variables. They observe and describe basic features of static electricity and electric current and explain and recognize applications of forces and electrical energy in the home and community.

Learners explain the role of the water cycle in changing landforms and earth materials. They explain the causes and impacts of extreme weather and identify appropriate and safe ways to respond to such events. They recognize the scale of space and describe the features of the solar system. They use models to communicate significant relationships and movements. They demonstrate curiosity and creativity in communicating information about earth processes to other people. Learners use objectivity and measurement to carry out scientific investigations

using fair tests and multiple trials to explore how forces influence the movement of familiar objects and predict how gravity affects objects on Earth.

Grade 6

At the end of Grade 6, learners describe the benefits of various separation techniques and demonstrate skills through the use of equipment. They use diagrams and flowcharts to describe changes of state. They use the words reversible and irreversible to describe changes to materials. They identify mixtures such as solutions and give examples such as mixture. They recognize and apply their understanding of the features of a fair test. Learners describe the different ways that plants reproduce and plan a simple scientific investigation to determine which method works best in a given habitat. They describe that vertebrates are animals with a backbone and that invertebrates do not have a backbone. They design and produce an example of a food web that identifies the role of consumers, producers, scavengers, and decomposers. They identify the technical terms biotic and abiotic as referring to living and non-living things.

Learners carry out investigations to observe patterns and systems scientifically. They support their observations and conclusions to explain occurrences and concepts using technical scientific language. They use critical thinking skills and creativity to make models and other devices to communicate their understanding to other people.

Learners describe that volcanoes can have unexpected and severe impacts on communities and that the uncertainty and impacts of unpredicted eruptions can be offset by understanding and following alerts from authorities. Learners explain that the weather patterns that produce seasons are largely predictable, and use models to explain natural processes and timing, such as the changes of season. Learners identify that scientific models are valuable in explaining other observations of patterns in nature, such as the apparent movement of celestial objects across the sky. They exhibit respect for cultures and interpretations of natural phenomena by indigenous people over generations and respect explanations of phenomena using scientific inquiry and objectivity.

Grade 7

At the end of Grade 7, learners use models to describe the Particle theory of matter. They use diagrams and illustrations to explain the motion and arrangement of particles during changes of state. They explain the role of solute and solvent in solutions and the factors that affect solubility. They demonstrate skills to plan and conduct a scientific investigation making accurate measurements and using standard units. Learners describe the parts and function of a compound microscope and use this to identify cell structure. They describe the cell as the basic unit of life and that some organisms are unicellular and some multicellular. They explain that there are two types of cell division, and that reproduction can occur through sexual or asexual processes. They use diagrams to make connections between organisms and their environment at various levels of organization. They explain the process of energy transfer through trophic levels in food chains.

Learners use systems to analyze and explain natural phenomena and explain the dynamics of faults and earthquakes. They identify and assess the earthquake risks for their local communities using authentic and reliable secondary data. They use national and local disaster

awareness and risk reduction management plans to identify and explain to others what to do in the event of an earthquake and/or tsunami. Learners explain the cause and effects of secondary impacts that some coastal communities may experience should a tsunami be produced by either a local or distant earthquake. Learners identify and explain how Solar energy influences the atmosphere and weather systems of the Earth and that these are the dominant processes that influence the climate of the country.

Learners employ scientific techniques, concepts, and models to investigate forces and motion, and describe their findings using scientific language, force diagrams, and distance-time graphs. They use their curiosity, knowledge and understanding, and skills to propose solutions to problems related to motion and energy. They use scientific investigations to describe the properties of heat energy. They apply their knowledge and problem-solving skills in everyday situations and explore how modern technologies may be used to overcome current global energy concerns.

Grade 8

At the end of Grade 8, learners apply knowledge and understanding of acceleration to everyday situations involving motion. They represent and interpret acceleration in distance-time, and velocity-time graphs to make predictions about the movement of objects. Learners link motion to kinetic energy and potential energy and explain transformations between them using everyday examples. Learners relate understanding of kinetic energy and potential energy to an appreciation of the hydroelectric resources of the country which generates electricity for use in homes, communities, and industries. They use scientific investigations to explore the properties of light and apply their learning to solving problems in everyday situations. Learners use models, flow charts, and diagrams to explain how body systems work together for the growth and survival of an organism. They represent patterns of inheritance and predict simple ratios of offspring. They explain that the classification of living things shows the diversity and the unity of living things. They describe the processes of respiration and photosynthesis, and plan and record a scientific investigation to verify the raw materials needed. They use flow charts and diagrams to explain the cycles in nature.

Learners describe the large-scale features of the 'blue planet' Earth and relate those features to the geological characteristics of the upper crustal layers of the Earth. They identify and describe the nature and impact of volcanic activity in building new crust and identify that these crust forming processes account for patterns and changes in the distribution of volcanoes, earthquakes, and mountain chains that have occurred over time. Learners identify the relationships between landforms and oceans to explain the formation and impacts of typhoons. Learners describe the structure of the atom and how our understandings have changed over time. They draw models of the atom and use tables to identify the properties of subatomic particles. They explain that elements and compounds are pure substances. They identify elements, their symbols, their valence electrons, their positions in groups and periods on the periodic table. They design and/or create timelines or documentaries as interesting learning tools.

Grade 9

At the end of Grade 9, learners describe that the transmission of traits is determined by DNA, genes, and chromosomes and explain that high levels of diversity help to maintain stability of an ecosystem. They identify critically endangered plants and animals of the Philippines and strategies to protect and conserve them. They describe features of typical Philippine ecosystems and conduct a survey to explore possibilities to

minimize the impact of human activities. Learners carry out a valid and reliable scientific investigation, showing the formation of a new substance. They demonstrate an understanding of the significance of valence and identify bonds as ionic, covalent, or metallic. They recognize the symbols of common elements and the formula for common compounds. They describe the properties of ionic, covalent, and metallic substances. They demonstrate critical and creative thinking in producing a learning tool about the role of bonds.

Learners exhibit skills in gathering information from secondary sources and identify the location and geological setting of the Philippines to explain its unique landforms and dynamic geologic activity in a global context. They recognize the size and scale of the Earth and describe evidence for a dynamic Earth. Learners demonstrate curiosity and open-mindedness to evaluate theories of the formation of the Solar System. They describe modern scientific processes and technologies used by scientists to investigate the nature and evolution of the Solar System. Learners demonstrate a practical understanding of Newton's three laws of motion and explain everyday application of Newton's laws. Learners explain the features of electricity and electrical circuitry in homes. Learners gather information from secondary sources to describe the nature and features of frequencies across the electromagnetic spectrum and identify practical applications and detrimental effects that electromagnetic radiation can have on living things.

Grade 10

At the end of Grade 10, learners describe and explain the geologically dynamic nature of the Philippine archipelago in relation to its plate tectonic setting, and use models to explain the earth structures, movements, and natural events that occur. They explain mechanisms that have contributed to the current distributions of continents and make predictions about changes that can be expected in the future. Learners describe rapid changes that are occurring in local and global climate patterns and propose solutions to address these changes. Learners describe qualitatively the factors that affect the trajectory of projectiles. They distinguish different types of collisions and describe the impacts on the motion of objects. They carry out investigations using models to identify relationships that affect the motion of objects and apply their understanding to real-life situations. Learners gather information from secondary sources to identify, describe, and explain how science impacts human activities and the environment.

Learners explain that there are different indicators for classifying substances as acids, bases, or salts. They describe the identifying factors for a chemical reaction as well as the important types of chemical reactions. They explain how some important chemical reactions impact the natural and built environments. They write balanced chemical equations using formula and apply the principles of conservation of mass. They explain factors that affect the rate of a reaction and that some reactions are exothermic, and others are endothermic. They demonstrate the knowledge and the skills needed to plan and conduct valid and reliable scientific investigations and record them appropriately. Learners describe homeostasis as a process that allows an organism to maintain stability. They describe and discuss that natural selection is the driving mechanism of evolutionary change. They explain the meaning of the term biotechnology and debate the societal, environmental, and ethical implications of utilizing biotechnological products and methods. They discuss the factors that limit the ecosystem's carrying capacity and the role of population growth.

For the operational purposes of curriculum implementation in schools, the four domains in the Science curriculum have been assigned in quarters as shown below, with Grades 3 to 6 in the elementary school and Grades 7 to 10 in the junior high school.

SEQUENCE OF DOMAIN PER QUARTER

	Elementary				Junior High School			
	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10
First Quarter	Materials	Materials	Materials	Materials	Science of Materials	Life Science	Force, Motion, and Energy	Earth and Space Science
Second Quarter	Living Things	Living Things	Living Things	Living Things	Life Science	Science of Materials	Earth and Space Science	Force, Motion, and Energy
Third Quarter	Force, Motion, and Energy	Force, Motion, and Energy	Force, Motion, and Energy	Force, Motion, and Energy	Force, Motion, and Energy	Earth and Space Science	Life Science	Science of Materials
Fourth Quarter	Earth and Space	Earth and Space	Earth and Space	Earth and Space	Earth and Space Science	Force, Motion, and Energy	Science of Materials	Life Science

SCIENCE CURRICULUM GUIDE

GRADE 4 FIRST QUARTER- Materials

Content	Content Standards <i>Learners learn that:</i>	Learning Competency <i>The learners...</i>
1. Science inventions 2. Materials and their uses 3. Gathering scientific information	1. Science inventions have brought about major changes to our daily lives. 2. Chemical properties of materials determine their uses. 3. Communication skills and open mindedness are needed in solving environmental issues.	1. use information from secondary sources to identify a famous Filipino and/or foreign scientist and their invention/s; 2. use information from the home or the local community to identify a science invention and explain its impact on their everyday life; 3. describe the chemical properties of materials, such as they can be burnt, react with other materials, or are degradable or biodegradable; 4. describe changes in properties of materials when exposed to certain changes in temperature, such as changes when wood or coal are burned; 5. demonstrate ways to minimize harmful changes in materials, such as restriction of burning of waste materials, and care in handling reactive materials; 6. identify issues and concerns in the local community and how they could be addressed by science, such as the treatment of waste; and 7. apply science process skills and attitudes in conducting a guided survey about environmental issues and concerns including grouping and classifying, communicating, and open mindedness.

Performance Standard

By the end of the Quarter, learners describe chemical properties of materials and changes to them. They demonstrate an understanding that science processes can solve everyday problems and use creativity and determination to provide examples. They exhibit objectivity and open-mindedness in gathering information related to environmental issues and concerns in the community.

Suggested Performance Task/s

- A. Create a simple model, illustration or write a story about a favorite science invention that you use in everyday life.
- B. Plan and produce a sample of useful fertilizer from household waste.

GRADE 4 SECOND QUARTER - Living Things

Content	Content Standards <i>Learners learn that:</i>	Learning Competency <i>The learners...</i>
<ol style="list-style-type: none"> 1. Systems in plants and animals 2. Plants and animals and their habitats 3. Life cycles of animals 4. Animals and the food they eat 5. Food chains 	<ol style="list-style-type: none"> 1. Animals and plants have systems that function to keep them alive. 2. Animals and plants live in habitats that meet their basic needs. 3. Animals have life cycles that include development and reproduction. 4. Animals can be grouped according to the food that they eat. 5. Food chains show a series of living things that depend on each other for food. 6. Using drawings, tables, and flowcharts is an important skill in learning science concepts and in learning about science processes. 	<ol style="list-style-type: none"> 1. describe in simple terms how the following human body systems work: muscular, skeletal, digestive, circulatory, and respiratory; 2. observe the root and shoot system in plants and describe why they are important; 3. use a drawing or diagram to classify some Philippine animals and plants, based on their habitat: some live on land (terrestrial), live in water (aquatic) or fly in the air (aerial); 4. make a list or draw up a table with examples of animals and plants in a particular habitat, such as a garden, rice field, seashore, and mangrove swamp; 5. use flow charts to compare the different stages in the life cycle of animals, such as a butterfly, frog, chicken, and human; 6. use information from secondary sources to group animals according to the food they eat. Some are: <ol style="list-style-type: none"> a. plant eaters (herbivores), b. meat eaters (carnivores), and c. plant and meat-eaters (omnivores); and 7. draw a simple food chain using living things from the Philippines and label them as herbivores, carnivores, and omnivores.

Performance Standard

By the end of the Quarter, learners identify that plants and animals have systems whose function is to keep them alive. They observe, describe, and create representations to show how living things interact with their habitat, survive, and reproduce in specific environments. They use flowcharts to show the feeding relationship among different organisms within a given environment.

Suggested Performance Task

Create a diorama, terrarium, or an aquarium to illustrate how some plants or animals live on land or in water.

GRADE 4 THIRD QUARTER - Force, Motion, and Energy

Content	Content Standards <i>The learners learn that:</i>	Learning Competencies <i>The learners...</i>
<ol style="list-style-type: none"> 1. Forces and movement 2. Observing, measuring, and predicting 3. Magnets 4. Sound, light, and heat energy 	<ol style="list-style-type: none"> 1. Science processes help in observing and predicting how things move. 2. Pushes and pulls can change the position and shape of objects. 3. Gathering scientific information helps explain the behavior of objects and materials. 4. Magnets affect some objects and materials without touching them. 5. Energy is present whenever there is movement, sound, light, or heat. 	<ol style="list-style-type: none"> 1. participate in guided activities to discover and predict how rigid and soft objects can be moved and/or changed in shape; 2. measure accurately the distance and time when things move using simple equipment; 3. identify that how far an object moves in a given time is called speed; 4. construct and label simple graphs of different speeds including stationary and uniform speeds, both fast and slow; 5. participate in guided activities to demonstrate that pushes and pulls can be used to change the speed and direction of an object including making it go faster, turn it to a different direction, slow it down, and stop it; 6. demonstrate through guided activities that pushes and pulls can be used to change the speed and direction of an object; 7. determine how forces can change the shape of objects such as when they are pushed, pulled, stretched, bent, twisted, or squeezed; 8. carry out guided investigations to identify the properties of magnets, including how they affect other magnets and objects made of different materials; 9. identify examples of how objects can affect other objects even when they are not in contact with each other, such as magnets attracting other objects, light from the sun affecting our eyes, and skin, and loud noises hurting our ears; 10. identify that energy is something that can cause change including light, sound, and heat energy; and 11. observe and identify sources and uses of light, sound, and heat energy at school, at home and in the local community.

Performance Standard

By the end of the Quarter, learners use simple equipment and processes to measure and record data related to movement and describe and predict the way things around them move using more scientifically technical language and concepts, such as speed and force. They

demonstrate an understanding that science processes are used to gain deeper understanding about forces and energy that cannot be seen directly, including the properties of magnet, light, sound, and heat. Learners apply their observation skills and objectivity to identify where energy is evident in their local communities and how it is used by people.

Suggested Performance Tasks

- A. Develop a poster to show some sources and uses of heat energy in your home or neighborhood.
- B. Collaborate in a small group to develop a safety guide that explains how to stay safe around intense light and sound. Include information on ways to protect eyes and ears and explain how the suggested ways could provide protection.

GRADE 4 FOURTH QUARTER - Earth and Space

Content	Content Standards	Learning Competencies
1. Soils 2. Characteristics of weather 3. Characteristics of the Sun	<i>The learners learn that:</i> 1. Soil and water resources are needed by plants and animals to live and grow. 2. Characteristics of the weather can be observed and measured. 3. The Sun is a ball of hot gases about 100 times the size of Earth, which radiates light energy needed by living things.	<i>The learners...</i> 1. participate in guided activities using simple equipment to compare different types of soil including sandy, clay, silt, and loam, including comparing the ability of the soils to hold water; 2. recognize that water is one of the basic needs of plants and animals; 3. participate in a guided investigation to identify the effect of different types of soil on the growth of plants; 4. identify some of the basic characteristics used to describe the weather, such as air temperature, air pressure, wind speed, wind direction, humidity, rain, and cloud cover; 5. use weather instruments to measure and record some of the characteristics of weather during a school day; 6. examine a local weather chart to make simple interpretations about the local weather and how it might change and describe and practice safety precautions to use during poor or extreme weather conditions; 7. describe some of the overall characteristics of the Sun, such as its composition, its size, and the main energy it radiates; 8. describe the changes in the direction and length of shadows from a shadow stick and use the information to infer why the Sun changes position during a day; and

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| | | 9. make suggestions about the importance of the Sun to living things for a group or class discussion and confirm and record ideas by referring to trustworthy secondary sources of information. |
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Performance Standard

By the end of the Quarter, learners use simple equipment to identify how types of soil hold water to support the growth of plants. They use instruments and secondary sources to measure and describe the characteristics of weather and use the information to make predictions about weather patterns in their local area. They demonstrate appreciation for the dangers of extreme weather events and use safe practice to protect themselves if they are caught in bad weather. Learners use personal observations and reliable secondary information sources to describe the Sun and explain its importance to life on Earth.

Suggested Performance Task

Construct a sundial that can indicate the time of the day.

Grade 7 FIRST QUARTER- Science of Materials

Content	Content Standards	Learning Competency
<ol style="list-style-type: none"> 1. Use of models 2. The Particle model and changes of state 3. Planning, following, and recording scientific investigations 4. Solutions, solubility, and concentration 	<p><i>Learners learn that:</i></p> <ol style="list-style-type: none"> 1. Scientists use models to explain phenomena. 2. The particle model explains the properties of solids, liquids, and gases and the processes involved in changes of state. 3. Diagrams and flowcharts are very useful in demonstrating and explaining the motion and arrangement of particles during changes of state. 4. There are specific processes for planning, conducting, and recording scientific investigations. 5. The properties of solutions such as solubility and reaction to litmus determine their use. 	<p><i>The learners...</i></p> <ol style="list-style-type: none"> 1. recognize that scientists use models to explain phenomena that cannot be easily seen or detected; 2. describe the Particle Model of Matter as “All matter is made up of tiny particles with each pure substance having its own kind of particles.”; 3. describe that particles are constantly in motion, have spaces between them, attract each other, and move faster as the temperature increases (or with the addition of heat); 4. use diagrams and illustrations to describe the arrangement, spacing, and relative motion of the particles in each of the three states (phases) of matter; 5. explain the changes of state in terms of particle arrangement and energy changes: <ol style="list-style-type: none"> a. solid → liquid → vapor, and b. vapor → liquid → solid; 6. follow appropriate steps of a scientific investigation which includes: <ol style="list-style-type: none"> a. Aim or problem, b. Materials and equipment, c. Method or procedures, d. Results including data, and e. Conclusion. 7. make accurate measurements using standard units for physical quantities and organize the collected data when carrying out a scientific investigation; 8. identify the role of the solute and solvent in a solution; 9. express quantitatively the amount of solute present in a given volume of solvent; 10. demonstrate how different factors affect the solubility of a solute in a given solvent, such as heat; 11. identify solutions, which can be found at home and in school and that react with litmus indicator, as acids, bases, and salts; and 12. demonstrate proper use and handling of science equipment.

Performance Standard

By the end of the Quarter, learners recognize that scientists use models to describe the particle model of matter. They use diagrams and illustrations to explain the motion and arrangement of particles during changes of state. They demonstrate an understanding of the role of solute and solvent in solutions and the factors that affect solubility. They demonstrate skills to plan and conduct a scientific investigation making accurate measurements and using standard units.

Suggested Performance Task

Design and carry out an investigation to determine the amount of salt in a sample of seawater.

GRADE 7 SECOND QUARTER - Life Science		
Content	Content Standards	Learning Competency
	<i>Learners learn that:</i>	<i>The learners...</i>
1. Science equipment: the compound microscope 2. Plant and animal cells 3. Cellular reproduction 4. Levels of biological organization 5. Trophic levels and the transfer of energy	1. Familiarity and proper use of a compound microscope are essential to observe cells. 2. The organelles of plant and animal cells can be identified using a compound microscope. 3. Cells are the basic unit of life and mitosis, and meiosis are the basic forms of cell division. 4. Fertilization occurs when a male reproductive cell fuses with a female reproductive cell.	1. identify the parts and functions, and demonstrate proper handling and storing of a compound microscope; 2. use proper techniques in observing and identifying the parts of a cell with a microscope such as the cell membrane, nucleus, cytoplasm, mitochondria, chloroplasts, and ribosomes; 3. recognize that some organisms consist of a single cell (unicellular) like in bacteria and some consist of many cells (multicellular) like in a human; 4. differentiate plant and animal cells based on their organelles; 5. recognize that cells reproduce through two types of cell division, mitosis and meiosis, and describe mitosis as cell division for growth and repair; 6. explain that genetic information is passed on to offspring from both parents by the process of meiosis and fertilization; 7. differentiate sexual from asexual reproduction in terms of: a) number of parents involved, and b) similarities of offspring to parents; 8. use a labelled diagram to describe the connections between the levels of biological organization to one another from cells to the biosphere;

	<p>5. Sexual reproduction is the basis of heredity.</p> <p>6. The level of biological organization provides a simple way of connecting the simplest part of the living world to the most complex.</p> <p>7. Identifying trophic levels helps understand the transfer of energy from one organism to another as shown in a food pyramid.</p>	<p>9. describe the trophic levels of an organism as levels of energy in a food pyramid; and</p> <p>10. use examples of food pyramids to describe the transfer of energy between organisms from one trophic level to another.</p>
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Performance Standard

By the end of the Quarter, learners demonstrate understanding of the parts and function of a compound microscope and use this to identify cell structure. They recognize that the cell is the basic unit of life and that some organisms are unicellular and some are multicellular. They explain that there are two types of cell division, and that reproduction can occur through sexual or asexual processes. They use diagrams to make connections between organisms and their environment at various levels of organization. They explain the process of energy transfer through trophic levels in food chains.

Suggested Performance Task

Create a visual representation, such as poster, model, or e-poster, explaining the trophic level in a chosen ecosystem.

GRADE 7 THIRD QUARTER - Force, Motion, and Energy

Content	Content Standards	Learning Competencies
	<i>The learners learn that:</i>	<i>The learners...</i>

<ol style="list-style-type: none"> 1. Balanced and unbalanced forces 2. Motion: displacement and velocity 3. Distance-Time graphs 4. Identifying and controlling variables 5. Heat transfer 	<ol style="list-style-type: none"> 1. Scientists and engineers analyze forces to predict their effects on movement. 2. Vectors differentiate the concepts of speed and velocity. 3. Graphing motion provides more accurate predictions about speed and velocity. 4. The particle model explains natural systems and processes. 5. Scientists and engineers conduct innovative research to find solutions to the current global energy crisis by seeking renewable energy solutions. 	<ol style="list-style-type: none"> 1. identify that forces act between objects and can be measured. 2. identify and describe everyday situations that demonstrate: <ol style="list-style-type: none"> a. balanced forces such as a box resting on an inclined plane, a man standing still, or an object moving with constant velocity; b. unbalanced forces, such as freely falling fruit or an accelerating car; 3. draw a free-body diagram to represent the relative magnitude and direction of the forces involving balanced and unbalanced forces; 4. identify that when forces are not balanced, they can cause changes in the object's speed or direction of motion; 5. explain the difference between distance and displacement in everyday situations in relation to a reference point; 6. distinguish between speed and velocity using the concept of vectors; 7. describe uniform velocity and represent it using distance-time graphs; 8. explain the difference between heat and temperature; 9. identify advantageous and disadvantageous examples of conduction, convection, and radiation; 10. explain in terms of the particle model the processes underlying convection and conduction of heat energy; and 11. gather information from secondary sources to identify and describe examples of innovative devices that can be used to transform heat energy into electrical energy.
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Performance Standard

By the end of the Quarter, learners employ scientific techniques, concepts, and models to investigate forces and motion and represent their understanding using scientific language, force diagrams, and distance-time graphs. They use their curiosity, knowledge and understanding, and skills to propose solutions to problems related to motion and energy. They explore how modern technologies might be used to overcome current global energy concerns.

Suggested Performance Task

Develop a 2-4 page brochure for parents or leaders in your community to inform them about modern technologies that can be used sustainably to transform heat into electricity in the local community.

GRADE 7 FOURTH QUARTER - Earth and Space Science

Content	Content Standards <i>The learners learn that:</i>	Learning Competencies <i>The learners...</i>
<ol style="list-style-type: none"> 1. System models 2. Earthquakes 3. The Sun’s influence on Earth 	<ol style="list-style-type: none"> 1. Rapid movements along normal, reverse or strike-slip faults cause earthquakes. 2. The damage or effects on communities depend on the magnitude of and distance from an earthquake. 3. Sunlight is the Earth’s external source of energy. 4. Solar energy influences the atmosphere and weather patterns. 5. The revolution, rotation, and the tilt of the Earth explain the patterns of day and night and the seasons. 	<ol style="list-style-type: none"> 1. classify geological faults according to the angle of the fault plane and direction of slip; 2. use models or illustrations to explain how movements along faults generate earthquakes and identify and explain which types of faults are most likely to occur in the Philippines and explain why; 3. describe how the effects of earthquakes on communities depend on their magnitude; 4. use the PHIVOLCS FaultFinder or other reliable information source to identify where the nearest fault system is located from their community and assess the risk of earthquakes to their local community; 5. make models of fault scenarios to illustrate: <ol style="list-style-type: none"> a. the epicenter of an earthquake from its focus, b. the intensity of an earthquake from its magnitude, and c. how underwater earthquakes may or may not generate tsunamis; 6. refer to the local disaster readiness plans to demonstrate what to do during and after an earthquake; 7. explain how earthquakes result in tsunamis that devastate shoreline communities; 8. describe procedures that the authorities have in place to alert communities of pending tsunamis and what procedures can be implemented should a tsunami impact a community; 9. explain how energy from the Sun interacts with the atmosphere; 10. make a physical model or use drawings to demonstrate how the tilt of the Earth relative to its orbit around the Sun affects the intensity of sunlight absorbed by different areas of Earth over a year; 11. explain, using models, how the tilt of the Earth affects the changes in the length of daytime at different times of the year; and

		12. explain how solar energy contributes to the occurrence of land and sea breezes, monsoons, and the Intertropical Convergence Zone (ITCZ).
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Performance Standard

By the end of the Quarter, learners appreciate the value of using systems to analyze and explain natural phenomena and demonstrate their understanding in explaining the dynamics of faults and earthquakes. They are confident in identifying and assessing the earthquake risk for their local communities using authentic and reliable secondary data. They use the country's disaster awareness and risk reduction management plans to identify and explain to others what to do in the event of an earthquake. Learners explain the cause and effects of secondary impacts that some coastal communities may experience should a tsunami be produced by either local or distant earthquake activity. Learners use reliable scientific information to identify and explain how solar energy influences the atmosphere and weather systems of the Earth and use such information to appreciate and explain the dominant processes that influence the climate of the Philippines.

Suggested Performance Tasks

- A. Design, test, and evaluate a model house that can withstand a model earthquake.
- B. Design, test, and evaluate a model of an innovative house that can adapt to the different weather conditions in the country.

GLOSSARY

The curriculum organizers described below are used together to form the curriculum description in the Grades 3 to 10 Science Curriculum Guide. The definitions within this section are drawn from DepEd Order No. 8, s. 2015 and DepEd Order No. 21, s. 2019.

- 1) **Standard** – In its broadest sense, it is something against which other things can be compared to for the purpose of determining accuracy, estimating quantity or judging quality. It is a stated expectation of what one should know and be able to do.
- 2) **Key Stage** – This refers to stages in the K to 12 Program reflecting distinct developmental milestones. These are Key Stage 1 (Kindergarten – Grade 3), Key Stage 2 (Grades 4 – 6), Key Stage 3 (Grades 7 – 10), and Key Stage 4 (Grades 11 and 12).
- 3) **Key Stage Standard** – This shows the level or quality of proficiency that the learner is able to demonstrate in each key stage after learning a particular area in relation to the core learning area standard.
- 4) **Grade Level Standard** – This shows the level or quality of proficiency that the learner is able to demonstrate in each Grade after learning a particular area in relation to the core learning area standard.

- 5) **Content Domain** – This is a particular strand or domain of the curriculum in which the scope and sequence of a set of related topics and skills are covered.
- 6) **Content Standard** – The content standards identify and set the essential knowledge and understanding intended to be learned. They cover a specified scope of sequential topics within each learning strand, domain, theme, or component. Content standards answer the question, “What should the learners know?”
- 7) **Learning Competency** – This refers to a specific skill performed with varying degrees of independence. It has different levels of difficulty and performance levels. It also refers to the ability to perform activities according to the standards expected by drawing from one’s knowledge, skills, and attitudes.
- 8) **Performance Standard** – The performance standards describe the abilities and skills that learners are expected to demonstrate in relation to the content standards and the integration of 21st century skills. The integration of knowledge, understanding, and skills is expressed through creation, innovation, and adding value to products/performance during independent work or in collaboration with others.

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