10

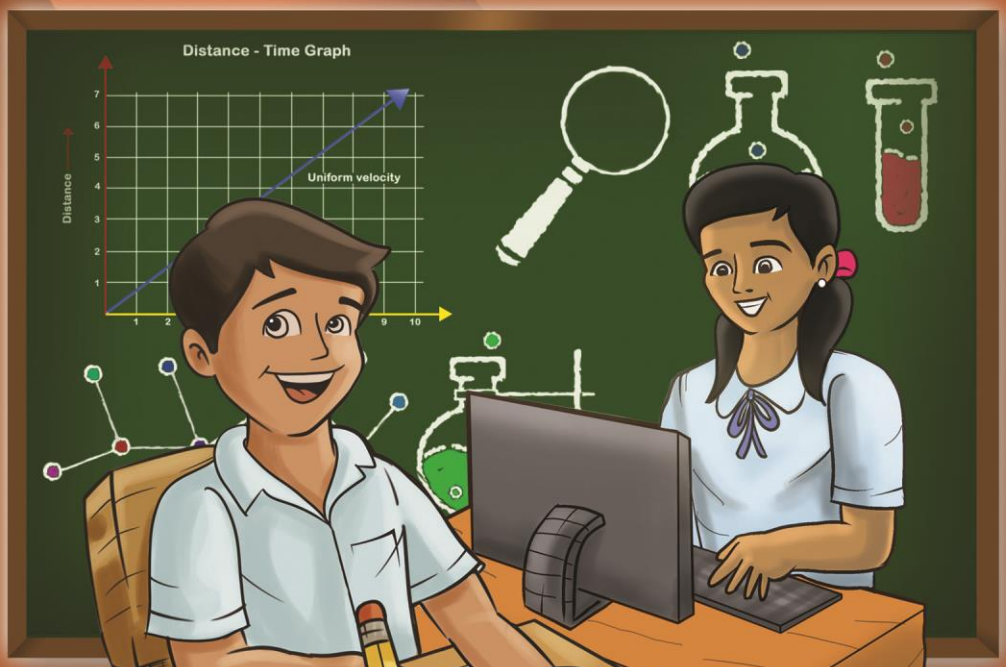
NATIONAL LEARNING CAMP

DepED DEPARTMENT OF EDUCATION

Science

Enhancement Learning Camp

Notes to Teachers



Enhancement Learning Camp

Notes to Teachers

Science Grade 10

Week 1 to Week 3

Lessons 1 – 18

Contents

Dear Reader

Every care has been taken to ensure the accuracy of the information provided in this Booklet. Nevertheless, if you identify a mistake, error or issue, or wish to provide a comment we would appreciate you informing the **Office of the Director of the Bureau of Learning Delivery** via telephone numbers (02) 8637-4346 and 8637-4347 or by email at bld.od@deped.gov.ph

Thank you for your support.

Notes to Teachers

Part A: Introduction to Science in the 2024 Learning Camp

The Science section of the 2024 Learning Camp for learners who have recently completed Grade 9, consists of 15 main lessons each focused on a single Key Idea (KI), and 3 consolidation. All 18 lessons are designed for a duration of 45 minutes.

The set of 18 lessons consists of single lessons addressing **Key Ideas** developed for the Grade 9 curriculum content. The Key Ideas are largely based on selected Most Essential Learning Competencies (MELCs) for the four Quarters of the Grade 9 Science. The lessons often include reference to MELCs from Grades 7-9 as well as prior learning needs to be firmly established for learners to cope with Grade 9 content.

The consolidation lessons, Lessons 6, 12 and 18 are delivered at the end of Weeks 1, 2 and 3 of the 2024 Learning Camp. These lessons are designed to reinforce learning from the main lessons of the week.

> Science as a subject provides excellent situations and scenarios for learners to explore the natural and technological world. This enables them to demonstrate their developing 21st-century skills, including interpreting and analyzing information and data, thinking critically to solve real-world problems, and communicating deep understanding
>
> The Science lesson plan sequences are designed to progressively build on what learners know and can do across science content (Grades 7-9) that they have previously encountered. The lessons all begin with a range of questions that help the teachers identify the **levels of prior learning** that each learner in the class can demonstrate. The Science lessons reinforce developmental frameworks for learners so that they can grow deeper understanding through recognizing the ways science language builds concepts, and through applying their understanding to familiar and authentic situations.
>
> Teachers must guide their learners to read and comprehend the scientific texts and information presented, and then support their learners with the conventions of science communication including through the use of *images, diagrams, flow charts, data tables, graphs, symbols* and *equations.*

Main lesson questions are designed to engage learners gradually in the higher-order thinking required to successfully answer the sort of questions they may encounter in lessons, or in national or international testing. The questions include:

- ***Literal questions*** require learners to find the answer from specific words in the text.
- ***Inferential questions*** require learners to derive an answer from implied meanings in the text, or to draw conclusions about the information in the text, based either on several parts of the text or on a reading of the whole text.
- ***Applied questions*** require learners to create responses by linking information provided or by drawing on their personal knowledge and experience.
- ***Evaluative questions*** require learners to draw conclusions from the information provided or discusses impacts on people and or the environment.

In other words, the questions can support learners to utilize a variety of strategies to provide better answers across a range of levels:

- Identifying answers that are provided directly in the stimulus.
- Identifying answers that are provided indirectly in the stimulus.
- Using information provided to prompt for answers.
- Using simple recall from their knowledge.
- Relating two or more pieces of information provided in the stimulus.
- Calculating answers given the information provided in the stimulus.
- Using their knowledge and understanding of issues presented in the stimulus.

Lessons are designed to give learners time to explore science ideas deeply and from several perspectives. Often, activities and questions deliberately ask similar questions but from different perspectives. There will be times when activities and questions are straightforward using a more traditional approach, but at other times, activities and questions will give answers and require learners to work backward, or to interpolate or extrapolate to make predictions.

An important note about *Sample answers*
Sample answers provide a range of possible responses that might be expected from learners. These are generally provided to show possible learner answers across a wide range or level of responses including the following:

- single words, phrases or statements (SIMPLE level responses),
- lists or several correct ideas identified, but not related (MEDIUM level responses),
- more complete and fuller answers showing correct relational understanding (High-level responses).

There are often multiple sample responses for the questions provided in the lesson plans. These are intended to support teachers to recognize **the level of response** intended by the question. I**t is not expected that teachers will use all the sample responses in giving learners feedback.** In fact, there would be great value in teachers recording some of the authentic answers that learners provide to use in teacher self-reflection and to discuss with colleague-teachers during the times that have been allocated for reflection and preparation during the learning camp (usually on the Mondays and Fridays over the 3 weeks).

HIGHER ORDER THINKING IN SCIENCE

The science lessons are designed to promote deeper and higher-order thinking through the use of the following approaches:

- **Explicit questions to determine prior learning.** The goal is to provide the opportunity for teachers to watch and listen to learners as they provide answers in written form and or through drawings and visual representations.

- **Explicit and systematic use of appropriate language for the grade level of learners.** This includes explicit and systematic support for learners to use technical scientific language to make meaning of more complex and abstract concepts. It is important to support learners in

developing their everyday understandings and everyday language (non-technical) to become more scientific (technical). This in turn helps learners to develop their thinking and understanding so they can deal with more symbolic and abstract ideas.

- **Use of real-world stimulus.** Information boxes include *Titles* to preview the context of the information provided and they will always include written text. The written text is often supported with related *images, diagrams, flow chart, tables of data, graphs*. These model the use of visual representations in authentic everyday science communications around the world.

- **Use of visual representations.** Visual representations help learners understand concepts easily due to the fact they stimulate images and affect their cognitive capabilities. Research shows that people can process visuals much faster than text. It has been reported that the human brain processes visuals around 60,000 times faster than text by quickly deciphering illustrative elements simultaneously. [Ref: using-images effectively (williams.edu)].

  Note that it is important to explicitly support learners to develop understanding of the conventions of science including helping them with things like how arrows are used to connect ideas. e.g. an arrow between two terms can indicate different relationships:

Here, 

ıe arrow indicates that a cause **produces** an effect.

- **Incorporation of *Science crosscutting concepts*.** Crosscutting concepts have value because they provide learners with connections and intellectual tools that are related across the differing areas of science disciplinary content and can enrich their application of practices and their understanding of core ideas.

1. **Patterns**. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

2. **Cause and effect**: Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.

3. **Scale, proportion, and quantity**. In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.

4. **Systems and system models**. Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.

5. **Energy and matter**: **Flows, cycles, and conservation**. Tracking changes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.

6. **Structure and function**. The way in which an object or living thing is shaped, and its substructure, determine many of its properties and functions.

7. **Stability and change**. For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. [Ref: *Cross Cutting Concepts*; Next Generation Science Standards, 2013].

TEACHERS REFLECTIONS On LEARNERS' RESPONSES TO LESSONS

After each lesson, **it is strongly recommended** to gather valuable diagnostic data on student learning, teachers are highly encouraged to collect learner worksheets after each lesson and review what students have recorded. **The worksheets can then be handed back to learners at the next lesson or the beginning of a new week.** The teacher then has the opportunity to read some of the learners' responses to the questions asked during the lesson on their worksheets. .

Part B: Commentary on Lesson Components in All Lessons

Overview

The NLC lessons emphasize consolidating and, where possible, extending student knowledge in previously covered topics. Lesson sets are designed to strengthen students' current foundational knowledge ready for future learning. The review lessons have been designed to be interactive among teachers, students, and peers.

At the same time, the expectation is that teachers will enhance their pedagogical practices and subject knowledge as well as refine further their teaching methods. The thinking behind the Camp lessons is grounded in the 'Science of Learning' framework, creating a dynamic, learning environment employing the findings of cognitive research and evidence-informed approaches.

Lesson Component 1 (Lesson Short Review)

Component 1 offers teachers the chance to:

- settle the class quickly;
- review or preview previously encountered information;
- address previous content in the form of a few targeted questions that are *relevant to the current lesson;*
- note what students already know;
- elicit answers from the class to reinforce the important content needed for the lesson; and
- address issues that may arise.

Overall, Component 1 acts as a partial advance organizer designed to remind students of previous work that has relevance to activities to be undertaken in the current lesson. When done carefully, this replay of previous information directed at what is to come in the lesson, helps students prepare for future memory recall, and decision-making.

Reminding students of *relevant* information at the beginning of a lesson, before encountering the main lesson learning focus, can enhance the brain's ability to:

- access information to be used in problems/questions/information to come;
- prepare, and have some oversight, for the direction of future learning; and
- further consolidate ideas in long-term memory.

The teacher should note any issues that may arise in student answers. This may be addressed later in the lesson or later lessons, if relevant.

Lesson Component 2 (Lesson Intention)

Component 2 offers teachers the opportunity to explain to the class the intention or purpose of the lesson. The explanation should link with student's prior knowledge or experience. This may mean connecting the purpose to the responses and levels of understandings in Component 1. The words and phrases used by the teacher should be familiar to, and understandable by, students. Information could include ideas personal to students that could facilitate student engagement in the lesson such as:

- the provision of a relevant context;
- asking a question that sounds interesting to that age group; and/or
- addressing an aspect that has a special interest to the class.

In addition, this component is an appropriate time to address what students might expect/aim to achieve, i.e., the lesson goal(s). Teachers should clarify the learning intention and what success looks like. (Note**:** Evaluation of the degree of success or partial success of student learning intention should occur as part of Component 5.)

Lesson Component 2 is about activating, in the student's brain, ideas already relevant to the students. The purpose is to help students contextualize their new learning experiences and to help them make sense of any new information.

Design considerations in statements of the lesson intention are about promoting student engagement and enthusiasm. This is best done by stating things in ways that make sense to as many students as possible in the class. In terms of timing, this component is relatively brief. Its presence, as one of five components, lies in *its importance* to the student's brain and learning. Finally, it is important *not to* overwhelm student with excessive and unnecessary detail that could disengage them at this early point in the lesson.

Lesson Component 3 (Lesson Language Practice)

Component 3 focuses on language skills like speaking, listening, and comprehension. It highlights key words or phrases relevant to this lesson. These words might be challenging to pronounce, understand, or use, or they might simply be important terms for students to remember. Typically, Component 3 targets around 6 words/phrases to allow students enough practice time during the lesson.

Deliberate practice concerns repeating aspects of learning that the teacher has deliberately identified/selected because it is where students are making an error that needs to be corrected, or because of its important role in learning. In the case of unfamiliar or unknown textual or symbolic language, deliberate practice can help students reduce cognitive load (reduce working memory) by making some aspects more familiar, enabling students to re-allocate resources to solving a problem, comprehending a passage, answering a question, explaining a concept, or describing some event or story, etc.

Overall, Component 3 can help achieve language familiarity by saying the word/phrase to spelling it correctly, or using it in a specific context. This may also help students to understand or unpack a visual text, diagram or graph, use in a graph for example, the teacher may need to point out such things as the graph heading, the axes, units, data points, or trend lines.

Lesson Component 4 (Lesson Activity)

Component 4 is focused on addressing the key idea for the lesson. It challenges students to apply prior knowledge to solve non-routine problems or interpret new texts. Students must accurately interpret the problem stem, which provides the essential information, and then answer a series of related questions with varying difficulty levels. By drawing on their background knowledge and the information in the stem, students can tackle these questions.

From a learning perspective, the lessons are intended to help students consolidate their understanding at different levels of difficulty, e.g the first questions provide a foundation at a basic level, while the second questions cater to the majority of students and require a step-by-step approach. Finally, the last question challenges all students, encouraging them to see connections and apply concepts to enhance their learning.

(Note: The level of difficulty of the questions should not stop any student from being given the opportunity allowed to experience questions at higher levels, including the more challenging questions, and to hear about, and be involved in, discussions about the answers.

Most students should be able to make some progress and be acknowledged for that. The exposure to these types of questions serves as springboard to their learning journey. Furthermore, these questions provide teachers a realistic understanding of what the students can achieve.

Component 4 has three aspects, 4A, 4B, and 4C. Students are first presented in 4A with the stem. This can be a stimulus or passage/text or diagram or … and are given the time/opportunity to understand the stem.

Then, in 4B and 4C, two separate sets of questions related to the same stem are presented. This process involves a set of three questions based on the same stem, which is then repeated, resulting in one set of questions in each of 4B and another set of questions in 4C.

Note: The early components, Components 1, 2 and 3, can be seen as bringing together the pre-requisite information that will place the student in the best possible position to be successful in Component 4. Component 4 begins with 4A.

4A Reading and Understanding the Stem

4A involves understanding the language of the stem. The purposes here are for the teacher:

- to model fluent reading of the stem (first);
- to identify any unfamiliar language the student possibly addressed in Component 3;
- to read the passage or describe the figure; etc
- to hear and experience fluency in reading the stem.

Other activities here could include students:

- reading to each other;
- reading silently to themselves; and
- exploring the meaning of the vocabulary.

4B Solving the First Set of Questions

4B involves students answering questions associated with the stem. The students will recognize that they have a stem (previously met in **4A**) and that this is followed by a small set of questions. Students find their own way to a response for each question in the set. The students write down responses or attempts at each question. It is important that every student in the class is expected to have a response. To achieve this desired result, it is important for teachers to ensure all students start on time at the same time.

When the students are finished, or sufficient time has been allocated, students provide answers to the questions and the teacher marks the questions. Discussion takes place about:

- the quality of the answers;
- the implications of errors; and
- what this information tells the class about the content.

The time allocated for 4B provides teachers with an opportunity to observe the quality and levels of student response, which they can use as basis of what the student knows.

Note: Students must start the questions promptly. This involves student self-regulation concerning focus and attitude to work, and may need to be consistently encouraged or reinforced by the teacher.

Teachers can seek out different responses or approaches or thinking exhibited. Errors made by students should be *acknowledged and valued* for their contribution to the class discussion and student learning. Those who achieve correct answers on different questions should also be acknowledged. **Note:** The questions are usually arranged in increasing level of difficulty from basic to more challenging.

4C Solving the Second Set of Questions

4C uses the same Stem as **4B** and repeats the same process as **4B** but offers students a second (different) batch of questions, again in order of increasing difficulty. When all questions are completed, as was the case in **4B**, students provide answers to all questions, i.e., the students write down responses to, or attempts at, each question. When they are finished, the questions are marked (either using teacher or student answers) and discussion takes place about the quality of correct answers the implications of errors and what this tells the class about the content.

Note: 4C offers a new start for students regardless of how they performed in **4B**. It allows all students to see **4C** as a new starting point and the class focus for all students should now be around the content and answers in **4C**.

For teachers, this approach serves two purposes. *First,* it is a practical way to ensure all students have experiences and can contribute perspectives with all questions asked. *Second,* the teacher will have the opportunity to practice further problem-solving questions where different sets of questions can be used with a familiar Stem. This approach is efficient as students obtain more problem-solving practice on the same underlying content.

Reducing cognitive load (working memory demands) is important in writing a stem. Stems in the lessons are designed to facilitate students' reading and interpretation. This is achieved by restricting materials to several sentences and a few paragraphs in length, and with no more than one diagram for each item. The teacher could have students read the stems together or individually to assist the development of their fluency with the language used.

In Component 4 students are expected to provide answers using:

- factual knowledge
- application of skills and procedures (fluency)
- understanding
- communicating skills
- reasoning and justification.

Clear feedback to students is very important. Teachers should assist students at a level that they can understand in addressing issues, misconceptions or errors that have arisen.

Lesson Component 5 (Lesson Conclusion)

Component 5 offers a student-focused summary of the lesson intention. **Students** reflect on their progress, achievement, or partial achievement of goals (lesson intention) and their performance and understandings. It takes up comments from Component 2 about teacher expectations. Here teachers can confirm student progress. Honesty is needed, as positive as circumstances permit, including the long-term impact of student effort and persistence.

Component 5 has a high metacognitive aspect for students – thinking about their thinking – which can be further enhanced by teacher modelling.

Part C: Curriculum References and Codes, and Teacher's Notes for Lessons

Grade 10 Lesson 1: Volcanoes, Earthquakes and Mountain Chains – Evidence for Plate Tectonics

Key Idea: The Philippine archipelago provides strong evidence for the Plate Tectonic Theory through the distribution of its active volcanoes, earthquake epicenters and major mountain belts.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*

Domain: *Earth and Space* **Grade – Quarter**: *Grade 10 – First Quarter;*

Content Standard: Learners *demonstrate an understanding of … the relationship among the locations of* volcanoes, earthquake epicenters, and mountain ranges

Most Essential Learning Competency (MELCs)

Week 1-3 Describe *and relate the distribution of active volcanoes, earthquake epicenters, and mountain belts to Plate Tectonic Theory*. (**No Code**)

Week 4 *Describe the different types of plate boundaries* (**S10ES –Ia-j-36.2**)

Week 5-6 *Explain the different processes that occur along the plate boundaries* (**S10ES –Ia-j-36.3**)

Week 8 *Enumerate the lines of evidence that support plate movement* (**S10ES –Ia-j-36.6**)

Prior learning:

Week 2: *Explain what happens when volcanoes erupt* (**S9ES-IIIb-28**)

LESSON STRUCTURE AND PURPOSE

Component 1 – Short Review

The purpose of the questions in the short review is to determine the level of prior knowledge and understanding about the lines of major mountain ranges that occupy the Philippines. The questions are focused on checking what knowledge and understanding learners have, including the terms used to describe geographic and geologic features. The teacher may be able to tell which are the meanings of terms that learners know for everyday use or for scientific descriptions.

Component 2 – Lesson Purpose and Intention.

This allows the teacher to make explicit, not only the science concepts, but also the skills that the learners will be working on during this lesson. The skills involved in this lesson include reading and interpreting maps and looking for patterns on the maps.

Component 3 – Lesson Language Practice

For this lesson, the specific words are highlighted because they can have both ***everyday meanings*** and ***scientific meanings***.

In the development of Earth Science, scientists over the years have used everyday objects to describe massive physical features of the Earth. Some examples include ***plates***, ***belts*** and ***chains.***

The teacher might have a short class discussion about the use of common terms for massive structures.

Component 4 – Lesson Activity

The main lesson stimulus includes a *map* of the Philippines with a ***legend*** that helps interpret what is being shown on the map. The map shows the main volcanoes and chain mountains of the Philippines that can be used to support the Theory of Plate Tectonics. It will help if learners can identify where their school is located on the map – they could mark it in on the map with a red X.

Where learners are having difficulty in recognizing the salient features, the teacher might encourage learners to draw or color the lines of volcanoes or chain mountains to help them see the patterns of distribution of the mountains and volcanoes – it is very important that the learners can recognize the **north-south alignment** of the islands in association with the volcanoes and mountains.

The questions in Component 4B are more focused on the locations of the volcanoes and mountain chains with the goal for learners seeing the alignment.

The questions in Component 4C are more focused on the general significance of the alignment with the overall goal for learners to begin to explore why the strong north-south alignment exists. This connects to the next lesson where the theory of plate tectonics explains how the features of the Philippines are formed by plates pushing in an east-west direction.

Component 5 – Lesson Reflection
This activity is designed to support learners to take an active role in thinking about their learning. It is important to let learners know that good learners reflect on their learning. The questions are designed to let the teacher know whether the lesson helped them to recall and understand evidence to support the Theory of Plate Tectonics, and their levels of interest in the topic.

After the lesson: After completion of each lesson, it is recommended that the teacher collects the learner worksheets to review what learners have recorded. Having the learners write down their answers gives valuable diagnostic evidence/data that the teacher can examine after the lesson. The worksheets can then be handed back to learners at the next lesson. The teacher then has the opportunity to read some of the learners' responses to the questions asked during the lesson on their worksheets.

Grade 10 Lesson 2: Plate Boundaries – Where the Action Is!

Key Idea: The Philippines archipelago provides strong evidence for the Plate Tectonic Theory because of the strong relationship between its distribution of volcanoes, earthquake epicenters and major mountain belts and the nearby and highly active plate boundaries.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Earth and Space* **Grade – Quarter**: *Grade 10 – First Quarter;*
Content Standard: Learners *demonstrate an understanding of the relationship among the locations of* volcanoes, earthquake epicenters, and mountain ranges
Most Essential Learning Competency (MELCs)
Week 1-3 Describe *and relate the distribution of active volcanoes, earthquake epicenters, and mountain belts to Plate Tectonic Theory*. (**S10ES –Ia-j-36.1**)
Week 4 *Describe the different types of plate boundaries* (**S10ES –Ia-j-36.2**)
Week 5-6 *Explain the different processes that occur along the plate boundaries* (**S10ES –Ia-j-36.3**)
Week 7 Describe the possible causes of plate movement (**S10ES –Ia-j-36.5**)
Week 8 *Enumerate the lines of evidence that support plate movement* (**S10ES –Ia-j-36.6**)
Prior learning:
Week 2: *Explain what happens when volcanoes erupt* (**S9ES-IIIb-28**)
Week 1: *Describe the different types of volcanoes and volcanic eruption* [Curric LCs: S9ES-IIIa-25]

LESSON STRUCTURE AND PURPOSE

Component 1 – Short Review

The purpose of the questions in the short review is to determine the level of prior knowledge and understanding that is needed for them to engage with the main stimulus of the lesson. The questions are focused on *orientating learners to features of maps and cross sections, as well as identifying what levels of prior learning in relation to the plate tectonic activity of the Philippines.*

Component 2 – Lesson Purpose and Intention.

The lesson is about the nature of the highly active plate boundaries that are located near the Philippines. The map and cross-section views are designed to help learners to better explain the distribution of volcanoes, earthquake epicenters and major mountain belts of the Philippines.

Component 3 – Lesson Language Practice

In this lesson scientific terms, such as *Continental crust; Oceanic Crust; Lithosphere; Asthenosphere; and Mantle, are* highlighted, with suggestions about how to help learners appreciate how the terms were originally created by scientists.

Component 4 – Lesson Activity

The main lesson stimulus includes a combination of text and *diagrammatic information* about what forces are shaping the Philippines. The learners need to recognize that the cross-section helps to visualize what is happening in three dimensions. The stimulus presents technical terms that should be used by learners to answer questions.

It is not expected that learners will always recall the terms, but the teacher should give learners confidence that they can find the correct terms from the stimulus to use in answering the questions. All information needed for Component 4B is provided directly in the stimulus.

Questions in Component 4C are requiring learners to apply their developing knowledge and understanding to provide good answers. These questions are supporting the learners through deliberate practice. The questions provide the teacher with opportunities to see if learners can give correct simple or complex answers. **It is not expected that all learners will be able to give answers at the level displayed in the sample answers** – the information is often provided to support teachers in considering which parts of a good answer the learners can provide.

Component 5 – Lesson Reflection

This activity is designed to support learners to take an active role in thinking about their learning. It is important to let learners know that good learners reflect on their learning. The questions are designed to let the teacher know whether the lesson helped them to recall and understand how plate tectonics impacts on the Philippines and which of the questions 4B or 4C were more difficult and why.

After the lesson: After each lesson, it is recommended that the teacher collects the learner worksheets to review what learners have recorded. Having the learners write down their answers gives valuable diagnostic evidence/data that the teacher can examine after the lesson. The worksheets can then be handed back to learners at the next lesson. The teacher then has the opportunity to read some of the learners' responses to the questions asked during the lesson on their worksheets.

Grade 10 Lesson 3: Evidence for the Movement of Tectonic Plates

Key Idea: *Evidence for continents moving includes a jig-saw puzzle matching of coastlines, rock types, and fossils that can be seen when the continents are reassembled to form a previous supercontinent such as Gondwanaland.*

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Earth and Space* **Grade – Quarter**: *Grade 10 – First Quarter;*
Content Standard: Learners *demonstrate an understanding of the relationship among the locations of* volcanoes, earthquake epicenters, and mountain ranges
Most Essential Learning Competency (MELCs)
Week 7 Describe the possible causes of plate movement (**S10ES –Ia-j-36.5**)
Week 8 *Enumerate the lines of evidence that support plate movement* (**S10ES –Ia-j-36.6**)

LESSON STRUCTURE AND PURPOSE

Component 1 – Short Review

The purpose of the questions in the short review is to determine the level of prior knowledge and understanding of lines of evidence that support plate movement. The questions are focused on engaging learners in the thought processes that have underpinned the current prevailing *Theory of Plate Tectonics* building from the earlier *Theory of Continental Drift*.

Component 2 – Lesson Purpose and Intention.

This allows the teacher to make explicit, not only the science concepts, but also the skills that the learners will be working on during this lesson. The lesson is focused on how current continents may have been in a supercontinent that split up and drifted apart. The skills that learners bring and use to understand the key idea of the lesson relate to their abilities to read and interpret forms of the global map. If these are lacking, use other maps, or maybe an *Earth Globe* may be helpful.

Component 3 – Lesson Language Practice

This activity is designed to highlight the importance for learners to be able to read, comprehend and interpret science texts**,** both for their learning and for answering questions.

The specific words presented here are relevant to the text and the processes involved. Unpacking their meaning and origins can be helpful to learners' understanding.

Component 4 – Lesson Activity

The main lesson stimulus includes *two maps* that show the same fossils and rock types on both.

[The second map shows some other important structures that the teacher might like to point out, although it is not necessary for this lesson to do so: 1. The mid-ocean ridges which are the structures on the ocean floor that exist following the breakup and separation of the continents and from where new oceanic crust is formed; 2. Their labelling of 'Modern Southeast Asian island chains', a part of which The Philippines occupies – this might help leaners to connect with and relate to the maps]

There may be a need to support learners to recognize that the present-day continents appear to have been part of one supercontinent in the past. The present-day continents should be easily recognized by most learners. If needed, the teacher could indicate that it is likely from recent research that also both Arabia, and Madagascar were part of Gondwanaland, but this is not needed for the exercises in this lesson.

The questions in Component 4B are designed to reinforce ideas and suggestions from learners. Questions 1 and 2 in Component 4B should be very easy for learners to extract from the text.

The questions in Component 4B are designed to focus on the fossil evidence and require much higher interpretation of the text information including understanding and interpreting fossil ages and how that relates to the patterns of distribution of fossils. If learners can complete the table successfully, they have demonstrated very good understanding of what the text is communicating to readers.

Learners who can give a reasonable answer to Question 2 are demonstrating relational thinking and solid understanding in Grade 10 level. There are many different aspects that learners might identify in this question.

Component 5 – Lesson Reflection
This activity is designed to support learners to take an active role in thinking about their learning. It is important to let learners know that good learners reflect on their learning. The questions are designed to let the teacher know whether the lesson helped them to recall and understand *Plate Tectonics* and which of the questions 4B or 4C were more difficult and why.

After the lesson: After each lesson, it is recommended that the teacher collects the learner worksheets to review what learners have recorded. Having the learners write down their answers gives valuable diagnostic evidence/data that the teacher can examine after the lesson. The worksheets can then be handed back to learners at the next lesson. The teacher then has the opportunity to read some of the learners' responses to the questions asked during the lesson on their worksheets.

Grade 10 Lesson 4: Classification of Living Things

Key Idea: *There is a hierarchical classification system that places all living things into groups.*

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Living Things;* **Grade – Quarter**: *Grade 8 – Fourth Quarter; for Grade 10 – Third Quarter*
Content Standard: Learners *demonstrate an understanding of how evolution through natural selection can result in biodiversity*
Most Essential Learning Competency (MELCs)

1. *Grade 8 – Fourth, Quarter* Week 4: *Classify organisms using the hierarchical taxonomic system* (**S8LT-IV-20**) *Leading to:*
2. *Grade 10 – Third Quarter, Week 6: Explain the occurrence of evolution.* (**S10LT-lllf-40**)

LESSON STRUCTURE AND PURPOSE

Component 1 – Short Review
The purpose of the questions in the short review is to determine the level of prior knowledge and understanding about *the current classification system first established by Linnaeus*. The questions are focused on *why scientists classify.*

Component 2 – Lesson Purpose and Intention.
This allows the teacher to make explicit, not only the science concepts, but also the skills that the learners will be working on during this lesson. The skills involved in this lesson *include reading and interpreting a complex table,* both essential requirements for learning science. The concepts

involved in this lesson include *that all living things have been identified as belonging to distinct groups and that humans fit into a distinct group in this system.*

Component 3 – Lesson Language Practice
This activity is designed to highlight the importance for learners to be able to read, comprehend and interpret science texts**,** both for their learning and for answering questions.

In this lesson, specific words such as *kingdom, domain, phylum*, are highlighted as relevant to the text used in component 4 and so learners are given the opportunity to show what they think these words mean in everyday settings and what they mean specifically in science. It is very important to recognize that some everyday words in the English language have different meanings when used in science.

Component 4 – Lesson Activity
Please be sure to point out to learners that the stimulus information box includes *a complex table that classifies three very different living things as well as two short paragraphs of text.*

The challenge for many learners in this main lesson activity will be to identify relevant information and to connect the *living things identified* to *the names of the classification group.* The activity is designed to assist learners in developing a more **relational** understanding of *the classification system first established by Linnaeus*. They should begin to see the relationships between *human beings and other living things.* It may be useful to discuss the concepts of *three domains.*

Component 5 – Lesson Conclusion
The intention here is to get some feedback from the learners on the lesson and their interests for future lessons. It may be valuable to compare their comments here with their answers to questions in Component 1.

Grade 10 Lesson 5: *Evolution*

Key Idea: *Several theories provide evidence about how living organisms have evolved.*

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Living Things;* **Grade – Quarter**: *Grade 10 – Third Quarter*
Content Standard: Learners *demonstrate understanding of how evolution through natural selection can result in biodiversity*
Most Essential Learning Competency (MELCs) Week 6: *Explain the occurrence of evolution* (**S10LT-llg-40**)

LESSON STRUCTURE AND PURPOSE

Component 1 – Short Review
The purpose of the questions in the short review is to determine the level of prior knowledge and understanding about *the theory of evolution.* The questions are focused on *the background to the theory of evolution.*

Component 2 – Lesson Purpose and Intention.
This allows the teacher to make explicit, not only the science concepts, but also the skills that the learners will be working on during this lesson. The skills involved in this lesson *include reading and*

interpreting technical text, both essential requirements for learning science. The concepts involved in this lesson include *that the characteristics of living things change and evolve over time.*

Component 3 – Lesson Language Practice
This activity is designed to highlight the importance for learners to be able to read, comprehend and interpret science texts**,** both for their learning and for answering questions.

In this lesson, specific words such as *variation,* are highlighted as relevant to the text used in component 4 and so learners are given the opportunity to show what they think these words mean in everyday settings and what they mean specifically in science. It is very important to recognize that some everyday words in the English language have different meanings when used in science.

Component 4 – Lesson Activity
Please be sure to point out to learners that the stimulus information box includes *four short paragraphs of text.*

The challenge for many learners in this main lesson activity will be to identify relevant information and to connect the *variation identified* to *the needs of the habitat.* The activity is designed to assist learners to develop a more **relational** understanding that *nature selects the variation in a species that are most useful for survival in their habitat.* They should begin to see the relationships between *living things of today and their common ancestors.* It may be useful to discuss the concepts of *the age of the Earth.*

Component 5 – Lesson Conclusion
The intention here is to get some quick feedback from the learners on the lesson and their interests for future lessons. It may be valuable to compare their comments here with their answers to questions in Component 1.

Grade 10 Lesson 6 (CONSOLIDATION): *Where is the Evidence?*

Key Idea/s being reinforced: Lines of evidence such as fossils, genetics, and comparative anatomy support the occurrence of evolution.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Living Things;* **Grade – Quarter**: *Grade 10 – Third Quarter*
Content Standard: Learners *demonstrate understanding of … how evolution through natural selection can result in biodiversity*

Most Essential Learning Competency (MELCs) Week 5**:** *Explain how fossil records, comparative anatomy and genetic information provide evidence for evolution* (**S10LT-llg-39**)

This is a CONSOLIDATION lesson.

The lesson is about providing a quite different everyday context for learners to apply scientific ideas that they have consolidated this week about *how living things are classified and how they are related to one another and how they have evolved over time.*

Component 1 – Short Review

The short review is aimed at helping learners to see the connection between the study of specific aspects of science (such as *the age of the Earth*) and the application of science that scientists work on in our modern society.

Component 2 – Lesson Purpose
The lesson is about finding evidence to support the theory of the evolution of living things over time.

Component 3 – Lesson Language Practice
The teacher might make a judgment on how long to practice using the terms provided.

Most terms are not new to the lesson as they have been used in previous lessons, however, some learners might need help to distinguish *fossils* from *rocks.*

Component 4 – Lesson Activity
The concepts being addressed in this lesson are drawn from research that indicates that the most common misconceptions about *variation and natural selection /the theory of evolution* include the **misconceived idea** that *characteristics that have changed during an individual organisms lifetime can be inherited by their offspring*. The main lesson activity gives the chance for teachers to find *out what learners know and understand about fossil records, similarity of structural features across different classes of living things and their familiarity with processes of matching DNA.*

Component 4B has relatively simple and straightforward questions. *Learners could use knowledge from the lessons of the week and from the information in the stimulus.* Component 4C has more complex questions but *learners could use knowledge from the lessons of the week and from the information in the stimulus.*

Component 5 – Lesson Conclusion
The intention here is to get some quick feedback from the learners on the lesson and their interests for future lessons. It may be valuable to compare their comments here with their answers to questions in Component 1

Grade 10 Lesson 7: Types of Waves to Transfer Energy

Key Idea: Compression (or longitudinal) waves and transvers waves both carry energy. In longitudinal waves, the vibrations occur parallel to the direction of wave travel; however, in transverse waves, the vibrations occur perpendicular to the direction of wave travel.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Force, Motion and Energy;* **Grade – Quarter**: *Grade 10 – Second Quarter*
Content standard: *The learners demonstrate understanding of…* the different zones of the electromagnetic spectrum
Most Essential Learning Competency (MELC/s):
Week 1-2 *Compare the relative wavelengths of different forms of electromagnetic waves*. (**S10FE-IIa-b-47**)
Prior learning focus for this lesson:
Grade 7 Content standard: *waves as a carriers of energy* MELC Grade 7; Week 4 *Infer that waves carry energy* (**S7LT-IIIc-4**) and *Describe the characteristics of sound using the concepts of*

wavelength, velocity, and amplitude **S7LT-IIIc-7**), and Week 5 *Explain color and intensity of light in terms of its wave characteristics* (**Old S7LT-IIIf-10**)
Grade 8 Content standard: *the propagation of sound through solid, liquid, and gas* **MELC** Grade 8 Week 4 *Investigates the effect of temperature to the speed of sound (***No Code***)*
Grade 8 Content standard: *some properties and characteristics of visible light* MELC Grade 8 Week 4 *Explain the hierarchy of colors in relation to the energy of visible light* (**S8FE-If-27**)

LESSON STRUCTURE AND PURPOSE

Component 1 – Short Review

The purpose of the questions in the short review is to determine the level of prior knowledge and understanding that learners have about types of waves. It can be expected that learners will initially recall some examples of compression waves.

Component 2 – Lesson Purpose

This allows the teacher to make explicit:

- the science concepts involved in the stimulus
- how learners will be extracting information from the Stimulus Box.

Asking learners to use the diagrammatic depictions of the models presented to ***visualize*** is effective because it helps learners to understand concepts that are not directly observable. Be sure to remind learners that many science models help people to understand the connections between everyday observable processes (such as the behaviors of a slinky spring to make waves) and the *particle model* that explains how energy travels at the micro-level.

Component 3 – Lesson Language Practice

This component is designed to help learners understand the technical terms which will be encountered in the lesson, and also to understand the *language and terms used to describe* the properties and characteristics of waves.

Component 4 – Lesson Activity

The main lesson stimulus includes slinky spring models of longitudinal and transverse waves. Help learners to understand that using models help them to understand science phenomena that cannot always be directly observed. They are conceptual models – they help with abstract or conceptual thinking. The slinky spring models are useful because they provide quick ways to notice the similarities and differences between longitudinal and transverse waves.

It is important to give learners plenty of time and support to visualize the models. Having a slinky spring, if available, would be excellent to use to demonstrate the two types of waves. Help learners if they are finding this difficult so they can answer some or all of the questions.

Component 5 – Lesson Conclusion

The intention here is to get some quick feedback from the learners on the lesson and their interests for future lessons.

This component is designed to support learners to take an active role in thinking about their learning. It is important to let learners know that good learners reflect on their learning. The questions are designed to let the teacher know whether the learners found using the technical terms difficult and whether they found the questions in component 4 interesting.

Grade 10 Lesson 8: How Does Light Energy Travel Through Space?

Key Idea: Light is a form of electromagnetic radiation which travels using transverse waves. Light and other electromagnetic waves do not need a physical medium for the transfer of energy.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Force, Motion and Energy;* **Grade – Quarter**: *Grade 10 – Second Quarter*
Content standard: *The learners demonstrate understanding of…* the different zones of the electromagnetic spectrum
Most Essential Learning Competency (MELC/s):
Week 1-2 *Compare the relative wavelengths of different forms of electromagnetic waves*. (**S10FE-IIa-b-47**)
Prior learning focus for this lesson:
Grade 7 Content standard: *waves as a carriers of energy* MELC Grade 7; Week 4 *Infer that waves carry energy* (**S7LT-IIIc-4**) and Week 5 *Explain color and intensity of light in terms of its wave characteristics* (**Old S7LT-IIIf-10**)
Grade 8 Content standard: *some properties and characteristics of visible light* MELC Grade 8 Week 4 *Explain the hierarchy of colors in relation to the energy of visible light* (**S8FE-If-27**)
NOTE: Concepts beyond Grade 10 in the curriculum:
Light as a wave and a particle (**S11/12PS-IVf-59**)

LESSON STRUCTURE AND PURPOSE

Component 1 – Short Review
The purpose of the questions in the short review is to determine the level of prior knowledge and understanding that learners have about light as a form of energy that travels in waves. It can be expected that learners will initially recall simple ideas.

Component 2 – Lesson Purpose
This allows the teacher to make explicit:

- the science concepts involved in the stimulus – the stimulus in this lesson is highly conceptual, with everyday examples to help learners connect to the deep conceptual physics involved.
- that learners should extract information from the Stimulus Box using the written text and the diagram.

This lesson is designed to be highly diagnostic, so the teacher can identify the levels that learners demonstrate and then pitch to those levels in the lesson. It is strongly recommended that the lesson be adjusted to a level that learners can understand – this may include using more concrete examples such as water waves to help learners engage with and connect their ideas about light energy.

Component 3 – Lesson Language Practice
This component is designed to help learners understand the technical terms which will be encountered in the lesson and also to understand how to extract information from a multi-modal stimulus text.

Component 4 – Lesson Activity
The main lesson stimulus includes text and a diagram to describe how light as a form of energy travels in transverse waves. The diagram is a providing a three-dimensional view of a transverse wave. The teacher may need to help learners understand the 'right angles' (90^o angles) involved – this is well achieved using hands to model the directions as the teacher talks.

The lesson uses familiar aspects of light such as color to assist learners to build their conceptual understanding.

Questions in Component 4B focus on information about the features of transverse waves that can be easily located in the stimulus. Questions in Component 4C focus more on the colors of light and the differences they have due to their frequencies and wavelengths.

Component 5 – Lesson Conclusion

The intention here is to get some quick feedback from the learners on the lesson and their interests for future lessons.

This component is designed to support learners to take an active role in thinking about their learning. It is important to let learners know that good learners reflect on their learning. The questions are designed to let the teacher know whether the learners found the lesson difficult.

Grade 10 Lesson 9: What Parts of White Light Have the Most Energy?

Key Idea: Violet light has the shortest wavelength of the colors that make up the visible light spectrum and so it has the highest energy of the colored light.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Force, Motion and Energy;* **Grade – Quarter**: *Grade 10 – Second Quarter*
Content standard: *The learners demonstrate understanding of…* the different zones of the electromagnetic spectrum
Most Essential Learning Competency (MELC/s):
Week 1-2 *Compare the relative wavelengths of different forms of electromagnetic waves*. (**S10FE-IIa-b-47**)
Prior learning focus for this lesson:
Grade 7 Content standard: *waves as a carriers of energy* MELC Grade 7; Week 4 *Infer that waves carry energy* (**S7LT-IIIc-4**) and Week 5 *Explain color and intensity of light in terms of its wave characteristics* (**Old S7LT-IIIf-10**)
Grade 8 Content standard: *some properties and characteristics of visible light* MELC Grade 8 Week 4 *Explain the hierarchy of colors in relation to the energy of visible light* (**S8FE-If-27**)
NOTE: Concepts beyond Grade 10 in the curriculum:
Light as a wave and a particle (**S11/12PS-IVf-59**)

LESSON STRUCTURE AND PURPOSE

Component 1 – Short Review

The purpose of the questions in the short review is to determine the level of prior knowledge and understanding that learners have about light energy. It can be expected that learners will initially recall some features of light energy.

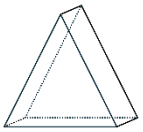
Component 2 – Lesson Purpose

This allows the teacher to make explicit the science concepts involved in the stimulus. The lesson relates the frequency and wavelength of the parts of white light to their relative amounts of energy.

Component 3 – Lesson Language Practice
It will be helpful to learners if the teacher previews the diagram in the Stimulus Box to be sure that learners can connect the colors with the information about their wavelengths (in nanometers or nm), frequencies (in hertz or hz) and energy (in electron-volts or eV).

Component 4 – Lesson Activity
The main lesson stimulus is about how white light can be broken into its component colors with violet light bending more than red light because it has the shortest wavelength and the highest energy of the colors.

There may be a need to help learners to recognize or recall a triangular prism shape. And to remind them that these can be made of clear glass or plastic. At just the right angle, a beam of white light will split into the colors of the rainbow.



Questions in Component 4B focus on what can be interpreted from the stimulus. Questions in Component 4C focus more on information that can be easily identified in the stimulus in order to understand the more difficult aspects such as the relationship between frequencies and wavelengths.

Component 5 – Lesson Conclusion
The intention here is to get some feedback from the learners on the lesson and their interests for future lessons.

This component is designed to support learners to take an active role in thinking about their learning. It is important to let learners know that good learners reflect on their learning. The questions are designed to let the teacher know how difficult learners found the different aspects of the lesson.

Grade 10 Lesson 10:The Electromagnetic Spectrum

Key Idea: The *electromagnetic spectrum* (*EMS*) comprises a continuous range of electromagnetic waves categorized by properties according to their ranges of wavelengths and frequencies.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Force, Motion and Energy;* **Grade – Quarter**: *Grade 10 – Second Quarter*
Content standard: *The learners demonstrate understanding of…* the different zones of the electromagnetic spectrum
Most Essential Learning Competency (MELC/s):
Week 1-2 *Compare the relative wavelengths of different forms of electromagnetic waves*. (**S10FE-IIa-b-47**)
Prior learning focus for this lesson:
Grade 7 Content standard: *waves as a carriers of energy* MELC Grade 7; Week 4 *Infer that waves carry energy* (**S7LT-IIIc-4**) and Week 5 *Explain color and intensity of light in terms of its wave characteristics* (**Old S7LT-IIIf-10**)
Grade 8 Content standard: *some properties and characteristics of visible light* MELC Grade 8 Week 4 *Explain the hierarchy of colors in relation to the energy of visible light* (**S8FE-If-27**)
NOTE: Concepts beyond Grade 10 in the curriculum:
Light as a wave and a particle (**S11/12PS-IVf-59**)

LESSON STRUCTURE AND PURPOSE

Component 1 – Short Review

The purpose of the questions in the short review is to determine the level of prior knowledge and understanding that learners have about electromagnetic waves. These were discussed in prior lessons.

Component 2 – Lesson Purpose

This allows the teacher to make explicit:

- the science concepts involved in the stimulus
- how learners will be extracting information from the Stimulus Box.

Point out to learners that the main lesson stimulus includes *a diagram* that depicts *numerical data* around a *symbolic representation* of the wave-shapes for the different regions of the electromagnetic spectrum.

Component 3 – Lesson Language Practice

This component is designed to help learners understand the technical terms and layout of scientific texts. Understanding similar words is important – e.g. *spectrum* being a full range; *spectra* being a part of a range.

Remind learners that scientists need quick ways to use the big and small numbers involved in describing distances and time when relating to the Solar System and the Universe or to the inside of atoms and smaller particles. Some learners might need help to see what the numbers mean – can they say which are **big** numbers and which are **small** numbers? Help learners understand why scientists use s*cientific notation* for very big and very small numbers.

Component 4 – Lesson Activity

This lesson is focused on helping learners to become very familiar with the electromagnetic spectrum. The questions are designed to see if learners can correctly and consistently extract data.

The table in 4C question 2 is designed to be diagnostic – to identify where learners might be having difficulty in seeing the patterns and trends in the electromagnetic spectrum.

Component 5 – Lesson Conclusion

This component is designed to support learners to take an active role in thinking about their learning. It is important to let learners know that good learners reflect on their learning.

Use this to get some feedback from the learners on the lesson, their enjoyment about the lesson and their interests for future lessons.

Grade 10 Lesson 11:The Sizes of Electromagnetic Waves

Key Idea: The sizes of electromagnetic waves, as determined by their wavelengths, affect their uses and applications in various ways.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Force, Motion and Energy;* **Grade – Quarter**: *Grade 10 – Second Quarter*
Content standard: *The learners demonstrate understanding of…* the different zones of the electromagnetic spectrum
Most Essential Learning Competency (MELC/s):

Week 1-2 *Compare the relative wavelengths of different forms of electromagnetic waves*. (**S10FE-IIa-b-47**)
Week 3-4 *Cite examples of practical applications of the different regions of EM waves, such as the use of radio waves in telecommunications* (**S10FE-IIc-d-48**)
Week 5 *Explain the effects of EM radiation on living things and the environment* (**S10FE-IIe-f-49**)

Prior learning focus for this lesson:

Grade 7 Content standard: *waves as a carriers of energy* MELC Grade 7; Week 4 *Infer that waves carry energy* (**S7LT-IIIc-4**) and *Describe the characteristics of sound using the concepts of wavelength, velocity, and amplitude* **S7LT-IIIc-7**), and Week 5 *Explain color and intensity of light in terms of its wave characteristics* (**Old S7LT-IIIf-10**)
Grade 8 Content standard: *the propagation of sound through solid, liquid, and gas* **MELC** Grade 8 Week 4 *Investigates the effect of temperature to the speed of sound (***No Code***)*
Grade 8 Content standard: *some properties and characteristics of visible light* MELC Grade 8 Week 4 *Explain the hierarchy of colors in relation to the energy of visible light* (**S8FE-If-27**)

LESSON STRUCTURE AND PURPOSE

Component 1 – Short Review

The purpose of the questions in the short review is to determine the level of prior knowledge and understanding that learners have about uses and applications of light energy as a form of electromagnetic radiation.

Component 2 – Lesson Purpose

The lesson is focused on the sizes of electromagnetic waves, in relation to their uses and penetration characteristics. The lesson may help learners to be better at using s*cientific notation* for very big and very small numbers. The stimulus provides supportive information by giving both s*cientific notation* and *decimal notation.*

Component 3 – Lesson Language Practice

This component is designed to help learners understand the technical terms which will be encountered in the lesson. It is suggested that for some learners, talking out the words will help – e.g. There may be value in pointing out that many ***verbs*** are converted to ***nouns*** in Science because they are recognized by the scientific community as general processes that apply across different areas of science. It's important that learners recognize what a 'range' is when referring to numbers as there are quite a few times when a range is provided appropriately or approximately, rather than an absolute number.

Component 4 – Lesson Activity

The main lesson stimulus uses combination of diagrams and text to support learning. The table from Lesson 10 is included to help learners recall the parts of and the features of the EMS.

There may be a need to provide further support to learners about the use of s*cientific notation. The stimulus in this lesson* gives both s*cientific notation* and *decimal notation* to help learners recognized sizes. It is suggested to begin with the sizes learners are familiar with – likely in the range from 1000m (1 km) to 1mm (the smallest graduation on a typical rule or tape measure). Referring to the size of the examples may be helpful – e.g. the size of *cells*, to the size of *molecules, and* to the size of *atoms* and finally to the size of *parts of atoms*.

The questions in Component 4B are designed to help learners to *read and extract information* correctly from the stimulus. The questions in Component 4C are designed to help learners *interpret* information from the stimulus.

Component 5 – Lesson Conclusion

The intention here is to get some quick feedback from the learners on the lesson. This component is designed to support learners to take an active role in thinking about their learning. The questions are designed to let the teacher know whether the learners found the lesson useful and enjoyable and what interest they have on further learning.

Grade 10 Lesson 12 (CONSOLIDATION): Applications and Harmful Aspects of EMS

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Force, Motion and Energy;* **Grade – Quarter**: *Grade 10 – Second Quarter*
Content standard: *The learners demonstrate understanding of…* the different zones of the electromagnetic spectrum
Most Essential Learning Competency (MELC/s):

Week 1-2 *Compare the relative wavelengths of different forms of electromagnetic waves*. (**S10FE-IIa-b-47**)
Week 3-4 *Cite examples of practical applications of the different regions of EM waves, such as the use of radio waves in telecommunications* (**S10FE-IIc-d-48**)
Week 5 *Explain the effects of EM radiation on living things and the environment* (**S10FE-IIe-f-49**)

Prior learning focus for this lesson:

Grade 7 Content standard: *waves as a carriers of energy* MELC Grade 7; Week 4 *Infer that waves carry energy* (**S7LT-IIIc-4**) and *Describe the characteristics of sound using the concepts of wavelength, velocity, and amplitude* **S7LT-IIIc-7**), and Week 5 *Explain color and intensity of light in terms of its wave characteristics* (**Old S7LT-IIIf-10**)
Grade 8 Content standard: *the propagation of sound through solid, liquid, and gas* **MELC** Grade 8 Week 4 *Investigates the effect of temperature to the speed of sound (***No Code***)*
Grade 8 Content standard: *some properties and characteristics of visible light* MELC Grade 8 Week 4 *Explain the hierarchy of colors in relation to the energy of visible light* (**S8FE-If-27**)

LESSON STRUCTURE AND PURPOSE

Component 1 – Short Review

The purpose of the questions in the short review is to determine the level of prior knowledge and understanding that learners have for the context of the consolidation lesson. It will be useful for learners to distinguish between the concepts of *harm* and *benefits* in relation to electromagnetic radiation. Question 3 is designed to identify if learners have now solidly learnt the main relationships between wavelength and frequency.

Component 2 – Lesson Purpose

The lesson is designed to provide a context for learners to apply their learning from the other lessons in the week. The lesson should help learners understand that the electromagnetic spectrum comprises of non-ionizing radiation, which is generally safe for living things, and ionizing radiation which can be harmful to living things. The degree to which electromagnetic are ionizing increases with short wavelengths and higher frequencies.

Component 3 – Lesson Language Practice

This component is designed to help learners understand the technical terms which will be encountered in the lesson and also to understand the ongoing importance of them being able to *identify, interpret and apply relevant information from scientific text and tables.*

Component 4 – Lesson Activity

The main lesson stimulus is about common applications and harmful effects of electromagnetic radiation. Point out that this lesson also includes table from Lesson 10 to help recall the features of the EMS. The table of information presents the types of EMS that are ionizing. Learners should have learned about *ions* in the *Matter* topic of the Second Quarter, Grade 9. They should have also encountered information about the DNA of cells in the Third Quarter, Grade 10. Check if leaners can see in this lesson the connections between the study of physics and the studies of life science (Biology) and matter (Chemistry).

Component 5 – Lesson Conclusion

This component is designed to support learners to take an active role in thinking about their learning. It is important to let learners know that good learners reflect on their learning. The questions are designed to let the teacher know whether the learners found the lesson *helped to consolidate their knowledge and understanding of the electromagnetic spectrum* and whether they found the questions to apply their *knowledge and understanding* were difficult answer.

Grade 10 Lesson 13:*Bonds*

Key Idea: *The formation of chemical bonds results in a chemical change.*

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Matter;* **Grade – Quarter**: *Grade 10 – Fourth Quarter*
Content Standard: Learners *demonstrate understanding of … the chemical reactions associated with biological and industrial processes affecting life and the environment.*
Most Essential Learning Competency (MELCs):

1. *Grade 9 – Second Quarter,* Weeks 2: Recognizing different types of compounds (ionic or covalent) based on their properties. (**S9MT-IIb-14**.)

Leading to:

2. *Grade 10 – Fourth Quarter:* Explain how the factors affecting rates of chemical reactions are applied in food preservation and material production, control of fire, pollution, and corrosion. (**S10MT-IVh-j-24**)

LESSON STRUCTURE AND PURPOSE

Component 1 – Short Review

The purpose of the questions in the short review is to determine the level of prior knowledge and understanding about *chemical bonds*. The questions are focused on *how bonds are formed*.

Component 2 – Lesson Purpose and Intention.

This allows the teacher to make explicit, not only the science concepts, but also the skills that the learners will be working on during this lesson. The skills involved in this lesson include understanding and describing the meaning of scientific diagrams, both essential requirements for learning science. The concepts involved in this lesson include *how atoms combine to form bonds.*

Component 3 – Lesson Language Practice

This activity is designed to highlight the importance for learners to be able to read, comprehend and interpret science texts**,** both for their learning and for answering questions.

In this lesson specific words such as *Bonds* are highlighted as relevant to the text used in component 4 and so learners are given the opportunity to show what they think these words mean in everyday settings and what they mean specifically in science. It is very important to recognize that some everyday words in the English language have different meanings when used in science.

Component 4 – Lesson Activity
The main lesson stimulus includes a *labelled diagram* that helps the learners visualize examples of *a chemical bond*. This will assist the learners to *answer the questions in 4B*. The main lesson stimulus and the questions in 4C further enhance learner's experience by introducing the idea of *the products formed by the bond*. This allows the formation of background knowledge *about different types of bonds.*

Component 5 – Lesson Reflection
This activity is designed to support learners to take an active role in thinking about their learning. It is important to let learners know that good learners reflect on their learning. The questions are designed to let the teacher know whether the lesson helped them to recall and understand *the concepts* and which of the questions 4B or 4C were more difficult and why.

Grade 10 Lesson 14:*Types of Bonds*

Key Idea: *The type of bond formed determines whether the result is a covalent or an ionic compound*.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Matter;* **Grade – Quarter**: *Grade 10 – Fourth Quarter*
Content Standard: Learners *demonstrate understanding of … the chemical reactions associated with biological and industrial processes affecting life and the environment.*
Most Essential Learning Competency (MELCs),

1. *Grade 9 – Second Quarter* Week Weeks 2: Recognizing different types of compounds (ionic or covalent) based on their properties. ***S9MT-IIb-14****.*
2. *Grade 9 – Second Quarter* Week Weeks 3: Explain how ions are formed. ***S9MT-IIe-f-16***

Leading to:

3. Weeks 7-8: *Explain how the factors affecting rates of chemical reactions are applied in food preservation and material production, control of fire, pollution, and corrosion*. ***S10MT-IVh-j-24****.*

LESSON STRUCTURE AND PURPOSE
Component 1 – Short Review
The purpose of the questions in the short review is to determine the level of prior knowledge and understanding about *types of bonds*. The questions are focused on *how they are different*.

Component 2 – Lesson Purpose and Intention.
This allows the teacher to make explicit, not only the science concepts, but also the skills that the learners will be working on during this lesson. The skills involved in this lesson include *reading and describing the meaning of scientific diagrams and using technical language*, both essential requirements for learning science. The concepts involved in this lesson *include that the differences between bonds is the participation of the valence electrons.*

Component 3 – Lesson Language Practice
This activity is designed to highlight the importance for learners to be able to read, comprehend and interpret science texts**,** both for their learning and for answering questions.

In this lesson specific words such as *configuration and charge* are highlighted as relevant to the text used in component 4 and so learners are given the opportunity to show what they think these words mean in everyday settings and what they mean specifically in science. It is very important to recognize that some everyday words in the English language have different meanings when used in science.

Component 4 – Lesson Activity
The main lesson stimulus includes *labelled scientific diagrams* that help the learners visualize examples of *chemical bonds*. This will assist the learners to *answer the questions in 4B*. The main lesson stimulus and the questions in 4C further enhance learner's experience by introducing the idea of *the formation of ions*. This allows the formation of background knowledge and the formation of schema for future learning.

Component 5 – Lesson Reflection
This activity is designed to support learners to take an active role in thinking about their learning. It is important to let learners know that good learners reflect on their learning. The questions are designed to let the teacher know whether the lesson helped them to recall and understand *chemical bonds* and which of the questions 4B or 4C were more difficult and why.

Grade 10 Lesson 15: Making and Breaking Bonds.

Key Idea: Changes in materials can be either reversible or irreversible.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Matter;* **Grade – Quarter**: *Grade 10 – Fourth Quarter*
Content Standard: Learners *demonstrate understanding of … the chemical reactions associated with biological and industrial processes affecting life and the environment.*
Most Essential Learning Competency (MELCs),

1. *Grade 9 – Second Quarter* Week 2: ***S9MT-IIb-14****.* Recognizing different types of compounds (ionic or covalent) based on their properties.

Leading to:

2. Weeks 5-6: *Apply the principles of conservation of mass to chemical reactions* ***S10MT-IVe-g-23***
3. Weeks 7-8: *Explain how the factors affecting rates of chemical reactions are applied in food preservation and material production, control of fire, pollution, and corrosion*. ***S10MT-IVh-j-24****.*

LESSON STRUCTURE AND PURPOSE
Component 1 – Short Review
The purpose of the questions in the short review is to determine the level of prior knowledge and understanding about *chemical change*. The questions are focused on *the difference between a chemical change and a physical change*.

Component 2 – Lesson Purpose and Intention.
This allows the teacher to make explicit, not only the science concepts, but also the skills that the learners will be working on during this lesson. The skills involved in this lesson include *reading and interpreting pictures of everyday events and using technical languag*e, both essential requirements for learning science. The concepts involved in this lesson include that *physical changes can be reversed but chemical changes are identified as irreversible.*

Component 3 – Lesson Language Practice
This activity is designed to highlight the importance for learners to be able to read, comprehend and interpret science texts**,** both for their learning and for answering questions.

In this lesson specific words such as *reactions* are highlighted as relevant to the text used in component 4 and so learners are given the opportunity to show what they think these words mean in everyday settings and what they mean specifically in science. It is very important to recognize that some everyday words in the English language have different meanings when used in science.

Component 4 – Lesson Activity
The main lesson stimulus includes *pictures of everyday events* that help the learners visualize examples of *physical and chemical change*. This will assist the learners to *answer questions in 4B.* The main lesson stimulus and the questions in 4C further enhance learner's experience by introducing the idea of *electrolysis as a chemical reaction*. This allows the formation of background knowledge and the formation of schema for future learning.

Component 5 – Lesson Reflection
This activity is designed to support learners to take an active role in thinking about their learning. It is important to let learners know that good learners reflect on their learning. The questions are designed to let the teacher know whether the lesson helped them to recall and understand that *changes in materials can be reversible or irreversible* and which of the questions 4B or 4C were more difficult and why.

Grade 10 Lesson 16:Signs of a Reaction

Key Idea: *There are several indicators for the identification of a chemical reaction*.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Matter;* **Grade – Quarter**: *Grade 10 – Fourth Quarter*
Content Standard: Learners *demonstrate understanding of … the chemical reactions associated with biological and industrial processes affecting life and the environment.*
Most Essential Learning Competency (MELCs)

1. Weeks 5-6: *Apply the principles of conservation of mass to chemical reactions* ***S10MT-lVe-g-23***
2. Weeks 7-8: *Explain how the factors affecting rates of chemical reactions are applied in food preservation and material production, control of fire, pollution, and corrosion*. ***S10MT-lVh-j-24****.*

LESSON STRUCTURE AND PURPOSE
Component 1 – Short Review
The purpose of the questions in the short review is to determine the level of prior knowledge and understanding about *chemical reactions*. The questions are focused on *the evidence for a chemical reaction.*

Component 2 – Lesson Purpose and Intention.
This allows the teacher to make explicit, not only the science concepts, but also the skills that the learners will be working on during this lesson. The skills involved in this lesson include *interpreting science tables and text and using technical language*, both essential requirements for learning science. The concepts involved in this lesson *include that there are specific indicators for chemical reactions.*

Component 3 – Lesson Language Practice
This activity is designed to highlight the importance for learners to be able to read, comprehend and interpret science texts**,** both for their learning and for answering questions.

In this lesson specific words such as *evidence* are highlighted as relevant to the text used in component 4 and so learners are given the opportunity to show what they think these words mean in everyday settings and what they mean specifically in science. It is very important to recognize that some everyday words in the English language have different meanings when used in science.

Component 4 – Lesson Activity
The main lesson stimulus includes *information in a table that helps the learners visualize examples of evidence for change*. This will assist the learners to *answer questions in 4B*. The main lesson stimulus and the questions in 4C further enhance learner's experience by introducing the idea of *recognizing a particular type of chemical reaction from the evidence*. This allows the formation of background knowledge and the formation of schema for future learning.

Component 5 – Lesson Reflection
This activity is designed to support learners to take an active role in thinking about their learning. It is important to let learners know that good learners reflect on their learning. The questions are designed to let the teacher know whether the lesson helped them to recall and understand *how important the recognition of evidence is in chemistry and* which of the questions 4B or 4C were more difficult and why.

Grade 10 Lesson 17:*Rates of Reaction*

Key Idea: *The rates of a chemical reactions can be critical to its successful use. Valid and reliable investigations identify the dependent and independent variable and control other variables.*

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Matter;* **Grade – Quarter**: *Grade 10 – Fourth Quarter*
Content Standard: Learners *demonstrate understanding of … the chemical reactions associated with biological and industrial processes affecting life and the environment.*
Most Essential Learning Competency (MELCs)

1. Weeks 5-6: *Apply the principles of conservation of mass to chemical reactions* ***S10MT-lVe-g-23***
2. Weeks 7-8: *Explain how the factors affecting rates of chemical reactions are applied in food preservation and material production, control of fire, pollution, and corrosion*. ***S10MT-lVh-j-24****.*

LESSON STRUCTURE AND PURPOSE
Component 1 – Short Review
The purpose of the questions in the short review is to determine the level of prior knowledge and understanding about *rates of chemical reactions*. The questions are focused on *the possible evidence for reactions that have very different rates.*

Component 2 – Lesson Purpose and Intention.
This allows the teacher to make explicit, not only the science concepts, but also the skills that the learners will be working on during this lesson. The skills involved in this lesson *include recognizing and recalling the requirements for valid and reliable scientific investigations*, both essential

requirements for learning science. The concepts involved in this lesson *include how the rates of reactions can be altered.*

Component 3 – Lesson Language Practice
This activity is designed to highlight the importance for learners to be able to read, comprehend and interpret science texts**,** both for their learning and for answering questions. In this lesson specific words such as *surface area, variable, dependent variable, independent variable, valid* are highlighted as relevant to the text used in component 4 and so learners are provided with the meaning for these words.
This activity also highlights the importance for learners to be able to read and interpret science tables and graphs both for their learning and for answering questions.

Component 4 – Lesson Activity
The main lesson stimulus includes the *description of a simple scientific investigation* that helps the learners visualize *examples of chemical reactions*. This will assist the learners to *better understand how reaction rates can be changed*. The main lesson stimulus and the questions in 4C further enhance learner's experience by introducing the idea of *reading graphs to interpret data*. This allows the formation of background knowledge and the formation of schema for future learning.

Component 5 – Lesson Reflection
This activity is designed to support learners to take an active role in thinking about their learning. It is important to let learners know that good learners reflect on their learning. The questions are designed to let the teacher know whether the lesson helped them to recall and understand *the importance of the rates of chemical reactions* and which of the questions 4B or 4C were more difficult and why.

Grade 10 Lesson 18 (CONSOLIDATION): Chemical Reactions in Nature

Key Idea: *Chemical reactions occur in nature, and some are essential to life.*

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Matter;* **Grade – Quarter**: *Grade 10 – Fourth Quarter*
Content Standard: Learners *demonstrate understanding of … the chemical reactions associated with biological and industrial processes affecting life and the environment.*
Most Essential Learning Competencies Weeks 7-8**:** *Explain how the factors affecting rates of chemical reactions are applied in food preservation and material production, control of fire, pollution, and corrosion*. (S***10MT-IVh-j-24***)

This is a CONSOLIDATION lesson.

LESSON STRUCTURE AND PURPOSE
Component 1 – Short Review
The purpose of the questions in the short review is to determine the level of prior knowledge and understanding about *natural chemical reactions such as photosynthesis*.

Component 2 – Lesson Purpose and Intention.
This allows the teacher to make explicit the science concepts and the skills that the learners will be working on during this lesson. The skills involved in this lesson include *interpreting information from pictures and diagrams* and how important this is for learning and when answering questions. The

concepts involved in this lesson *include that the chemical reactions of photosynthesis and respiration are essential for life.*

Component 3 – Lesson Language Practice
This activity is designed to highlight the importance for learners to be able to read and interpret *science diagrams and pictures* both for their learning and for answering questions. In this lesson specific words such as *photosynthesis, respiration and decomposition* are highlighted as relevant to the text used in component 4 and so learners are provided with the meaning for these words.

Component 4 – Lesson Activity
The main lesson stimulus includes diagrammatic representations of *a natural landscape of vegetation.* This will encourage learners to feel confident to answer the questions. This activity enhances the learners' knowledge and understanding about *the connections between plants and animals is a chemical process*. The questions in 4B and 4C are directed at this level of knowledge and understanding and are consolidating the concept that *plants make their own food through the chemical process of photosynthesis*. A common misunderstanding about the chemical process of *respiration* is that *it could not possibly be happening in our cells. That a chemical reaction involving oxygen is happening in our bodies*, an abstract idea, is counterintuitive for many learners.

Component 5 - Lesson Reflection
This activity is designed to support learners to take an active role in thinking about their learning. It is important to let learners know that good learners reflect on their learning. The questions are designed to let the teacher know whether the lesson confirmed their knowledge and understanding of *chemical reactions that occur in nature* and which of the questions B and C they found the most difficult and why.

For inquiries or feedback, please write or call:

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