9

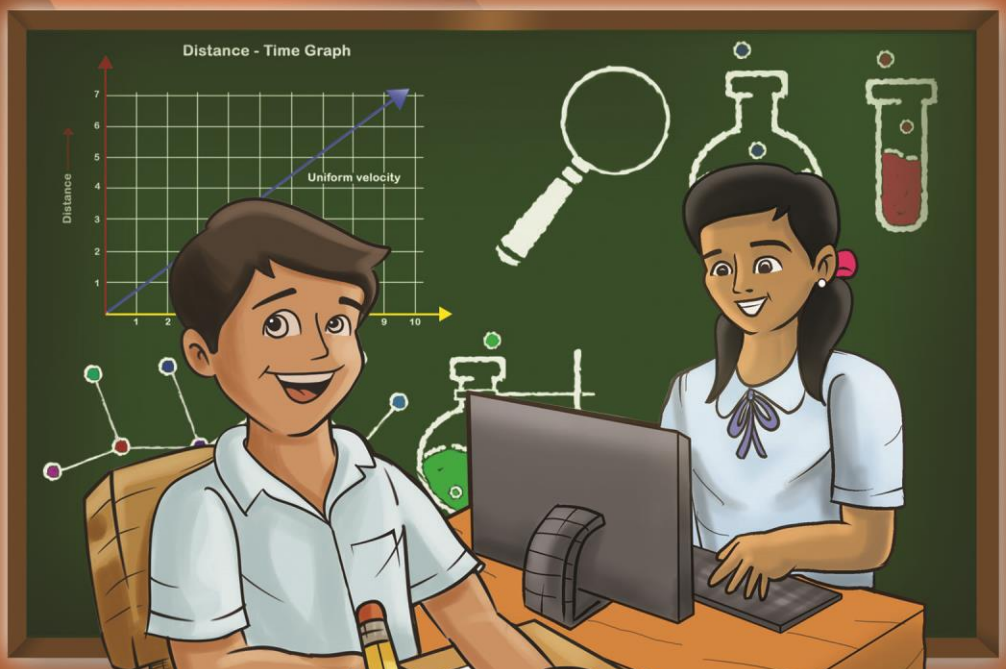
NATIONAL LEARNING CAMP

DepED DEPARTMENT OF EDUCATION

Science

Consolidation Learning Camp

Notes to Teachers



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Consolidation Learning Camp
Notes to Teachers

Science Grade 9

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 orseveral 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 stimulates 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, 

, the 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 helps 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 Teachers' Notes for Lessons

Grade 9 Lesson 1: *The Bohr Model*

Key Idea: The structure of the atom includes subatomic particles, their symbol, mass, charge, and location.

CURRICULUM REFERENCES

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

Domain: MATTER **Grade – Quarter**: Grade 8 – Third Quarter; for Grade 9 – Second Quarter;

Content Standard: Learners *demonstrate understanding of …* 1. the development of atomic models that led to the description of the behavior of electrons within atoms.

Most Essential Learning Competency (MELCs):

1. Week 5-6. Determine the number of protons, neutrons, and electrons in a particular atom. (**S8MT-lll-f-10)**
2. Leading to: Week 2. How atomic models describe the position and energies of the electrons (**9MT-llb-14)**

and

3. Week 4-5. Explain how the structure of the carbon atom affects the type of bonds it forms (**S9MT-llg-17**)

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 *the structure of the atom*. The questions are focused on *the names of the subatomic particles*.

Component 2 – Lesson Purpose.

This allows the teacher to make explicit, both the science concepts and the skills that the learners will be working on during this lesson. The skills involved in this lesson *include reading scientific diagrams and using technical language,* both essential requirements for learning science. The concepts involved in this lesson include *the limits of the structure of the atom as described by Niels Bohr and that scientists sometimes draw diagrams and use models to represent what cannot be seen with the naked eye*.

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 *orbit, protons and neutrons* are highlighted as relevant to the text used in component 4 and so learners are allowed 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 symbolic representations of the structure of atoms 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 statement about *the suggestions made by Bohr* to *the structure as shown in the diagram.* The activity is designed to assist learners to develop a more **relational** understanding of *the structure of the atom*. They should begin to see the relationships between *the different subatomic particles and their role in the electron configuration of elements.* It may be useful to discuss the concepts of charge.

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.

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 9 Lesson 2: *More about atoms*

Key Idea: The specific structure and position of the subatomic particles in the atoms of an element determine the characteristics of that element.

CURRICULUM REFERENCES

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

Domain: MATTER **Grade – Quarter**: Grade 8 – Third Quarter; for Grade 9 – Second Quarter;

Content Standard: Learners *demonstrate understanding of …* 1. the development of atomic models that led to the description of the behavior of electrons within atoms.

Most Essential Learning Competency (MELCs):

1. Week 5-6. Determine the number of protons, neutrons, and electrons in a particular atom. (**S8MT-lll-f-10)**
2. Leading to: Week 2. How atomic models describe the position and energies of the electrons (**9MT-llb-14**) and
3. Week 4-5. Explain how the structure of the carbon atom affects the type of bonds it forms (**S9MT-llg-17**)

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 *the structure of the atom*. The questions are focused on *the properties of the sub-atomic particles*.

Component 2 – Lesson Purpose.

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 scientific diagrams and using technical language,* both essential requirements for learning science. This lesson explores how atoms of one element differ from the atoms of another element.

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 *aluminum, carbon, and lead* are highlighted as relevant to the text used in component 4 and so learners are *provided with what these words mean in science in component 4*. 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 *pictorial representations of several elements as well as text.*

The challenge for many learners in this main lesson activity will be to identify relevant information and to connect the statement about *the appearance of each element* to *its common use.* The activity is designed to assist learners to develop a more **relational** understanding *of the atomic structure of matter*. They should begin to see the relationships between *the atomic number of an element and its common use.* It may be useful to discuss the concepts of *valence electrons*.

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 9 Lesson 3: *Elements*

Key Idea: In chemistry elements are identified as pure substances.

CURRICULUM REFERENCES

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

Domain: MATTER **Grade – Quarter**: Grade 7 – First Quarter; for Grade 8 – Third Quarter; for Grade 9 – Second Quarter;

Content Standard: Learners *demonstrate understanding of …* 1. the development of atomic models that led to the description of the behavior of electrons within atoms.

Most Essential Learning Competency (MELCs):

1. Week 2-3. Recognize that substances are classified into elements and compounds (**S7MT-ig-h-5)**

2. Leading to: Week 7-8. Leading to: Use the periodic table to predict the chemical behavior of an element (**S8MT-lll-j-12**)
3. Leading to: Week 2. How atomic models describe the position and energies of the electrons, (**9MT-llb-14**). and
4. Week 4-5. Explain how the structure of the carbon atom affects the type of bonds it forms (**S9MT-llg-17**)

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 *the concept of a pure substance*. The questions are focused on *the differences between pure substances and mixtures.*

Component 2 – Lesson Purpose.

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 understanding tables and using technical language,* both essential requirements for learning science. The concepts involved in this lesson include *the concept of what is a pure substance in chemistry using elements as an example.*

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 *pure substance, and substance* are highlighted as relevant to the text used in component 4 and so learners are allowed 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 provides information about some common elements as well as text.

The challenge for many learners in this main lesson activity will be to identify relevant information and to connect the statement about *where the element is found* to *its common use.* The activity is designed to assist learners in developing a more **relational** understanding *of the properties of different elements and their common uses.* They should begin to see the relationships between *the study of chemistry and its significance to their own daily lives.* It may be useful to discuss the concepts of *the history of chemistry*.

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 9 Lesson 4: Chemical Compounds

Key Idea: Compounds are identified as pure substances in chemistry.

CURRICULUM REFERENCES

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

Domain: MATTER **Grade – Quarter**: Grade 7 – First Quarter; for Grade 8 – Third Quarter; for Grade 9 – Second Quarter;

Content Standard: Learners *demonstrate understanding of …* 2. how atoms combine with other atoms by transferring or by sharing electrons.

Most Essential Learning Competency (MELCs):

1. Week 2-3. Recognize that substances are classified into elements and compounds (**S7MT-ig-h-5)**
2. Leading to: Week 7-8. Leading to: Use the periodic table to predict the chemical behavior of an element (**S8MT-lll-j-12**)
3. Leading to: Week 2. How atomic models describe the position and energies of the electrons, (**9MT-llb-14**).

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 *chemical compounds*. The questions are focused on *the difference between elements and compounds.*

Component 2 – Lesson Purpose.

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 pictorial representations and using technical language,* both essential requirements for learning science. The concepts involved in this lesson include *that compounds are an example of a pure substance but are different to elements.*

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 *chemicals, composition* are highlighted as relevant to the text used in component 4 and so learners are allowed to show what they think these words mean specifically in science by completing a mix-and-match activity. 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 *pictorial representations of a landscape 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 formulae as shown on the pictorial landscape* to *the name of*

the compound.it represents. The activity is designed to assist learners to develop a more **relational** understanding of *the presence of chemical compounds in their environment*. They should begin to see the relationships between *chemistry and their daily lives.* It may be useful to discuss the concepts of *using formulae*.

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 9 Lesson 5: The Chemical Nature of Earth

Key Idea: The periodic table is a useful tool to determine the chemical properties of elements.

CURRICULUM REFERENCES

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

Domain: MATTER **Grade – Quarter**: Grade 8 – Third Quarter; for Grade 9 – Second Quarter;

Content Standard: Learners *demonstrate understanding of …* 2. how atoms combine with other atoms by transferring or by sharing electrons.

Most Essential Learning Competency (MELCs):

1. Week 5-6. Determine the number of protons, neutrons, and electrons in a particular element **(S8MT-IIIc-d-10)**
2. and: Week 7-8. Leading to: Use the periodic table to predict the chemical behaviour of an element (**S8MT-III-j-12**)
3. Leading to: Week 2. How atomic models describe the position and energies of the electrons, (**9MT-IIb-14**).

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 *the periodic table*. The questions are focused on *the number of groups and periods of the periodic table.*

Component 2 – Lesson Purpose.

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 scientific diagrams and using technical language,* both essential requirements for learning science. The concepts involved in this lesson include *the concepts of how the groups and periods are organized in the periodic table.*

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 *period* are highlighted as relevant to the text used in component 4 and so learners are provided *with a sentence that illustrates what 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 *an extract of a periodic table as well as several short paragraphs of text.*

The challenge for many learners in this main lesson activity will be to identify relevant information and to connect the statement about the *organization of the elements according to increasing atomic number,* to *the structure of the periodic table.* The activity is designed to assist learners in developing a more **relational** understanding of the *chemical properties of elements, their group on the table and their outermost (valence) electrons.* They should begin to see the relationships between *periods in the table and the number of shells in an atom.* It may be useful to discuss the concepts of *electronic configuration*.

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 9 Lesson 6 (CONSOLIDATION): *History of Chemistry*

Key Idea: The scientific understanding of important elements and compounds has evolved.

CURRICULUM REFERENCES

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

Domain: MATTER **Grade – Quarter**: Grade 9 – Second Quarter;

Content Standard: Learners *demonstrate an understanding of* the type of bonds that carbon forms that result in the diversity of carbon compounds.

Most Essential Learning Competency (MELCs): Week 4-5. Explain how the structure of the carbon atom affects the type of bonds it forms **(S9MT-IIg-17)**

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 to see *that many of the elements and compounds that they have learned about are part of their daily lives.*

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 *elements and the periodic table*) and *the application of science that scientists work on in our modern society.*

Component 2: Lesson Purpose.

The skills involved in this lesson *include reading and interpreting dense texts using technical language,* both essential requirements for learning science. The concepts involved in this lesson include *that our current understanding of chemistry is based on the work of many other scientists including alchemists that has taken place over many centuries.*

Component 3: Lesson Language Practice

In this lesson specific words such as *alchemy* are highlighted as relevant to the text used in component 4 and so learners are *provided with a definition in the stimulus*. The teacher might make a judgment on how long to practice using the terms provided.

Component 4: Lesson Activity

The concepts being addressed in this lesson are drawn from research that indicates that common misconceptions about *chemistry* include the **misconceived idea** that *chemistry is a new science and that it happens in a laboratory and is not part of our daily lives.*

The main lesson activity gives the chance for teachers to find out what learners know and understand about the historical development of the science of chemistry. It introduces them to ideas about chemistry in ancient times as well as the importance of compounds of carbon in our daily lives.

Component 4B has relatively simple questions. Learners could answer from the information in the stimulus. **Component 4C** has more complex questions and includes one about possible professions in chemistry.

Component 5: Lesson Conclusion

This lesson has a range of reflection questions in the conclusion. It will be interesting to see if learners feel comfortable demonstrating metacognition. Analyzing learners' responses and discussing with your teacher colleagues on a reflection and planning day can help teachers make adjustments within the lesson plan template to better meet the needs of your learners.

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 9 Lesson 7: *Cell Division.*

Key Idea: Mitosis and Meiosis are the basic forms of cell division.

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 9 – First Quarter;

Content Standard: Learners *demonstrate understanding of …* 1. how genetic information is organized in genes on chromosomes 2. the different patterns of inheritance

Most Essential Learning Competency (MELCs):

1. Week 2. Compare mitosis and meiosis and their role in cell division. (**S8LT-lVd-16**)
2. Week 2. Explain the significance of meiosis in maintaining chromosome numbers. (**S8LT-LVe-17**) Leading to
3. Weeks 3-4: Explain the different patterns of non-mendelian inheritance (**S9LT-id-29**)

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 *the process of cell division*. The questions are focused on *the role of cell division in human reproduction.*

Component 2 – Lesson Purpose.

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 that learners *interpret diagrammatic representations of important concepts in science.* The concepts involved in this lesson include the *processes of mitosis and meiosis and their role in biological inheritance.*

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 *chromosomes and gametes* are highlighted as relevant to the text used in component 4 and so learners are given *the definition of these words in the stimulus 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 *symbolic representations of the processes of cell division as well as text.*

The challenge for many learners in this main lesson activity will be to identify relevant information and to connect the statement about *the scientific processes of cell division* to the *questions in 4B and 4C.* The activity is designed to assist learners indeveloping a more **relational** understanding of *cell division*. They should beginto see the relationships between *the processes and the concept of inheritance.*

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 9 Lesson 8: Genes, DNA, and Chromosomes

Key Idea: DNA, genes, and chromosomes carry important information for heredity.

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 9 – First Quarter;

Content Standard: Learners *demonstrate understanding of …* 1. how genetic information is organized in genes on chromosomes 2. the different patterns of inheritance

Most Essential Learning Competency (MELCs):

1. Weeks 3: Predict phenotypic expressions of traits following simple patterns of inheritance. **S8LT-IVf-18** Leading to
2. Weeks 3-4: Explain the different patterns of non-mendelian inheritance (**S9LT-id-29**)

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 *how fertilization occurs in humans.* The questions are focused on *the names of the participating cells and chromosome numbers.*

Component 2 – Lesson Purpose.

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 that learners *read and understand technical terms and scientific text.* The concepts involved in this lesson include the concept *of inheritance involving chromosomes, genes, and DNA.*

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 genotype, heredity, genome, diploid, haploid and DNA are highlighted as relevant to the text used in component 4 and so learners are provided with the meaning of these words 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 *symbolic representations of the double helix structure of DNA as well as text.*

The challenge for many learners in this main lesson activity will be to identify relevant information and to connect the statement of the definitions of *important biological terms* to the *questions in 4B and 4C.* The activity is designed to assist learners in developing a more **relational** understanding of *the system of human inheritance.* They should begin to see the relationships between *the gene, our DNA and how we inherit from our parents.*

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 9 Lesson 9: Body Systems Working Together.

Key Idea: Organ systems work together for the growth and survival of the organism.

CURRICULUM REFERENCES

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

Domain: Living Things **Grade – Quarter**: Grade 9 – First Quarter;

Content Standard: Learners *demonstrate understanding of …* 1. how the different structures of the circulatory and respiratory systems work together to transport oxygen -rich blood and nutrients to the different parts of the body

Most Essential Learning Competency (MELCs):

Weeks 1-2: Explain how the Respiratory and circulatory systems work together to transport nutrients, gases, and other molecules to and from the different parts of the body. (**S9LT-Ia-b-26**)

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 *the respiratory system.* The questions are focused on *how and what we breathe in and out.*

Component 2 – Lesson Purpose.

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 that learners *interpret diagrammatic representations of parts of the human body.* The concepts involved in this lesson include the concept *that the* respiratory and circulatory systems work together to keep us alive and healthy.

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 *respiratory; circulatory, diffuse, alveoli, and hemoglobin* are highlighted as relevant to the text used in component 4 and so learners are provided with the meanings of these words, 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 *diagrammatic representations of the two body systems as well as text.*

The challenge for many learners in this main lesson activity will be to identify relevant information and to connect the statement of the definitions of *important biological terms* to the *questions in 4B and 4C.* The activity is designed to assist learners to develop a more **relational** understanding of *how the two systems work together.* They should begin to see the relationships between the *process of oxygenation of the blood by the lung and the role of the circulatory system in transporting the oxygenated blood to all parts of the body.*

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 9 Lesson 10: What is needed for a volcano to form?

Key Idea: Volcanoes form over time through a combination of geological processes and conditions including having a source of magma and some weakness in the Earth's crust for the magma to come to the surface.

CURRICULUM REFERENCES

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

Domain: Earth and Space **Grade – Quarter**: Grade 9 – Third Quarter;

Content Standard: Learners demonstrate understanding of … volcanoes found in the Philippines

Most Essential Learning Competency (MELCs)

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 learners have about *volcanoes and what comes out of them***.** It can be expected that learners will initially recall what a volcano is and what comes out of one, at least in everyday terms. Question 3 is relational and may be too difficult for many learners to answer fully – the questions are designed for the teacher to hear and see what learners know and can do at the beginning of the lesson.

Component 2 – Lesson Purpose.

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. This lesson is about the key factors that are needed for a volcano to form.

The lesson may also help learners to be better able to identify and extract information from a scientific text that uses a lot of technical scientific language. The emphasis is to support learners to understand the structure of the text, and the style of language used, to be more efficient at finding answers to the questions asked.

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 *factor, processes* and *conditions,* are highlighted as relevant to the text used in component 4 and so learners are allowed to show what they think these words mean in everyday settings and what they mean specifically in science.

Technical scientific terms, such as *magma; runny or viscous lava,* are also identified. The teacher may need to determine which words are most important to preview for the lesson

There may be value for some to explore terms like *magma* and *lava* where they may have unique mother tongue meanings in some regions.

Component 4 – Lesson Activity

The main lesson stimulus provides a multi-media text including a ‘comic strip’ style diagram to help show stages in volcano development. Some learners might need that to be explicitly pointed out to them. There may be value in helping learners to understand how the text is organized – 1. an overview paragraph; 2. the diagram; 3. seven key factors (each with more details).

It might be useful to point out to learners that **technical science terms** are often given in *italic writing*. Understanding how the text is organized and presented will help learners to ***locate information*** to answer the questions.

Component 4B focuses on extracting and reworking information from the stimulus. The matching exercise is designed to lighten the cognitive load for learners. Point out to learners that sequencing is an important skill in science, especially for Earth Science.

Component 4C focuses on the types of eruptions and what impact or effect that has on the size and shape of a volcano. Reinforce that information to answer questions is provided in the stimulus information. Try and help the learners to relate the 'runniness' of lava to how far it will spread from a volcanic vent. It might be good to discuss how runny liquids like water, honey and toothpaste are to help with the concept.

Component 5 – Lesson Reflection

This activity is designed to support learners to take an active role in thinking about their learning. The questions are designed to inform the teacher about what learners know and can do; what they enjoyed about the lesson; and what they might like to learn more about in this topic.

Grade 9 Lesson 11: *Types of Volcanoes*

Key Idea: The different types of volcanoes found around the world can be described according to their activity and the types of materials they erupt.

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

Domain: Earth and Space **Grade – Quarter**: Grade 9 – Third Quarter;

Content Standard: Learners demonstrate an understanding of volcanoes found in the Philippines.

Most Essential Learning Competency (MELCs)

Week 1: Describe the different types of volcanoes and volcanic eruption [Curric LCs: S9ES-IIIa-25]

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 ***engage learners*** by finding out if they know the names of volcanoes in their local area, as well as famous ones in the Philippines. It will be interesting for the teacher to hear how learners describe the features of a volcano. Question 3 is a 'why' question which can be insightful to check for deeper relational understanding.

Component 2 – Lesson Purpose.

This lesson is about the key factors that are needed for a volcano to form. The lesson is not exploring every different type of volcano that exists on the Earth, but some quite different types to show the diversity that volcanoes have. The lesson may also help learners to better appreciate the sizes of volcanoes, especially how big and small they can be. The key point is for learners to understand that the size and shape of volcanoes are closely related to their activity and the types of materials they erupt.

The lesson may also help learners to be better able to identify and extract information from a scientific text that uses a lot of technical scientific language. The emphasis is to support learners to understand the structure of the text, and the style of language used, to be more efficient at finding answers to the questions asked.

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 four volcano types are highlighted.

It can be good to ask the learners to say **why** they think volcanoes have these names. Focusing on the origin of words may help learners to remember the terms. The naming of

volcanoes is about either their shapes or what they are made of; e.g. *Caldera* comes from the Spanish name for a cooking pot or *Caldron*. The term phreatic originates from the Greek *phrear*, meaning a water "well" or "spring".

Component 4 – Lesson Activity

The main lesson stimulus is about some different types of volcanoes. Point out the written text supports the ***cross-sectional diagrams*** to reinforce the sizes and shapes of the volcanoes. Point out the ***scales*** provided to help learners understand volcano ***sizes***. Point out that technical science terms are often in *italic writing*. The stimulus text refers to runny *basaltic* lava, and the thicker *andesite* to *rhyolite* lava types. There is no need to focus on this detail unless the learners know something about these lava compositions.

Component 4B focuses on strato-volcanoes as a common Philippine type. Component 4C focuses on much more complex volcanic systems and so the learners might need more guidance here. If needed, just focus on the lesson **key idea** – that the different types of volcanoes found around the world are classified according to their activity and the types of materials they erupt.

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 inform the teacher about what learners know and can do; if they can distinguish between the different types of volcanoes and what they found hard to do. Knowing this may help with future lessons.

Grade 9 Lesson 12 (CONSOLIDATION): TAAL – a very small but dangerous volcano!

Key Idea/s being reinforced:

- Different types of volcanoes and volcanic eruptions,
- Explaining what happens when volcanoes erupt,
- Identifying the signs that indicate to people that an eruption might occur.

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

Domain: Earth and Space **Grade – Quarter**: Grade 9 – Third Quarter;

Content Standard: Learners demonstrate an understanding of volcanoes found in the Philippines.

Most Essential Learning Competency (MELCs)

Week 1: Describe the different types of volcanoes and volcanic eruption [Curric LCs: S9ES-IIIa-25]

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 that learners have about the Taal volcano. It is also designed to identify if learners know what might happen to indicate that a volcano is going to erupt.

Component 2 – Lesson Purpose.

The lesson being a consolidation lesson builds on learners' understandings from the last two lessons using an authentic scientific report. It also is designed to help consolidate the scientific skills in sequencing information.

Component 3 – Lesson Language Practice

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

In this lesson the words are more technical, which learners need to engage with without being scared to explore their origin and meaning. Technical scientific terms, such as *phreatic and phreato-magmatic eruptions,* are more easily understood once learners know that '*phreat*' refers to '*water*'. The teacher may need to determine which words are most important to preview for the lesson

Where '*caldera system'* is read, ask learners and talk out what a ***system*** is.

Component 4 – Lesson Activity

Point out that the main lesson stimulus is an authentic scientific report about a recent eruption of Taal Volcano. To help direct learners to parts of the report, paragraphs have been numbered. If needed, help learners with any terms they need to find information to answer questions. Point out it refers to the *Philippine Institute of Volcanology and Seismology* (PHIVOLCS) – a wonderful organization that helps Filipino people cope with living in a volcanically active region.

Component 4B focuses on what happens before an eruption and on what happens after an eruption. The questions are designed to help learners extract correct information and to sequence it correctly.

Component 4C focuses on the Taal Caldera System, so that learners can compare it to other volcano types. In Question 3, it is okay for learners to design a much more simple table that is provided as a sample. Work at the level that learners can achieve success with.

Component 5 – Lesson Reflection

This activity is designed to support learners to take an active role in thinking about their learning. The questions should help learners to see that some information just needs to be found and recorded to answer questions. The other questions are designed to see if learners can distinguish between hard and easier questions.

After the lesson: After each lesson, including the consolidation 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 9 Lesson 13: Temperature and Heat – what is the difference?

Key Idea: *Temperature* is a measure of the average kinetic energy of particles in an object or system. This is not the same as *heat*, which is the internal thermal energy of an object or system which can be transferred to another object or system. Scientists define *heat* as a form of energy that flows between objects or systems due to their temperature difference.

CURRICULUM REFERENCES

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

Domain: Force, Motion and Energy; **Grade – Quarter**: Grade 9 – Fourth Quarter

Content standard: *The learners demonstrate understanding of…* the relationship among heat, work and efficiency.

Most Essential Learning Competency (MELCs): Week 5 *Construct a model to demonstrate that heat can do work* (**S9FE-IVe-42**)

Prior learning focus for this lesson: MELC: Grade 8 week 4: Differentiate between heat and temperature at the molecular level (**S8FE-Ig-29**)

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 difference between temperature and heat*. The questions are focused on learners' understanding of temperature firstly as that is most likely to be a scientific concept that they understand better and can give correct answers for.

Component 2 – Lesson Purpose.

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. This lesson is about reinforcing that learners can distinguish between *heat* and *temperature*. The lessons this week will focus on using examples to help everyone be clear on how, in Science, heat and temperature are different but related concepts. The lesson in particular may help learners to better understand heat at the micro or particle level.

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 *kinetic energy; thermal energy; heat; temperature; and average*, are highlighted as relevant to the text used in component 4 and so learners are allowed to show what they think these words mean in everyday settings and what they mean specifically in science. Most terms should be familiar to learners; however, it is particularly important to recognize what ***average*** means.

Component 4 – Lesson Activity

The main lesson stimulus includes *symbolic representations* of *particles of matter* that help explain what is happening and help the learners visualize examples of *hot objects*. This will assist the learners to *read and interpret the written text*.

Component 4B Questions 1 and 2 focus on the ***states of matter*** (which learners should already know about from earlier grades). For Question 3 in Component 4B, the teacher may need to help learners identify the 'collisions' in the first diagram in the lesson stimulus that depicts the ways that particles in a substance can move.

Component 4C focuses on the second diagram. This is a good opportunity for learners to think about variables and fair testing – note that everything in this example is the same except for the amount or mass of water, and so we can conclude that the amount of heat here is dependent on the amount or mass of water – the more mass, the more heat it can store.

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 was interesting, challenging and therefore enjoyable.

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 9 Lesson 14: Can Heat do Work for us?

Key Idea: *Heat transfer* is one way that thermal energy of an object or system can be moved to another object. *Work transfer* is the other way that thermal energy of an object or system can be moved to another object.

CURRICULUM REFERENCES

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

Domain: Force, Motion and Energy; **Grade – Quarter**: Grade 9 – Fourth Quarter

Content standard: *The learners demonstrate an understanding of* the relationship among heat, work and efficiency.

Most Essential Learning Competency (MELC/s): Week 5 *Construct a model to demonstrate that heat can do work* (**S9FE-IVe-42**)

Prior learning focus for this lesson:

Old Curric – Grade 8 Q1: The learners demonstrate an understanding of work using constant force, power, gravitational potential energy, kinetic energy, and elastic potential energy.

MELC: Grade 8 Q1 – Week 2: Infer that when a body exerts a force on another, an equal amount of force is exerted back on it. (**S8FE-Ia-16**)

Week 2-3: Identify and explain the factors that affect potential and kinetic energy (**S8FE-Ia-16**)

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 ***heat*** and ***work***, particularly from the last lesson. The questions provide scope for learners to answer using everyday language and understanding, but also provide opportunities for learners with scientific knowledge and understanding to demonstrate that. At this point, the goal for the teacher is to find out just what learners know and can do. Accept answers at a range of levels unless they are showing severe misconceptions.

The sample answers in the lesson plans are to provide background information as a guide only to the teacher – **there is no need to provide all the answers to learners here.**

Component 2 – Lesson Purpose.

This lesson is about the transfer of energy through *heat* and *work*. The lesson may also help learners reinforce a good understanding of the scientific meanings of temperature and heat.

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 help with the terms *heat; work; model; transfer* in a science context.

Ask the learners to suggest what they understand a '***model'*** to be. They might have a different answer if you ask: "What is a model in Science?"

Component 4 – Lesson Activity

Refer learners to the main lesson stimulus pointing out that it includes ***two models*** that help explain the difference between heat and work when we are exploring understanding about thermal energy. Help learners to see that these are simple models that show a scientific principle – they do not necessarily cover all aspects of the science we are learning about and the models might not be good practical prototypes to build for practical reasons!

Component 4B focuses on Joseph's model. Component 4C focuses on Ana's model. Both components link to the definition of work as the *energy transferred* to or from an object when a force moves the object over some distance [W = F x d].

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 *energy transfers.*

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 9 Lesson 15: *Transferring heat*

Key Idea: *Conduction*, *convection* and *radiation* are the main three ways to transfer heat but they all transfer heat in different 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 9 – Fourth Quarter

Content standard: *The learners demonstrate understanding of…* the relationship among heat, work and efficiency.

Most Essential Learning Competency (MELC/s): Week 6: Explain how heat transfer and energy transformation make heat engines work (**S9FE-IVg-45**)

Prior learning focus for this lesson: MELC: Q3, Grade 7 – Week 6: Infer the conditions necessary for heat transfer to occur (**S7LT-IIIh-i-12**)

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 concept of '*transfers'* of energy, especially *heat*, in Science. The review questions are focused on everyday thinking and language to get

learners engaged. The questions should let the teacher know if learners recall relevant scientific ideas from earlier grades – it is okay if learners do not know the technical terms, but if they can give examples would be a good starting point for the lesson.

Component 2 – Lesson Purpose.

This lesson is about the three main ways that heat is transferred in everyday situations. The lesson may also help learners to better understand what heat transfer means.

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 terms listed here are good ones for learners to practice saying.

Discuss the form of the words e.g. The three terms have the same ending '**…tion'.**

Point out that lots of technical science terms have this ending. What does that indicate about the words? Suggested explanation: The suffixes "-tion" and "-sion" are both used to create **nouns** from **verbs** to describe a state, condition, action, process, practice, or result. These are common situations that occur when we are describing or explaining the natural or made physical world in science.

Component 4 – Lesson Activity

The main lesson stimulus includes a sketch of a possible domestic situation that should help the learners visualize examples of *Conduction; Convection; and Radiation.*

The questions in Component 4B and 4C are designed to help learners to consider different ways to think about a science concept – how heat travels.

Component 4C questions should help learners think about how fast heat can travel depending on the way it transfers.

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 role of particles in transferring heat and which of the questions 4B or 4C were more difficult and why.

Grade 9 Lesson 16: Heat Transfer in a Kitchen Oven

Key Idea: An electric oven is an application that utilizes all the ways that heat energy can be transferred, or moved. It is also a good application to demonstrate how electrical energy can be transformed, or changed, into heat 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 9 – Fourth Quarter

Content standard: *The learners demonstrate an understanding of* the relationship among heat, work and efficiency.

Most Essential Learning Competency (MELC/s): Week 6: Explain how heat transfer and energy transformation make heat engines work (**S9FE-IVg-45**)

Prior learning focus for this lesson: MELC: Q3, Grade 7 – Week 6: Infer the conditions necessary for heat transfer to occur (**S7LT-IIIh-i-12**)

LESSON STRUCTURE AND PURPOSE

Component 1 – Short Review

The purpose of the questions in the short review is to identify if learners can distinguish *heat transfer* (moving it from one place to another) from *heat transformation* (i.e. into a different form of energy e.g. movement energy).

Component 2 – Lesson Purpose.

This lesson is about how household appliances produce heat to do work and how the heat is transferred from the oven to the food. The lesson may also help learners to better recall the differences between *conduction*, *convection* and *radiation*.

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 case, the idea is to check if learners know that the parts of the oven listed are all made of metal.

Component 4 – Lesson Activity

The main lesson stimulus includes a *labeled diagram* and *brief written text* to convey scientific information about an everyday appliance. The stimulus is deliberately short on words to see if learners can use technical language to describe the application of science.

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 heat transfers and transformation in everyday appliances, 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 9 Lesson 17: Generating Electricity for Household, Commercial & Industrial Use in the Philippines

Key Idea: The processes of heat transfer and energy transformations are fundamental processes for generating electricity at large scale in the Philippines for household, commercial and industrial uses.

CURRICULUM REFERENCES

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

Domain: Force, Motion and Energy; **Grade – Quarter**: Grade 9 – Fourth Quarter

Content standard: *The learners demonstrate understanding of…* the relationship among heat, work and efficiency.

Most Essential Learning Competency (MELC/s): Week 7: Explain how electrical energy is generated, transmitted, and distributed (**S9FE-IVh-j-46**)

LESSON STRUCTURE AND PURPOSE

Component 1 – Short Review

The last two lessons in the sequence shift learners to a much larger industrial setting to apply the basic concepts about heat and work and about heat transfers and heat transformations.

The purpose of the questions in the short review is to determine the level of prior knowledge and understanding about *electricity* and *electrical* energy concerning *heat transfers* and *transformations.*

Component 2 – Lesson Purpose.

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. This lesson is about helping learners to understand the scientific difference between *energy transfer* and *energy transformation.* The lesson uses technical scientific diagrams that show *processes* and *devices* where energy changes occur. The lesson should help learners to better understand how *heat* does *work,* but also how to *interpret* and *summarize* information.

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 it is important that learners can recognise that the diagrams are showing large-scale industrial plants and equipment. There is a need to follow the connections between the various elements being presented.

Component 4 – Lesson Activity

The main lesson stimulus utilizes a cross-sectional diagram to describe and explain a complex system. It should be noted that some parts of the diagram represent underground systems.

The questions in 4B are designed to help orientate the learners to the situation.

The questions in 4C focus on summarising the systems and scientific processes occurring in the power plant.

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 information.

After the lesson: At the 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 9 Lesson 18 (CONSOLIDATION): Comparing Fossil-fuels to Geothermal sources of heat to generate electricity

CURRICULUM REFERENCES

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

Domain: Force, Motion and Energy; **Grade – Quarter**: Grade 9 – Fourth Quarter

Content standard: *The learners demonstrate an understanding of* the relationship among heat, work and efficiency.

Most Essential Learning Competency (MELC/s): Week 7: Explain how electrical energy is generated, transmitted, and distributed (**S9FE-IVh-j-46**)

This is a CONSOLIDATION lesson

LESSON STRUCTURE AND PURPOSE

Component 1 – Short Review

The purpose of the questions in the short review is to make connections between the Fossil-fueled power plant and the geothermal-powered electricity plant.

Component 2 – Lesson Purpose.

This lesson is about looking for similarities and differences in how electricity is generated by the use of fossil fuels compared to geothermal sources of heat. The lesson may also help learners to consolidate ideas about heat transfer and transformations involving heat.

Component 3 – Lesson Language Practice

Unpack the possible meaning of the terms. It should help if the teacher mentions that a 'well' is a deep hole that engineers have drilled into the hot ground near volcanoes.

Component 4 – Lesson Activity

Refer learners to the main lesson stimulus, pointing out that the diagrams are ***cross-sections*** that summarize the key components and processes of two types of electricity generation power plants that are used in the Philippines.

The questions in Component 4B are designed to assist learners to see the similarities and differences in how electricity is generated by the use of fossil fuels compared to geothermal sources of heat. **NOTE**: the tasks may look difficult, but are designed for the learners to use shading with a coloured pencil to highlight the similarities so they can then see and read about the differences more clearly. An important part of teaching in Science is to give learners confidence that they can really answer questions if they analyse information carefully.

Question 3 in Component 4C is difficult – it might be useful to discuss with learners how heat is quickly generated in a bicycle pump using increases and reductions in pressure.

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 about the similarities and differences in how electricity is generated by the use of fossil fuels compared to geothermal sources of heat, and which of the questions B and C they found the most 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.

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