8

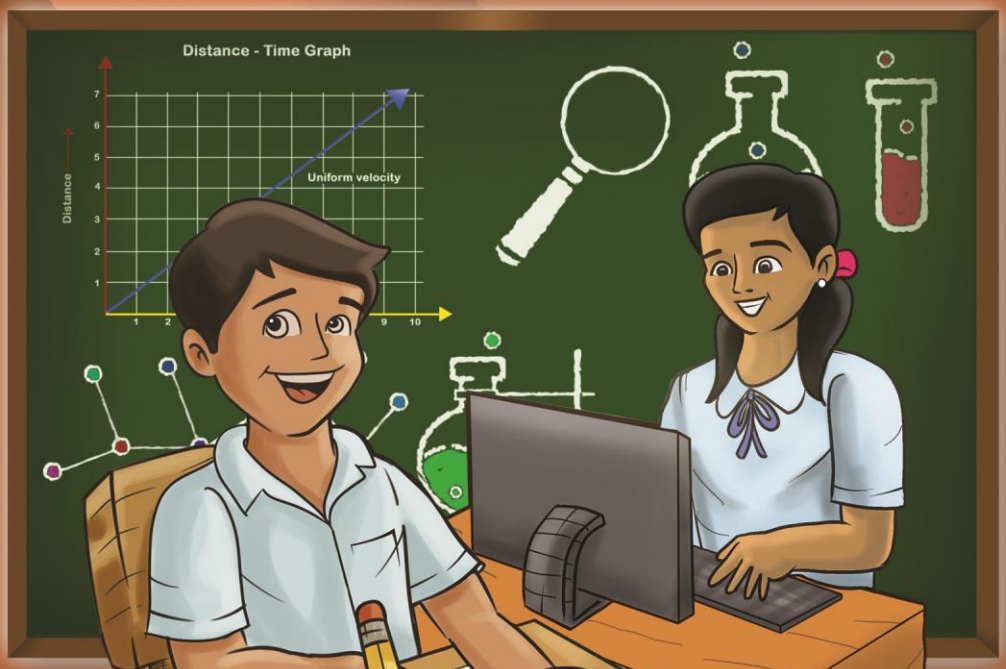
NATIONAL LEARNING CAMP

DepED DEPARTMENT OF EDUCATION

Science

Consolidation Learning Camp

Notes to Teachers



Consolidation Learning Camp

Notes to Teachers

Science Grade 8

Week 1 to Week 3

Lessons 1 – 18

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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 students who have recently completed Grade 8, consists of 25 main lessons each focused on a single Key Idea (KI), and 5 consolidation. All 30 lessons are designed for a lesson duration of 45 minutes.

The set of 18 lessons is comprised of single lessons addressing **Key Ideas** developed from the Grade 8 curriculum content. The Key Ideas are largely based on selected Most Essential Learning Competencies (MELCs) for the four Quarters of the Grade 8 content.

The consolidation lessons, Lessons 6, 12 and 18 are each delivered at the end of Week 1, 2 and 3of 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 so that they can demonstrate their developing 21st century skills, including *interpreting and analyzing information and data*, *thinking critically to solve real world problem*, and *communicate deep understanding*.

The science lesson plan sequences are designed to progressively build on what learners know and can do across science content 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 establish developmental frameworks for learners so that they can develop deeper understanding through recognizing the ways science language builds concepts and through applying their understanding to familiar and authentic situations.

It is important that teachers 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 chart, 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 that require learners to find the answer from specific words in the text;
- Inferential questions that 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 that require learners to create responses by linking information provided or by drawing on their personal knowledge and experience; and
- Evaluative questions that 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 own knowledge.
•	Relating two or more pieces of information provided in the stimulus.
•	Calculating answers given information provided in the stimulus.
•	Using their own knowledge and understanding to issues presented in the stimulus.

Lessons are designed to give learners time to explore science ideas deeply and from a number of 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 be giving answers and require learners to work backwards, 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 learners' answers across a wide range or level of responses including the following:

- single words, phrases or statements (SIMPLE level responses),
- lists a number of correct ideas identified, but not clearly 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. It 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

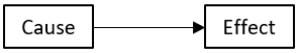
The science lessons are designed to promote deeper and higher order thinking through the use of the following approaches:

- **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 to develop 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 learning helps learners understand concepts easily due to the fact it stimulates images and affects their cognitive capabilities. In fact, 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.

  With a food chain, 

, the arrow shows energy flows **from** plant **to** animal, and the arrow can be appropriately interpreted as "**is eaten by,**" rather than "eats."

- **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 that the teacher collects the student 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 or at the beginning of the next 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 and their students, and with students and their peers.

At the same time, the expectation is that teachers will enhance their own 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
- briefly 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, prior to 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 in later lessons, if relevant.

Lesson Component 2 (Lesson Intention)

This component offers teachers the opportunity to explain to the class the intention or purpose of the lesson. The explanation should link with student 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, in clear language, 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 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 brain and learning. Finally, it is important *not to* overwhelm students with excessive and unnecessary detail that could disengage them at this early point in the lesson.

Lesson Component 3 (Lesson Language Practice)

Component 3 concerns language use – speaking, hearing, listening, and comprehending. The focus is on words or phrases that are important to this lesson. It maybe language that has the potential to cause difficulties for the students through speech, interpretation, or understanding, or simply a reminder that these words are important to, or will be used in, this lesson. Typically, the language identified is restricted to about 6 words/phrases so that there is enough time for students to use them in practice.

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 aspect more familiar, enabling students to re-allocate resources to a problem solution, 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, being able to spell it, or using it in a specific context. This may also involve helping students to understand or unpack a visual text, diagram or graph, e.g., for a graph, 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)

Addressing the key idea for the lesson is the focus of Component 4. It involves students applying known content to solve non-routine problems or interpreting new texts. This requires students to interpret/understand the meaning of the stem of the problem correctly and then answer a few questions of varying degrees of complexity related to the stem. The stem holds the needed information that will be the basis for the questions. Following the stem is a small number of questions that can be answered by utilizing students' background content knowledge and understanding, together with information in the stem.

From a learning perspective, the lessons are intended to help students consolidate their understanding at different levels of difficulty, e.g., the early questions are at an elementary level allowing the students to get started, then the next level is directed at the majority of students and usually requires a number of steps to reach a conclusion, and, finally, the third question attempts to offer all students the opportunity to be challenged and experience enhancements of their learning through seeing how ideas are connected or applied.

(Note: The level of difficulty of the questions should not stop any student from being given the opportunity to experience, with support, 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 point of question levels is to at least have students experience these more demanding questions and their answers as the start of the process for their learning journey. It is also designed to offer teachers a more realistic view of potential expectations of students in their class.)

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 are given the time/opportunity to understand the stem.

Then, in 4B and 4C, two separate set 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 build on as a base of what the student knows.

Note: It is important that students 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 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 and 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 are able to 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, 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

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 own thinking – which can be further enhanced by teacher modelling.

Part C: Curriculum References and Codes, and Teachers Notes for Lessons

Grade 8 Lesson 1: *Balanced and Unbalanced Forces.*

Key Idea: *Net Force* is the sum of all the forces acting on an object; When the forces acting on an object are balanced, there is no net force (F_{net}) and so the object will not move. When the forces acting on an object are unbalanced, there is net force (F_{net}) and so the object will move.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Force, Motion and Energy;* **Grade – Quarter**: *Grade 8 – First Quarter*
Content Section: 1. Laws of Motion; 1.1 Law of Inertia, 1.2 Law of Acceleration, 1.3 Law of Interaction
Most Essential Learning Competency (MELCs), Week 1-2:

1. investigate the relationship between the amount of force applied and the mass of the object to the amount of change in the object's motion; (S8FE-Ia-15)
2. infer that when a body exerts a force on another, an equal amount of force is exerted back on it; (S8FE-Ia-16)
3. demonstrate how a body responds to changes in motion; (S8FE-Ib-17)

LESSON OVERVIEW:

The lesson is about balanced and unbalanced forces and how forces can affect the way an object moves. [Note that the *Key Idea* includes reference to the formal symbol for symbol net force, (F_{net}), however, this is just for teacher information – it is not expected that Grade 8 students will use this annotation.]

The lesson also identifies if learners can identify, use and generate explanatory symbolic representations to describe the direction, magnitude, and effect of forces.

For teacher background:

At the macroscale, the motion of an object subject to forces is governed by Newton's Second Law of Motion. Under everyday circumstances, the mathematical expression of this law in the form *F = ma* (i.e., total force = mass times acceleration) accurately predicts changes in the motion of a single macroscopic object of a given mass due to the total force on it.

Component 1: Short Review

The intention here is to use questions that will trigger for the learners their prior learning about *motion* and *forces*. It uses questions that will help the teacher check if learners have the language and understanding for the lesson and later lessons. The three questions are designed to check if students have an *everyday* understanding and/or a *scientific* understanding of the situation.

For Question 3 (Q3), the teacher may need to help students to represent physics phenomena in *words, symbols, or drawings,* by giving an example for another situation, e.g., *pointing up =* ↑.

Component 3: Lesson Language Practice

The focus here is to prepare students to read and understand the main stimulus for the lesson. The words selected for students to practice often have a unique or more precise

meaning in science compared to when the words are used in more very-day language situations. It can be useful to discuss some ways these words can be used in a variety of situations in the local community and then to make sure students understand these meanings can be different when they are used in science.

Component 4: Lesson Activity
Please be sure to point out to students that the stimulus information box includes *symbolic representations* of forces that help explain what is happening. (These types of representations can also be referred to as free-body diagrams).

The challenge for many students in this main lesson activity will be to identify relevant information and to connect the statement about balanced and unbalanced forces to the *symbolic representations.* The activity is designed to assist students to develop a more **relational** understanding of force and motion. They should begin to see the *cause-and-effect* relationships between forces and motion: cause → effect e.g., *an unbalanced force causes the effect of an object moving*.

It may be useful to discuss the concepts of net force in Component 4C Question 3 if required:

- The net force when forces are balanced = 0 = no movement or change in movement.
- There is a net force when forces are unbalanced = movement or a change in movement.

Component 5: Lesson Conclusion
The intention here is to get some quick feedback from the students 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 8 Lesson 2: *Let's get rolling!*

Key Idea: A force acting on an object is not seen directly but is detected by its effect on the object's motion or shape.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Force, Motion and Energy;* **Grade – Quarter**: *Grade 8 – First Quarter*
Content Section: 1. Laws of Motion; 1.1 Law of Inertia, 1.2 Law of Acceleration, 1.3 Law of Interaction
Most Essential Learning Competency (MELCs), Week 1-2:

1. investigate the relationship between the amount of force applied and the mass of the object to the amount of change in the object's motion; (S8FE-Ia-15)
2. infer that when a body exerts a force on another, an equal amount of force is exerted back on it; (S8FE-Ia-16)
3. demonstrate how a body responds to changes in motion; (S8FE-Ib-17)

LESSON OVERVIEW:
The intention here is to focus on changes in ***motion***. Changes in ***shape*** can be done at a later date, maybe by using collisions to change the shape of soft paper shapes or plasticine.

This lesson uses the following teaching strategies:

- Modelling the use of student experiments to help students learn – an ***inquiry approach***. This approach sets a *guided challenge* to students to help them think about the science concepts involved. An inquiry approach also provides students with an environment to learn from mistakes and to share their thinking with other students and the teacher. Good questions help guide the students.
- The progressive introduction of *technical science terms*, as needed, within everyday English language. Technical terms are written in *italic type*, to signal the terms to students. This helps students to identify that some words and phrases are used differently in science – they have technical meaning.

The lesson will help students to:
- explain phenomena scientifically,
- identify the question explored in a given scientific study.
- recognize, offer and evaluate explanations.
- recall and apply appropriate scientific knowledge.

Concepts and processes to keep in mind:
- There may be a need to adjust the levels of the questions depending on the prior learning and understanding that students display in their answers in Components 1, 3 and 4.
- There may be a need to discuss with students the concept that 'when *forces* are *balanced*, there is *no net force*'. *Net Force* (F_{net}) is the sum of all the forces acting on an object.

Component 1: Short Review
The **Short review** uses human and societal impacts to identify student understanding.

Component 2: Lesson Purpose
When introducing the lesson, it is important to recognize that the concept of *force* is a very difficult one for people to understand, because in is often intangible (imperceptible), especially when we are trying to explain non-contact forces such as *magnetism* and *gravity*. These forces are relatively weak compared to, say, atomic forces.

At Grade 8, it is very acceptable for students to think of a force as a *push* or *pull*.

Component 4: Lesson Activity
The scenario presented, *Building a Force Detector*, provides an information box that draws on an experimental investigation with images, and a data table of results. This is the type of practical investigation that individual students or groups of students could do together. Such experiences help students to investigate forces in controlled experiments so that they can explore changing one variable at a time and using multiple trials to achieve valid and reliable scientific results.

The questions are designed to focus students on 1. practical investigation skills, and 2. Scientific knowledge and understanding involving force and motion. Acceleration is only mentioned and used briefly here to provide the independent variable.

Component 5: Lesson Conclusion

Questions here are designed to alert students to their **metacognitive skills** – helping them to learn **HOW** they learn. In this case, there are many questions that students can answer by directly finding the correct relevant information in the provided text. It can be helpful to explain to students that it is a good learning technique for them to use in assessments to look for answers that might be given in a text or stimulus. This also helps with understanding what is needed to answer questions.

Grade 8 Lesson 3: *Newton's First Law – The Law of Inertia*

Key Idea: An object at rest will remain at rest until acted upon by an unbalanced force, and an object in motion will stay in motion unless acted on by an external force. [Newton's First Law]

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Force, Motion and Energy;* **Grade – Quarter**: *Grade 8 – First Quarter*
Content Section: 1. Laws of Motion; 1.1 Law of Inertia, 1.2 Law of Acceleration, 1.3 Law of Interaction
Most Essential Learning Competency (MELCs), Week 1-2:

1. Investigate the relationship between the amount of force applied and the mass of the object to the amount of change in the object's motion; (S8FE-Ia-15)
2. infer that when a body exerts a force on another, an equal amount of force is exerted back on it; (S8FE-Ia-16)
3. demonstrate how a body responds to changes in motion; (S8FE-Ib-17)

LESSON OVERVIEW:

This lesson is designed to provide students with *scientific* and *everyday* meanings of key terms and then uses everyday situations to help students identify the scientific concepts associated with the *Law of Inertia.*

Component 1: Short Review

The short review checks if students are gaining an improved and progressing scientific understanding of force. The main intention in the review is to reinforce good concepts about gravity that will be needed and used later in the lesson and the lesson sequence.

Component 2: Lesson Purpose

While introducing the lesson, consider if all students understand **the concept of motion of objects.** Indicate that this lesson will draw on everyday situations to better understand how scientists explain what is happening when objects are stationary and what is happening when they are moving.

Component 3: Lesson Language Practice

The teacher might make a judgment on how long to practice using the highly technical terms provided. These are terms that relate to conceptual understanding that will take many students some time to acquire.

The teacher should also make a judgement on how much support students will need to engage in the scientific and non-scientific terminology contained in the Stimulus box.

Component 4: Lesson Activity

The teacher should decide how much help their students will need to recognize and interpret the 9 situations provided. The key is to help them to recognize how the Law explains the actions described in the situation. If the context appears foreign to the students, the teacher could provide an alternative situation; e.g., if students do not recognize the movement of tenpin ball in situations 4. and 5., the teacher could refer to some other situations that reflect the same basic science situation such as lawn bowls, or skittles, or the winter Olympic sport of curling to have students engage in the context.

For some students to answer Q3. in Component 4C, it might be necessary for the teacher to remind students that in most situations where an object is **in contact** with the ground or are on other objects that are **in contact** with the ground, there will be *gravity* acting down and *normal force* acting up against it.

Note also that the questions in **Component 4C** provide students with choice in the situations to explore deeply. It is very good if students choose to develop explanations for more than one situation.

Component 5: Lesson Conclusion

The intention here is to get some quick feedback from the students 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 8 Lesson 4: *Crash – Force Can Make the Difference.*

Key Idea: For any given object, a larger force causes a larger change in motion. [Newton's Second Law]

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Force, Motion and Energy;* **Grade – Quarter**: *Grade 8 – First Quarter*
Content Section: 1. Laws of Motion; 1.1 Law of Inertia, 1.2 Law of Acceleration, 1.3 Law of Interaction
Most Essential Learning Competency (MELCs), Week 1-2:

1. Investigate the relationship between the amount of force applied and the mass of the object to the amount of change in the object's motion; (S8FE-Ia-15)
2. infer that when a body exerts a force on another, an equal amount of force is exerted back on it; (S8FE-Ia-16)
3. demonstrate how a body responds to changes in motion; (S8FE-Ib-17)

LESSON OVERVIEW:

The intention of this lesson is to focus on connecting descriptive to quantitative ways to analyze motion. The main focus of the lesson is supporting students to think more

quantitatively. The lesson is designed to lead students to a deeper understanding of the Second Law through *Force* equals *Mass* times *Acceleration* (F=ma).
This lesson uses the following teaching strategies:

- Modelling the use of student experiments to help students learn – an ***inquiry approach***. This lesson builds on the concepts and thinking introduced in Lesson 2. The teacher may like to practice asking strategic questions to help guide the students. The students' responses will give great insights into what students really know and understand.
- Continued development of *technical science language*, as needed, established from everyday English language. Technical terms are written in *italic type*, to signal the terms to students. This helps students to identify that some words and phrases are used differently in science – they have *technical* meaning.

The lesson will help students to:

- explain phenomena scientifically;
- recognize, offer and evaluate explanations;
- recall and apply appropriate scientific knowledge; and
- evaluate a scientific investigation.

Concepts and processes to keep in mind:

- There may be a need to adjust the levels of the questions depending on the prior learning and understanding that students display in their answers in Components 1.
- There may be value in frequently leading students to consider the link between the acceleration of the cars and the force applied to the blocks (and the impact in terms of the distance the blocks are pushed).

Component 1: Short review
The **Short review** is aimed at linking the lesson to situations recognizable in everyday life.

Component 2: Lesson Purpose
When introducing the lesson, it is important to continue to reinforce the *cause and effect concept* (Cause → Effect) as this helps student to think relationally.

Component 3: Lesson Language Practice
This component provides a good opportunity to see if students can distinguish scientific terms, such as *mass* and *acceleration,* from non-technical terms, such as *Conducted, Wondered* and *Identical.*

Component 4: Lesson Activity
The scenario presented extends from Lesson 2, *Building a Force Detector*, by describing how a student used the same experimental set up to do further investigations.

The questions are designed to focus students more on 1. The experimental method, and 2. scientific knowledge and understanding about acceleration and motion. *Acceleration* is now much more prominent in the learning sequence, with inclusion in the data table.

Question 3 in Component 4C is the culmination of learning on the Second Law and may need more time than other components and questions, depending on the levels of understanding in the class.

Component 5: Lesson Conclusion

Two short questions here are designed to build **metacognitive skills** – helping them to learn **HOW** they learn. In this case, time might be well spent discussion with students about how to answer the harder questions.

Grade 8 Lesson 5: *A Balloon Rocket*

Key Idea: When one object exerts a force on a second object, the second object exerts an equal opposite force on the first object. The size of the force on the first object equals the size of the force on the second object. [Newton's Third Law].

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Force, Motion and Energy;* **Grade – Quarter**: *Grade 8 – First Quarter*
Content Section: 1. Laws of Motion; 1.1 Law of Inertia, 1.2 Law of Acceleration, 1.3 Law of Interaction
Most Essential Learning Competency (MELCs), Week 1-2: *2. infer that when a body exerts a force on another, an equal amount of force is exerted back on it;* (S8FE-Ia-16)

This lesson is designed to provide students with *scientific* and *everyday* meanings of key terms and then uses everyday situations to help students identify the scientific concepts associated with the *Law of Interaction,* also referred to as the *Law of Action and Reaction.*

Component 1: Short Review

The short review checks if students understand some basic language that will be used in the lesson, and to check if students can see the relationships between the associated words. The main intention in the review is to identify students who are operating with everyday language or scientific language, or maybe both.

Component 2: Lesson Purpose

While introducing the lesson, it might be useful to identify how many students have heard of the phrase, "To every action there is an equal and opposite reaction.", and how they interpret it.

Component 3: Lesson Language Practice

The teacher might make a judgment on how long to practice using the technical terms provided. The terms suggested here may have meanings for students who are interested in action or adventure movies or books. If so, it can be useful to draw on their knowledge, and use that to engage other students. The teacher should also make a judgement on how much support students will need to engage in the scientific and non-scientific terminology contained in the stimulus box.

Component 4: Lesson Activity

The teacher should decide how much help their students will need to recognize and interpret the situations provided. The situation could be easily replicated in the classroom if the school has some balloons and string.

Component 5: Lesson Conclusion

The intention here is to get some quick feedback from the students on the lesson and their interests for future learning. It would be good to find out the range of students' understanding about 'models' in everyday and science contexts.

Grade 8 Lesson 6: *Putting it All Together in a Golf Swing!*

Key Idea: When an acceleration is applied to an object, the object will then travel with constant velocity (i.e. at the same speed and direction) **until** it is acted on by an external force.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Force, Motion and Energy;* **Grade – Quarter**: *Grade 8 – First Quarter*
Content Section: 1. Laws of Motion; 1.1 Law of Inertia, 1.2 Law of Acceleration, 1.3 Law of Interaction
Most Essential Learning Competency (MELCs), Week 1-2:

1. *investigate the relationship between the amount of force applied and the mass of the object to the amount of change in the object's motion;* (S8FE-Ia-15)
2. *infer that when a body exerts a force on another, an equal amount of force is exerted back on it;* (S8FE-Ia-16)
3. *demonstrate how a body responds to changes in motion;* (S8FE-Ib-17)

This is a CONSOLIDATION lesson.

The lesson is about providing a quite different everyday context for students to practice how to apply scientific ideas that they have consolidated this week about ***motion***.

The learning strategy of analyzing component parts of a process is modelled in this activity. The lesson should help students to analyze and synthesize information to understand the problem of hitting a golf ball correctly. Teachers may have a chance to explain or show that Newton's three Laws of Motion are all used in modern tracking and coaching technologies, including in golf, in most sports involving moving equipment, and in tracking airplanes and space craft around and beyond the Earth.

Component 1: Short Review
The short review is aimed at helping students to see the connection between the study of specific aspects of science (such as forces and motion) and the application of science that scientists work on in our modern society.

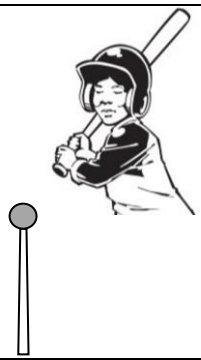
Component 2: Lesson Purpose
The lesson introduction gives the teacher the opportunity to signal the link between analyzing information (breaking into parts) and synthesizing information (bringing the parts together).

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 students might need help to distinguish vertical from horizontal which will be needed in some questions.

Component 4: Lesson Activity

The activity uses the sport of Golf as a familiar situation for hitting a stationary ball.

If golf is not generally known or recognized by students, the same questions could be easily applied to a similar situation such as hitting in T-ball. Other sports hitting an object from a stationary position at some time in a game would include hockey, ice hockey, football, etc.	

The concepts being addressed in this lesson are drawn from research that indicates that the most common **misconception** about Newtons first and second laws are ones that has been recognized over many years – it is the **misconceived idea** that sustaining motion requires a continued force. [REF: The Physics Classroom]

The main lesson activity gives the chance for teachers to find out what ideas students hold deeply, and to help them with more scientific ways to understand motion if necessary.

The teacher should decide how much help their students' need in this activity.

Component 4B has relatively simple and straightforward questions. Students should be able to recall the knowledge needed to answer from the lessons of the week. In answering the most difficult relational questions, the teacher may be able to help put together a good class answer from the part answers that student provide.

Component 4B has a more complex structure but the answers should not be beyond the students if they have been able to engage in prior lessons. The students might just need help to understand how to complete the table.

Component 5: Lesson Conclusion

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

Grade 8 Lesson 7: *Distinguishing Asteroids and Comets.*

Key Idea: Understanding the origin of asteroids and comets, and their motion helps scientists to explain the nature and formation of the Solar System.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Grade – Quarter: *Grade 8 – Second Quarter;* **Domain:** *Earth and Space*
Content Section: *3. Other members of the Solar System; 3.1 Comets, 3.2 Meteors , 3.3 Asteroids*
Most Essential Learning Competency (MELCs), Week 6: 9. *compare and contrast comets, meteors, and asteroids;* (S8ES-IIg-22)

LESSON OVERVIEW:

The lesson consolidates learners' understanding of how asteroids and comets form and travel in space and how they are visible from or how they can impact on Earth.

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 *Solar System* and the *Universe***.** It can be expected that learners will initially recall the *Major* member of the Solar System such as the *Sun*, *planets* and *moons*. Learners who recall the focus the curriculum places on the minor members of the Solar System will provide information about *asteroids* and *comets* and *meteors*. Asking learners to visualize in science is effective because it helps learners to understand concepts that are not directly observable.

Component 2: Lesson Purpose

This allows the teacher to make explicit not only the science concepts but also how learners will be extracting information from the stimulus box.

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 big numbers involved in describing distances and time when relating to the Solar System and the Universe.

Component 4: Lesson Activity

It is important to give learners plenty of time and support to visualize the context, especially where comets and asteroids are likely to be found in the Solar System. Help learners if they are finding this difficult so they can answer some or all of the questions.

A key lesson goal is for learners to be able to compare and contrast the features of comets and asteroids.

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.

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 8 Lesson 8: *Making Meaning of Meteoroids, Meteors & Meteorites.*

Key Idea: Analyzing the nature and origin of meteors and meteorites helps scientists to explain natural phenomena that occur with our planet as well as how the Solar System formed.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Grade – Quarter: *Grade 8 – Second Quarter;* **Domain:** *Earth and Space*
Content Section: *3. Other members of the Solar System; 3.1 Comets, 3.2 Meteors , 3.3 Asteroids*
Most Essential Learning Competency (MELCs), Week 6: *9. compare and contrast comets, meteors, and asteroids;* (S8ES-IIg-22)

LESSON OVERVIEW:

The lesson consolidates learners' understanding of the importance of describing scientific phenomena accurately.

The lesson consolidates the relationships between similar astronomical objects, and the use of flow charts to help learners to recognize the way that objects change depending on their journey through space.

Component 1: Short Review

The questions here are helping the learners to understand the scenario to be used in Component 4.

Component 2: Lesson Purpose

Please point out that this lesson provides learners with situations that may impact on our Earth in the future. It might be good to relate the scenario to some well-known movies about *Meteors.*

Component 3: Lesson Language Practice

This component is designed to help learners understand the terms being used. It is a good idea to ask learners to practice saying the words in a sentence because that helps them make connections to the concepts involved.

Component 4: Lesson Activity

It is important to give learners plenty of time and support to visualize the scenario. Help learners if they are finding this difficult so they can answer some or all of the questions.

Component 5: Lesson Conclusion

Questions here are designed to alert learners to their **metacognitive skills** – helping them to learn **HOW** they learn. In this case, there are many questions that learners can answer by directly finding the correct relevant information in the provided text. It can be helpful to explain to learners that it is a good learning technique for them to use in assessments to look for answers that might be given in a text or stimulus. This also helps with understanding what is needed to answer questions.

Grade 8 Lesson 9: *Food Chains and Energy*

Key Idea: Science texts often use flowcharts to communicate complex scientific ideas.

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
Content section: *1. Ecosystems, Transfer of energy through trophic levels.*
Most Essential Learning Competency, Week 5: 22. *describe the transfer of energy through the trophic levels.* (S8LT-IVi-22)

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 interactions of living things in an ecosystem.** The questions are focused on the recognition of **the terms used such as herbivore and carnivore.** This builds on students' previous experience in **using terms such as biotic and abiotic.**

Component 2 – Lesson Purpose and Intention.

This allows the teacher to make explicit not only the science concepts but also the skills that the students will be working on during this lesson. The skills involved in this lesson include **reading flow-charts** and **using technical language,** both essential requirements for learning science. The concept involved in this lesson is the concept that **there is a sequence of links that show how nutrients and energy are passed from one organism to another.**

Component 3 – Lesson Language Practice

This activity is designed to highlight the importance for students to be able to read, comprehend, and interpret **flow charts,** both for their learning and for answering questions. It is to see if they can **work out and say in words what a diagram means.** In this lesson **specific diagrams** that **represent the flow of nutrients and energy** are highlighted as these are relevant to the diagrams used in component 4 and so students have the opportunity to show what they think these **diagrams mean in words.**

Component 4 – Lesson Activity

The main lesson stimulus includes **diagrammatic representations of a number of food chains**. This provides students with examples from different ecosystems. The diagram is intended to help students **visualize the processes involved.** The questions in 4B **are to determine their level of knowledge of the terms used in food chains including, herbivore, carnivore, and omnivore.** Questions in 4C **are to determine whether students can apply their knowledge of the terms to ecosystems in the Philippines. A common misconception around food chains is that the organism at the end of the food chain has gained more nutrients and energy than, for instance, the plants have at the beginning. The reality is that as energy is passed on through the chain there is less and less energy available.**

Component 5 – Lesson Reflection

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

After the lesson: At the completion of each lesson, it is recommended that the teacher collects the student worksheets to review what students have recorded. Having the students 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 students at the next lesson. The teacher then has the opportunity to read some of the students' responses to the questions asked during the lesson on their worksheets.

Grade 8 Lesson 10: *Trophic Levels and Losing Energy – The Food Web!*

Key Idea: Science texts often use multi-step flowcharts to communicate complex scientific ideas.

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*
Content section: *1. Ecosystems, Transfer of energy through trophic levels.*
Most Essential Learning Competency, Weeks 5-6:

23. analyze *the roles of organisms in the cycling of materials* (S8LT-IVi- 23)
22. *describe the transfer of energy through the trophic levels.* (S8LT-IVi-22)

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 transfer of energy through the trophic levels in an ecosystem.** The questions are focused on the recognition of **the terms used such as *producers* and *herbivores*.**

Component 2 – Lesson Purpose and Intention.

This allows the teacher to make explicit not only the science concepts but also the skills that the students will be working on during this lesson. The skills involved in this lesson include **interpreting flow-charts** and **using technical language,** both essential requirements for learning science. The concept involved in this lesson is the concept that **there is transfer of energy through the trophic levels of an ecosystem.**

Component 3 – Lesson Language Practice

This activity is designed to highlight the importance for students to be able to read, comprehend and interpret **flow charts,** both for their learning and for answering questions. It is to see if they can **work out and say in words what a diagram means.** In this lesson **specific diagrams** that **represent the flow of nutrients and energy** are highlighted as these are relevant to the diagrams used in component 4 and so students have the opportunity to show what they think these **diagrams mean in words.**

Encourage students to speak out what the diagram is describing, e.g. "*Producers pass on some (10%) of their energy to first level consumers*.".

Component 4 – Lesson Activity

The main lesson stimulus includes a **diagram depicting the trophic levels in a food web.** This activity is designed to highlight the importance for students to be able to read, comprehend, and interpret **diagrams depicting the trophic levels in a food web,** both for their learning and for answering questions. It is to see if they can **work out and say in words what a diagram is showing.**

The questions in **4B** are seeking to determine students' levels of knowledge and skill in interpreting the relationships between the **plants, animals, and other organisms that transfer energy in an ecosystem.**

Questions in **4C** are to determine whether students can apply their knowledge about **the loss of calories as energy is transferred in an ecosystem that could be found in the Philippines.**

A common misconception around food webs is that the organisms that are higher in the food web gain more nutrients and energy than those that are lower in the food web. The reality is that as energy is passed on through the food web, there is less and less energy going to the animals higher up the trophic levels. **There may be a need to help students understand that only 10% of energy is passed on at each trophic level.**

Component 5 – Lesson Reflection

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

Grade 8 Lesson 11: *Humans and the Environment*

Key Idea: Science texts are often written with technical language that helps communicate complex scientific ideas.

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*
Content section: *4.Ecosystems, 4.*3 *Impact of human activities in an ecosystem*
Most Essential Learning Competency, Week 7: *25. suggest ways to minimize human impact on the environment*. (S8LT-IVj-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 about **the human impact on the environment.** The questions are focused on the recognition of **large-scale impact.** This builds on students' previous experience in **learning about the interactions between biotic and abiotic factors and the transfer of energy in organisms within ecosystems.**

Component 2 – Lesson Purpose and Intention.

This allows the teacher to make explicit not only the science concepts but also the skills that the students will be working on during this lesson. The skills involved in this lesson include **reading and using technical language,** both essential requirements for learning science. The concept involved in this lesson is the concept that **humans as part of an ecosystem have had and continue to have a significant impact on their environment.**

Component 3 – Lesson Language Practice

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

specific words are deforestation, erosion, and pollution are highlighted as relevant to the text used in component 4 and so students are given the opportunity **to match the words with their meaning.**

Component 4 – Lesson Activity

The main lesson stimulus includes a **short text describing one of the impacts humans have had on their environment over many hundreds of years and that is the process of deforestation. The text describes why it has occurred, what it has caused, and some suggestions on how it could be minimized.** Questions in 4B are directed at students' **comprehension and interpretation of the text** and in the questions of 4C students are asked to **relate the information from the text to issues in their own environment and globally.**

Component 5 - Lesson Reflection

This activity is designed to support students to take an active role in thinking about their learning. It is important to let students know that good learners reflect on their learning. The questions are designed to let the teacher know **whether the students found the text in component 4 interesting** and whether **they learned something about minimizing the impact of deforestation.**

After the lesson: At the completion of each lesson, it is recommended that the teacher collects the student worksheets to review what students have recorded. Having the students 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 students at the next lesson. The teacher then has the opportunity to read some of the students' responses to the questions asked during the lesson on their worksheets.

Grade 8 Lesson 12: Dynamics of a Food Web

Consolidation lesson: Science texts often use multi-step flowcharts that help communicate complex scientific ideas.

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*
Content section: *1. Ecosystems, Transfer of energy through trophic levels.*
Most Essential Learning Competency, Week 7:
22. describe the transfer of energy through the trophic levels (S8LT-IVi-22)
Related Curriculum Learning Competency, *Grade 7: 11. predict the effect of changes in one population on other populations in the ecosystem* (7LT-IIi-11)

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 **aspects of food chains and food webs.** This consolidates and draws on students' previous experience in **learning about the interactions between biotic and abiotic factors and the transfer of energy in organisms within ecosystems.**

Component 2 – Lesson Purpose and Intention.

This allows the teacher to make explicit not only the science concepts but also the skills that the students will be working on during this lesson. The skills involved in this lesson include **reading complex flow diagrams** and **using technical language,** both essential requirements for learning science. The concept involved in this lesson is the concept that **there is a dependence of one organism on another in an ecosystem.**

Component 3 – Lesson Language Practice

This activity is designed to highlight the importance for students to be able to read, comprehend, and interpret complex **flow diagrams,** both for their learning and for answering questions. It is to see if they can **work out and say in words what a diagram means.** In this lesson **a diagram of a complex food web** that indicates the **interdependence of one organism on another** is highlighted in the lesson activity

Component 4 – Lesson Activity

The main lesson stimulus includes a **diagrammatic representation of a food web**. This provides students with examples from **a familiar ecosystem**. The diagram is intended to help students **visualize the processes involved.** The questions in **B are to determine their understanding of the roles of the organisms in the food web and their level of understanding of how much energy is available in different trophic levels.** Questions in **C are to determine whether students can apply their knowledge and understanding of food webs to predict the effect of changes in one population on other populations in the ecosystem.**

Component 5 – Lesson Reflection

This activity is designed to support students to take an active role in thinking about their learning. It is important to let students know that good learners reflect on their learning. The questions are designed to let the teacher know **whether the students found the diagram of the food web interesting** and whether **they believed that they had increased their knowledge about ecosystems.**

After the lesson: At the completion of each lesson, it is recommended that the teacher collects the student worksheets to review what students have recorded. Having the students 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 students at the next lesson. The teacher then has the opportunity to read some of the students' responses to the questions asked during the lesson on their worksheets.

Grade 8 Lesson 13: *The Nature of Matter – Properties of Solids, Liquids and Gases*

Key Idea: Science texts are often written with technical language that helps communicate complex scientific ideas.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Matter;* **Grade – Quarter**: *Grade 8 – Third Quarter*
Content section: Properties 1.1. *Characteristics of solids, liquids, and gases*
Related Curriculum Learning Competency, Grade 3: 1. *describe different objects based on their characteristics (e.g. Shape, Weight, Volume, Ease of flow);* (S3MT-Ia-b-1)

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 classifying the states of matter. The questions are focused on using definiteness of shape and volume for this purpose. Although this has been identified in Grade 3 curriculum content, this understanding is essential prior knowledge for the next step to classify the states of matter based on the arrangement and motion of the particles in solids, liquids, and gases identified in Grade 8 and it is therefore critical to revisit this material learned 4 years previously.

Component 2 – Lesson Purpose and Intention.

This allows the teacher to make explicit not only the science concepts but also the skills that the students will be working on during this lesson. The skills involved in this lesson include reading (a science text) and using technical language, both essential requirements for learning science. The concepts involved in this lesson are firstly that there are three states of matter namely solids, liquids and gases and that the differences between each of these states can be described by the properties of definite shape and definite volume.

Component 3 – Lesson Language Practice

This activity is designed to highlight the importance for students 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 shape, definite, liquid, volume, and gas are highlighted as relevant to the text used in component 4 and so students 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 materials that help the students visualize examples of solids liquids ,and gases. This will assist the students to use the properties of definite shape and definite volume to classify common materials as solids, liquids or gases. The questions in 4B are to determine their knowledge and understanding of these concepts. The main lesson stimulus

and the questions in 4C further enhance student's experience by introducing the idea of measuring volume and how that can be done accurately for solids, liquids, and gases. 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 students to take an active role in thinking about their learning. It is important to let students 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 properties of shape and volume and which of the questions 4B or 4C were more difficult and why.

After the lesson: At the completion of each lesson, it is recommended that the teacher collects the student worksheets to review what students have recorded. Having the students 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 students at the next lesson. The teacher then has the opportunity to read some of the students' responses to the questions asked during the lesson on their worksheets.

Grade 8 Lesson 14: *The Nature of Matter – Maria's Special Drink*

Key Idea: Scientific knowledge about solids liquids and gases helps to solve real-life problems.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Matter;* **Grade – Quarter**: *Grade 8 – Third Quarter*
Content section: Properties 1.1. *Characteristics of solids, liquids, and gases*
Most Essential Learning Competency (MELCs), Weeks 1-2: *Explain the properties of solids, liquids, and gases based on the particle nature of matter;*
Related Curriculum Learning Competency:
Grade 3: 1. *1. describe different objects based on their characteristics (e.g. Shape, Weight, Volume, Ease of flow);* (S3MT-Ia-b-1)
Grade 7*: 1. describe the components of a scientific investigation* (S7MT- Ia-1)

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 classifying the states of matter. The questions are focused on using definiteness of shape and volume for this purpose. Although this has been identified in Grade 3 curriculum content, this understanding is essential prior knowledge for the next step to classify the states of matter based on the arrangement and motion of the particles in solids, liquids, and gases identified in Grade 8 and it is therefore critical to revisit this material learned 4 years previously.

Component 2 – Lesson Purpose and Intention.

This allows the teacher to make explicit not only the science concepts but also the skills that the students will be working on during this lesson. The skills involved in this lesson include reading (a science text) and using technical language, both essential requirements for learning science. The concepts involved in this lesson are firstly that there are three states of matter namely solids, liquids, and gases and that the differences between each of these states can be described by the properties of definite shape and definite volume.

Component 3 – Lesson Language Practice

This activity is designed to highlight the importance for students to be able to read, comprehend, and interpret science texts**,** both for their learning and for answering questions. In this lesson, the specific words ***solid, states of matter*** build on Lesson 13 words such as *shape, definite, liquid, volume,* and *gas*. This component gives students the opportunity to complete a table about the everyday meanings of words compared to the scientific meanings of words. Suggest to students to use their own words to give a meaning for these scientific terms. Give encouragement to students' answers. Read out some answers for students to write down. This may come from one or several of the students or from the sample answer.

Component 4 – Lesson Activity

The main lesson stimulus provides a scenario using everyday materials that should help the students visualize a challenge in understanding solids and liquids. The questions in 4B are to determine their knowledge and understanding of the stimulus and how to measure liquids. The questions in 4C focus on real-life problem solving.

Component 5 – lesson Reflection

The lesson conclusion is designed to support students to take an active role in thinking about their learning. It is important to let students 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 properties of shape and volume and which of the questions 4B or 4C were more difficult and why.

After the lesson: At the completion of each lesson, it is recommended that the teacher collects the student worksheets to review what students have recorded. Having the students 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 students at the next lesson. The teacher then has the opportunity to read some of the students' responses to the questions asked during the lesson on their worksheets.

Grade 8 Lesson 15: *The Particle Nature of Matter*

Key Idea: The properties of solids liquids and gases can be described scientifically using the *particle model*.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Matter;* **Grade – Quarter**: *Grade 8 – Third Quarter*
Content section: 1. *The Particle Nature of Matter*
Most Essential Learning Competency, Weeks 1-2: 1*. Explain the properties of solids, liquids, and gases based on the particle nature of matter*. (S8MT-IIIab-8)

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 particle nature of matter. The questions are focused on – the properties of solids, liquids, and gases in terms of particles. This builds on student understanding of the properties of solids, liquids, and gases in terms of shape and volume from the previous lessons and as identified in Grade 3 curriculum content.

Component 2 – Lesson Purpose and Intention.

This allows the teacher to make explicit not only the science concepts but also the skills that the students will be working on during this lesson. The skills involved in this lesson include reading diagrams and using technical language, both essential requirements for learning science. The concepts involved in this lesson are firstly that the changes of state between solids, liquids, and gases can be explained and identified by the arrangement and motion of the particles and that all matter (anything that has mass and takes up space) is made of particles and that the differences between the three states of matter (solids, liquids, and gases) can be described by the differences in the arrangement and motion of particles.

Component 3 – Lesson Language Practice

This activity is designed to highlight the importance for students to be able to read, comprehend, and interpret science diagrams both for their learning and for answering questions. It is to see if they can work out and say in words what a diagram means. In this lesson specific diagrams that represent particles are highlighted as these are relevant to the diagrams used in component 4 and so students have the opportunity to show what they think these **diagrams mean in words.**

Component 4 – Lesson Activity

The main lesson stimulus includes diagrammatic representations of the three states of matter. This will assist students to use the arrangement and motion of particles to identify the three states of matter: solids, liquids, and gases and to explain their properties of shape and volume. The diagram is intended to help students visualize particles and their motion and arrangement. As these particles are unseen by us with a naked eye, the diagrammatic representation becomes very important to reach a better understanding of this concept. The questions in 4B are to determine their knowledge and understanding of these concepts. Questions in 4C are moving toward an appreciation of the changes of state and the introduction of heat as a form of energy needed in this process. The particulate view of matter is counter intuitive and the use of diagrams is intended to assist with this problem.

Component 5 - Lesson Reflection

This activity is designed to support students to take an active role in thinking about their learning. It is important to let students know that good learners reflect on their learning. The questions are designed to let the teacher know which questions or diagrams the students found useful to improve their knowledge and or understanding about the particle nature of matter and what they found difficult, and why.

After the lesson: At the completion of each lesson, it is recommended that the teacher collects the student worksheets to review what students have recorded. Having the students 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 students at the next lesson. The teacher then has the opportunity to read some of the students' responses to the questions asked during the lesson on their worksheets.

Grade 8 Lesson 16: *Changes of State in Terms of Particles*

Key Idea: The physical changes in states of matter can be described and explained scientifically using the particle model.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Matter;* **Grade – Quarter**: *Grade 8 – Third Quarter*
Content section: 1. *The Particle Nature of Matter*
Most Essential Learning Competency, Weeks 3-4: 9*. Explain physical changes in terms of the arrangement and motion of particles, atoms and molecules;* (S8MT-IIIc-d-9) [Note: the lesson does not address nor focus on *atoms* or *molecules*]

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 particle nature of matter. The questions are focused on physical changes in terms of the arrangement and motion of particles. This builds on student understanding to classify the states of matter based on the arrangement and motion of the particles in solids, liquids and gases in the previous lesson.

Component 2 – Lesson Purpose and Intention.

This allows the teacher to make explicit not only the science concepts but also the skills that the students will be working on during this lesson. The skills involved in this lesson include reading diagrams and how important this is for learning and when answering questions. The concepts involved in this lesson are that the changes of state between solids, liquids, and gases can be explained and identified by the arrangement and motion of the particles.

Component 3 – Lesson Language Practice

This activity is designed to highlight the importance for students to be able to read, comprehend, and interpret science diagrams both for their learning and for answering questions. It is to see if they can work out and say in words what a diagram means**.** In this lesson, specific diagrams that represent change of state are highlighted as these are relevant to the diagrams used in component 4 and so students are given the opportunity to show what they think these diagrams mean in words.

Component 4 – Lesson Activity

The main lesson stimulus includes diagrammatic representations of the arrangement and motion of particles in a change of state event**.** This will assist students to visualize particles and their motion and arrangement. As these particles are unseen by us with a naked eye, the diagrammatic representation becomes very important to reach a better understanding of this highly abstract and symbolic concept. This activity further enhances the students' knowledge and understanding of the scientific terms used for the processes of change of state. The questions in 4B and 4C are directed at this level of knowledge and understanding and are consolidating the concept that heat as a form of energy is needed in some of these processes. Scientific language often includes nominalizations and abstractions which are difficult for many students to understand and use.

Component 5 – Lesson Reflection

This activity is designed to support students to take an active role in thinking about their learning. It is important to let students know that good learners reflect on their learning. The questions are designed to let the teacher know which diagrams the students found difficult to read and which of the questions 4B and 4C they found the most difficult and why.

Grade 8 Lesson 17: *Change of State in the Water Cycle*

Key Idea: Science texts often use flowcharts to communicate complex scientific ideas.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Matter;* **Grade – Quarter**: *Grade 8 – Third Quarter*
Content section: 1. *The Particle Nature of Matter*
Most Essential Learning Competency, Weeks 3-4: 9*. Explain physical changes in terms of the arrangement and motion of particles, ~~atoms and molecules;~~* (S8MT-IIIc-d-9) [Note: the lesson does not address nor focus on *atoms* or *molecules*]

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 processes involving change of state in the water cycle. The questions are focused on what the processes are and the role of the sun in these processes*.* This builds on student understanding of the names of the processes involved in the changes of state for matter from the previous lesson.

Component 2 – Lesson Purpose and Intention.

This allows the teacher to make explicit not only the science concepts but also the skills that the students will be working on during this lesson. The skills involved in this lesson include reading (using technical language) and completing diagrammatic representations of a water cycle in nature. The concepts involved in this lesson are firstly that the differences between the three states of matter (solids, liquids and gases) can be described by the differences in the arrangement and motion of particles as well as that the physical changes can be explained in terms of the arrangement and motion of particles and that this can be used to understand and explain the water cycle in nature.

Component 3 – Lesson Language Practice

This activity is designed to highlight the importance for students to be able to read, comprehend and interpret science diagrams both for their learning and for answering questions. It is to see if they can work out and say in words what a diagram means**.** In this lesson a specific diagram that demonstrates the physical processes of change for water from a solid to a liquid, to a gas is highlighted as it is relevant to the diagram and the text in component 4. Students are given the opportunity to show what they think these diagrams mean in words.

Component 4 – Lesson Activity

The main lesson stimulus includes a written text outlining the steps in a water cycle as well as a labelled illustration of a water cycle in nature. This will assist students to visualize the processes that take place in nature and provide an opportunity for them to relate their understanding of the physical changes that occur between a solid, a liquid and a gas from their previous lesson to an understanding of the water cycle in the real world. For the questions in 4B the students are required to obtain information from a text to complete the diagram of the water cycle. For the questions in 4C students are asked to predict the effect on the water cycle if energy from the sun is not available for periods of time. This is looking at the science of change of state and the particle model at a more global level. Some students will have difficulty in moving from the theoretical to a practical 0currence in nature.

Component 5 - Lesson Reflection

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

so why. The questions are also aimed to find out if the students found using scientific / technical language in the diagram interesting.

After the lesson: At the completion of each lesson, it is recommended that the teacher collects the student worksheets to review what students have recorded. Having the students 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 students at the next lesson. The teacher then has the opportunity to read some of the students' responses to the questions asked during the lesson on their worksheets.

Grade 8 Lesson 18: *Heating Water – An Experiment*

CONSOLIDATION LESSON: Science texts often include graphs to communicate trends in data.

CURRICULUM REFERENCES

Curriculum: *K to 12 Science Curriculum Guide (Grade 3 to Grade 10) August 2016*
Domain: *Matter;* **Grade – Quarter**: *Grade 8 – Third Quarter*
Content section: 1. *The Particle Nature of Matter*
Most Essential Learning Competencies:
Weeks 1-2: 8*. Explain the properties of solids, liquids, and gases based on the particle nature of matter;* (S8MT-IIIab-8)
Weeks 3-4: 9*. Explain physical changes in terms of the arrangement and motion of particles, atoms and molecules;* (S8MT-IIIc-d-9) [Note: the lesson does not address nor focus on *atoms* or *molecules*]

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 processes involving heat in changes of state.

Component 2 – Lesson Purpose and Intention.

This allows the teacher to make explicit not only the science concepts but also the skills that the students will be working on during this lesson. The skills involved in this lesson include reading graphs and how important this is for learning and when answering questions. The concepts involved in this lesson are that the changes of state between solids, liquids, and gases can be explained and identified by the arrangement and motion of the particles and that these changes require energy in the form of heat.

Component 3 – Lesson Language Practice

This activity is designed to highlight the importance for students to be able to read and interpret science diagrams and graphs both for their learning and for answering questions. It is to see if they can work out and say in words what a graph means. In this lesson, specific graphs that represent change of state are highlighted as these are relevant to the graph used in component A and so students are given the opportunity to show what they think these graphs mean in words.

Component 4 – Lesson Activity

The main lesson stimulus includes diagrammatic representations of an experiment a small group of students did under instruction**.** This will encourage students to feel confident to answer the questions. This activity enhances the students' knowledge and understanding about change of state as they see confirmation of the need for heat energy in a real-life process. The questions in B and C are directed at this level of knowledge and understanding and are consolidating the concept that

heat as a form of energy is needed. A common misunderstanding about change of state is that while the ice melts the temperature would be going up but that is not the case while the change of state occurs the temperature remains the same. Particle kinetics, an abstract idea, is counterintuitive for many students.

Component 5 - Lesson Reflection

This activity is designed to support students to take an active role in thinking about their learning. It is important to let students 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 the particle model and which of the questions B and C they found the most difficult and why.

After the lesson: At the completion of each lesson, it is recommended that the teacher collects the student worksheets to review what students have recorded. Having the students 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 students at the next lesson. The teacher then has the opportunity to read some of the students' responses to the questions asked during the lesson on their worksheets.

For inquiries or feedback, please write or call:

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