SCIENCE & TECHNOLOGY

ENHANCED CURRICULUM 2021

Grade Five (5)

EFFECTIVE SCHOOLS SKN
REACH. GROW. DEVELOP

Ministry Of Education
Education Planning Department
Curriculum Development Unit- Teacher Resource Center

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INTRODUCTION

The Ministry of Education of St. Kitts and Nevis has developed this curriculum to assist teachers as they continually strive for greater success for our students. The curriculum is the result of extensive consultation within the Federation where our citizens expressed their aspirations for education. It has culminated in the preparation of a Curriculum and Assessment Framework that has guided curriculum development. For the first time in the Federation's history, we have a statement of the attributes of educated persons:

Educated persons from St. Kitts and Nevis will reach their full potential academically, physically, socially, culturally, emotionally, and morally, applying these skills to think critically and creatively, live respectfully, communicate effectively, and contribute responsibly to sustainable national development.

This vision is followed with seven essential education competencies that highlight the priorities for education. Stakeholders from throughout the Federation agreed that an educated person in St. Kitts and Nevis:

1. Is an engaged, responsible, caring, tolerant participant in civil society.
2. Is creative, enterprising, and resilient.
3. Thinks critically, communicates effectively, and solves problems.
4. Leads a healthy and active life.
5. Demonstrates technological empowerment.
6. Uses literacy and numeracy to understand, appreciate and act in the world.
7. Demonstrates an appreciation for the culture of St. Kitts and Nevis

The essential education competencies have served as a foundation for the development of the curriculum with the goal of ensuring that every student has the opportunity to reach his/her full potential. Eight principles of learning, nine principles of assessment and extensive goals for inclusivity and integration form the basis for a curriculum that reflects the priorities, culture and context of St. Kitts and Nevis. These appear in the complete Curriculum and Assessment Framework that has been appended to this curriculum.

The curriculum is also informed by International Standards and the OECS Learning Standards which have been tailored to reflect the unique context and diversity of our Federation. Key International Standards that have informed curriculum enhancement include:

Language Arts – International Literacy Association
Health and Wellness - UNESCO, WHO and Canadian Health Education Curricula

Mathematics – National Council of Teachers of Mathematics (approx. 100,000 members)
Science – Next Generation of Science Standards (developed with input from the National Science Teachers Association and the US National Research Council)
Social Studies – National Council of Social Studies College Career and Civic Life Framework for Social Studies Standards

The curriculum places an emphasis on knowing individual students so that teachers might chart individual progress and target teaching. Using Universal Design for Learning, the curriculum endeavours to include all learners and provide approaches to learning that represent the diversity of students in St. Kitts and Nevis. The curriculum emphasizes an assets-based approach to education where learning builds on students' prior knowledge and encourages more student discussion as this is one of the most powerful tools to literacy development. The incorporation of technology has been embedded in the curriculum. Technology will also be used to access the wealth of learning resources that are available through the internet. The effective use of technology coupled with extensive curriculum materials obtained from a variety of sources reduces the dependence on traditional textbooks.

The curriculum has been developed using the backward design approach (Wiggins & McTighe, 1999; 2008) where essential learning outcomes have been carefully determined and articulated. This is followed by a means of determining whether students have achieved the outcomes. Each essential learning outcome is divided into specific curriculum outcomes (SCOs) which outline the knowledge, skills and values envisioned to be obtained. Assessment strategies are provided so that teachers might determine where students are in the process toward the specific curriculum outcomes. Instructional strategies guide teachers in helping students achieve the outcomes described. The strategies include activities, discussions, debates, demonstrations, etc. and are accompanied by numerous resources that teachers might use. The guide also provides hints of knowledge that would be useful to teachers when exploring the essential learning outcome, inclusive resources that might be used, how technology might be incorporated and how integration might occur with other subjects. It describes how the curriculum specifically relates to the Curriculum and Assessment Framework so that teachers continually refer back to the foundation and the vision for educated persons in St. Kitts and Nevis.

How to use the Science and Technology Enhanced Curriculum

Purpose of the Subject: The study of science encompasses knowledge, processes, and values. Scientifically literate persons will foster an attitude of caring not only for themselves, but as responsible citizens, for the world around them. Their decision making will be enhanced by a systematic study of the structure and behavior of the physical and natural world through observation and experiment. In learning science, students benefit from leveraging and evaluating available technological tools to study and therefore understand the world and their relationship to it.

Topic: Structure and Properties of Matter

STEP ONE (1)

Essential Learning Outcome: Develop a model to describe that matter is of particles too small to be seen.

STEP TWO (2)

Grade Level Guidelines: Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students can demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

STEP THREE (3)

STEP FOUR (4)

Specific Curriculum Outcomes

Students are expected to:

Knowledge:

- Define the following:
  - Matter
  - Mass
  - Weight
  - States of matter
  - Physical change

STEP SIX (6)

Inclusive Assessment Strategies

Have students decide whether the following are true or false statements.

1. The light from a torch would be considered matter. (F)
2. The heat from a candle is not matter because it doesn't occupy space (T)
3. A bicycle weighs less than a car on earth (T)

STEP FIVE (5)

Inclusive Learning Strategies

Engage students in a discussion:
When you describe things around us, what words do we use?
That box of books for example. What words would you use to describe it? (*Typical responses: shape, length, width, height, weight, color*).
When scientists talk about something having a distinct shape, they often refer to it as being **matter**.

Useful Content Knowledge for the Teacher about the Outcome:

STEP SEVEN (7)

Glossary

Matter: everything that has mass and takes up space.

Mass: a measure of the amount of matter something is made from; we measure mass in grams and kilograms.

Properties: the special features or characteristics of something.

Physical properties: those characteristics which can be observed by the senses.

Chemical properties: characteristics which are not easily observed by senses, and which determine how substances behave.

Inclusive Resources and Materials Use of multisensory activities and materials to assist all learners.

STEP EIGHT (8)

Activity materials: box of books, alcohol, water, candle, ice cubes

Strategies that Support the Curriculum and Assessment Framework

STEP NINE (9)

Elements of the Essential Education Competencies that are addressed:	
Is an engaged, responsible, caring, tolerant participant in civil society	Critical thinking- analysing
Is creative, enterprising, and resilient	
Thinks critically, communicates effectively, and solves problems	Use of instructional videos
Leads a healthy and active life	Writing assignments
Demonstrates technological empowerment	Yes- folklore stories about predicting weather-condensation, precipitation
Uses literacy and numeracy to understand, appreciate and act in the world	Critical thinking- analysing
Demonstrates an appreciation for the culture of St. Kitts and Nevis	

Elements that are integrated across subjects:
Language arts; reading, writing, critiquing information.

Elements from Local Culture, Technology, TVET, Environment that are integrated:
Use of YouTube Video to support learning.

Items of Inspiration (teaching tips, inspirational passages, connections to educational research

Change of state must be handled carefully when using water as an example of typical properties- water is actually atypical in its behaviour

Topic One (1)

Structure and Properties of Matters

Purpose of the Subject: The study of science encompasses knowledge, processes, and values. Scientifically literate persons will demonstrate an attitude of caring not only for themselves, but as responsible citizens, for the world around them. Their decision making will be enhanced by a systematic study of the structure and behavior of the physical and natural world through observation and experiment. In learning science, students benefit from leveraging and evaluating available technological tools to study and therefore understand the world and their relationship to it

Topic: Structure and Properties of Matter

Essential Learning Outcome: Develop a model to describe that matter is made up of particles too small to be seen.

Grade Level Guidelines: Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students can demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

Specific Curriculum Outcomes

Students are expected to:

Knowledge

- Define the following
  - Matter
  - Mass
  - Weight
  - States of matter
  - Physical change
  - Chemical change
  - Physical property
  - Chemical property

- Explain that the objects and materials around us are made from matter

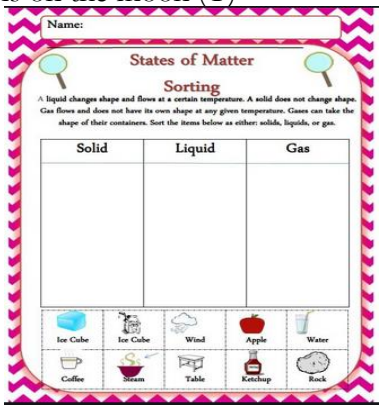
- Explain that matter has mass and takes up space.

- Demonstrate how particles move as it relates to temperature change

Inclusive Assessment Strategies

Have students decide whether the following are true or false statements.

1. The light from a torch would be considered matter. (F)
2. The heat from a candle is not matter because it doesn't occupy space (T)
3. A bicycle weighs less than a car on earth (T)
4. A bicycle weighs less than a car on the moon. (T)
5. The mass of a car is different on the earth than on the moon. (F)
6. The mass of a bicycle is the same on the earth as it is on the moon (T)



Inclusive Learning Strategies

Engage students in a discussion:
When you describe things around us, what words do we use?
That box of books for example. What words would you use to describe it? (*Typical responses: shape, length, width, height, weight, color*).
When scientists talk about something having a distinct shape, they often refer to it as being **matter**.
If you lift one book rather than the whole box it takes less energy, correct? On the earth that difference is called its weight- the box weighs more. If you take the box to the moon, it has the same shape, but it would have a different weight because the force of gravity is different on the moon. That is why astronauts on the moon seem to bounce when they walk (see: **https://www.youtube.com/watch?v=x2adl6LszcE** (2:52 min)

When scientists describe objects around us, they often refer to them as **matter**.

- Account for the change in properties of matter as we heat up the matter or cool it

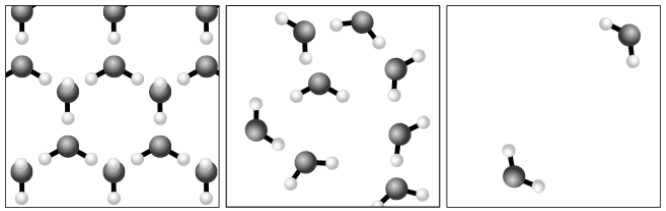
Skills

- Observe and describe some physical changes
- Observe and describe some chemical changes
- Identify and investigate solids, liquids, and gases
- Describe the properties of the solid, liquid and gas states of matter
- Use their bodies to dramatize/explain how particles move with temperature change and how that affects the state of matter.
- Explain and solve everyday problems that involve state change of matter

Retrieved from:
https://i.pinimg.com/736x/8f/ac/fd/8facfd810050abe52bb7115cb7fa063e--sorting-activities-science-activities.jpg

Simulating State Change
Have students stand up and pretend they are states of matter. Using their fists to represent particles of matter, ask them to simulate the physical change that occurs going from solid to liquid to gas as we heat the matter.

But Water is Unique
When water freezes it takes up more space in solid form than liquid because it forms hexagons



Solid Water Liquid Water Water Vapor (Gas)

Retrieved from:
https://web.stanford.edu/~peastman/statmech/phasetransitions.html

Pose this problem to students to think about overnight. You have a bottle of water, but it is warm and not very thirst quenching, so you place it in the freezer part of your refrigerator to get cold. You forget about it and when you awake in the morning, the bottle has burst open with ice inside. Why did the bottle expand?

The fact that the box doesn't change shape going to the moon means that while the weight might change the **mass** of the **matter** doesn't change.
Have students work in groups. Discuss the things listed here. Decide whether each has a mass and takes up space (Matter). Is it made from matter?
Sort the things into two groups: matter and not matter
Add some more items to your sets. Discuss your lists as a class.

Retrieved from: Bright Ideas: Student's Book 3

an apple a song a frog a beam of light a coin

the air in a football a thought kindness

the earth

Matter
Matter takes up **space.** Everything around us is made up of matter
(Rock, metal, plant, animals, plastic, glass)

Matter usually takes one of three forms (liquid, solid or gas). They are known as states of matter.

States of Matter
States of matter are characterised by the distance between their particles as we heat up a solid, the particles begin to move so that they collide and take up more space eventually becoming a liquid.

Values

- Participate in classroom discussions
- Look for applications of the matter theory to solve everyday problems.
- When conducting practical and group work, display sensitivity and offer assistance to peers who may have physical or learning challenges
- Demonstrate awareness of the need to recycle materials
- Show concern for their safety and that of others when using materials
- Appreciate the importance of accuracy and honesty
- Willingness to observe, question, explore and investigate
- Work collaboratively while exploring and investigating
- Appreciate that there are different materials around us

(The ice hexagons that form from particles of water take up more space than the liquid form of water, so the additional air space (in the middle) causes the water to expand as it freezes)
Water is different from most other things. Normally, the solid state takes up the least space.

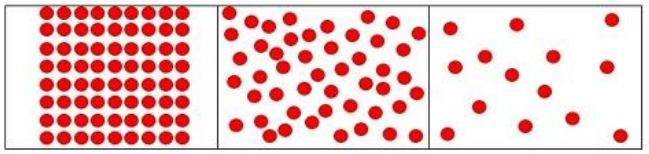
Application Question

Another question to pose as a challenge for homework. Why do bridges in cold climates have joints?
(The metal and concrete when warmed will have particles that move more and take up more space. They will therefore expand. If they are cooled, they will shrink as particles slow and take up less space. Bridge design must account for this movement otherwise the bridge would break!)

See:
https://www.popularmechanics.com/science/a18757126/how-and-why-bridges-are-made-to-move/

See video here:
https://www.youtube.com/watch?v=ihKok1qwCJc (0:57 mins)

If we further heat a liquid the particles get far apart and form a gas.
We can distinguish solids, liquids and gases based on their properties of shape, mass, and volume.



Solid Liquid Gas

Have students watch the following video:
https://www.youtube.com/watch?v=wclY8F-UoTE (4:34 mins)
and make note of answers to the following questions:

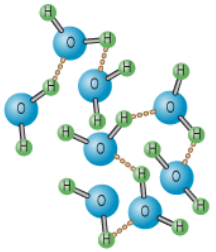
1) Do all of the states of matter have a constant volume?
2) Can all of the states of matter be compressed?
3) Can you pour all of the states of matter?

Provide students with a variety of substances which undergo phase changes. Elicit from students what would happen to these objects with temperature change? For example, what would happen if they were heated or if they were cooled?

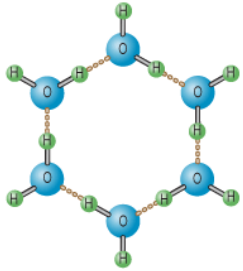
- Allow students to work in groups to arrive at predictions about what would happen in different scenarios. Have them observe changes that occur when rubbing alcohol is exposed to room temperature overnight. Have them also compare water in its liquid form to its solid form, ice. Have students note that these substances have been changed physically.

	Read each scenario then state whether it is a physical or chemical change Umm! A student removes a loaf of bread hot from the oven. The student cuts a slice off the loaf and spreads butter on it. Does the butter have a physical or chemical change? (P) _____ Your friend decides to toast a piece of bread but leaves it in the toaster too long. The bread is black and the kitchen if full of smoke. Does the bread undergo a chemical or physical change? (C) _____ You forgot to dry the bread knife when you washed it and reddish-brown spots appeared on it. Does the knife undergo chemical or physical change? (C)_____ In baking biscuits and other quick breads, the baking powder reacts to release carbon dioxide bubbles. The carbon dioxide bubbles cause the dough to rise. Does the baking powder undergo a chemical or physical change? (C) **Assessments** 1) Students should write a poem about the states of matter 2) Students should write a mystery story that involves a change in the state of matter 3) Students should research examples of what happens to metals when we heat them. 4) When we heat table syrup or oil it seems easier to pour. Have students explain with pictures, why that might happen.	• Help students form a definition for the term **physical change**. (a change in which no new substances are formed) • Explain to students that everything is made up of particles and normally at cold temperatures they are close together (solid). As we heat them up, they begin to move around and get further apart and behave like liquids. Finally, if we heat them enough, they move around rapidly colliding with each other getting far apart and behaving more like a gas. Students should watch the following video on particles of matter: **https://www.youtube.com/watch?v=npv74D2MO6Q** (3:49 mins) • Ask students to identify other substances that undergo physical changes. Demonstrate some of those changes. For example, heat can be applied to butter or wax so that students can observe melting. Boil some water until it changes to steam. Hold a piece of ice over the steam and allow the students to observe the change in the ice. Allow students to record and describe their observations. Explain to students that heating liquid water to form steam (called **evaporation**) only makes the particles of water move faster, get further apart, and form a gas (water vapor). If we cool this gas, the particles slow and we get liquid water back again. We call this **condensation.**

Water when cooled down behaves differently than many other substances. When the particles slow down from cooling, they actually form ice made up of hexagons (6 sided). That is why snowflakes are 6-sided.

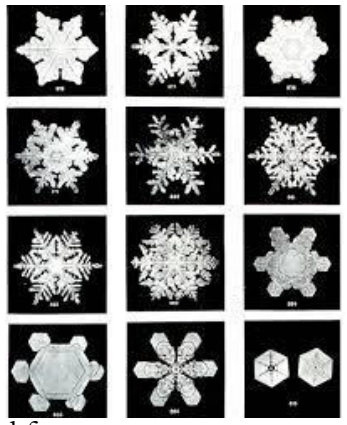


Structure of molecules in water



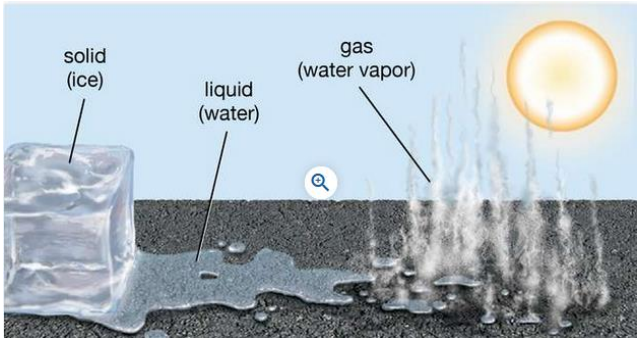
Structure of molecules in ice

Retrieved from:
http://mubirupepu.blogspot.com/2017/04/structure-of-water-and-ice.html



Retrieved from:
https://geology.com/articles/snowflakes/

Physical Change



Retrieved from:
https://www.britannica.com/science/phase-state-of-matter

If we melt an ice cube and it converts to liquid water, we can still freeze it again and get back the original ice cube. We have only changed the state of matter, not the chemistry-it is still water! If we heat water in a pot and place a glass plate over the top of the pot, we will see the steam condense under the plate and droplets fall back in the pot. The cool plate causes the water vapor (gas molecules) to slow down and form liquid water again. There is no chemical change, only a physical one.

Chemical Change

Set up a burning candle. Explain to students that the wick draws the melted wax into its core where it burns the wax as a fuel. How do we know there is a chemical change happening here? Some signs that are common:

- Heat is given off
- Light is given off
- A gas is given off

		• Color change of wax as it burns and leaves soot on the wick • Can we reverse the process and get back the wax again? No…therefore not just a physical change but a chemical transformation of the wax. See also: **https://www.youtube.com/watch?v=h4IBh7ZfEBI** (0:5 4 mins)

Useful Content Knowledge for the Teacher about the Outcome:

Glossary

Matter: everything that has mass and takes up space.

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Chemical properties: characteristics which are not easily observed by senses, and which determine how substances behave.

Inclusive Resources and Materials Use of multisensory activities and materials to assist all learners

Activity materials: box of books, alcohol, water, candle, ice cubes

Strategies that Support the Curriculum and Assessment Framework

Elements of the Essential Education Competencies that are addressed:

Is an engaged, responsible, caring, tolerant participant in civil society	
Is creative, enterprising, and resilient	
Thinks critically, communicates effectively, and solves problems	Critical thinking- analysing
Leads a healthy and active life	
Demonstrates technological empowerment	Use of instructional videos
Uses literacy and numeracy to understand, appreciate and act in the world	Writing assignments
Demonstrates an appreciation for the culture of St. Kitts and Nevis	Yes- folklore stories about predicting weather-condensation, precipitation

Elements that are integrated across subjects:
Language arts; reading, writing, critiquing information

Elements from Local Culture, Technology, TVET, Environment that are integrated:
Use of YouTube Video to support learning

Items of Inspiration (teaching tips, inspirational passages, connections to educational research):
Change of state must be handled carefully when using water as an example of typical properties- water is atypical in its behaviour

Purpose of the Subject: The study of science encompasses knowledge, processes, and values. Scientifically literate persons will foster an attitude of caring not only for themselves, but as responsible citizens, for the world around them. Their decision making will be enhanced by a systematic study of the structure and behavior of the physical and natural world through observation and experiment. In learning science, students benefit from leveraging and evaluating available technological tools to study and therefore understand the world and their relationship to it

Topic: Structure and Properties of Matter

Essential Learning Outcome: Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling or mixing substances the total weight of matter is conserved.

Grade Level Guidelines: Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

Specific Curriculum Outcomes

Students are expected to

Knowledge

- Define
  - Chemical change
  - Physical change
  - Closed system
  - Open system
- Explain how, for most solids, a physical change from solid to liquid doesn't change the mass of the object
- Explain why water in the form of ice weighs less than pure liquid (because the hexagonal ice structure captures air and not water molecules)
- Give an example of a chemical change in an open system
- Give an example of a chemical change in a closed system

Inclusive Assessment Strategies

Classroom discussion regarding experiments

Graphing Results (of total mass (ordinate which is the vertical or Y-axis) versus time of burning (abscissa which is the horizontal or X-axis)

- Ask students to account for the shape of their graphs
  (*There should be a slow decrease in mass from the upper left to the lower right as time passes until the candle is fully burned and then the mass will remain the same)*

The first experiment with the balloon was a case of chemical change in a closed system.
Ask students why it might be called a closed system?
(*Because all the reactants and products were enclosed in the balloon, everything could be weighed that was a part of the chemical change- the system was closed to the outside*)

The second experiment with the candle was also a chemical change but this change happened in an open system. Ask students why this experiment was different and would be considered an open system?

Inclusive Learning Strategies

Do you think the weight of the following items will be the same or different between the solid form and liquid form?

_____

Refer to the items in the table. Give students a piece of each solid item on an aluminum plate to weigh. Have them carefully melt the item exposed to the hot sun, Now has them weigh the item on the plate again.

In each case the item turns to a liquid. Do the liquids all weigh the same as the starting solids? (*Butter and chocolate weigh the same but not water.)*

Investigating weight

	Beginning solid	Liquid after melting	Solid after freezing
Chocolate			
Butter			
Water			

Skills

- Participate in class discussions of experiments
- Predict experiment results
- Observe experiments
- Explain experimental results
- Construct a graph of the candle experiment
- Interpret a graph
- Provide evidence to support the claim that the amount of matter present is conserved in a closed system for both physical and chemical changes

Values

- When conducting practical and group work, display sensitivity and offer assistance to peers who may have physical or learning challenges
- Demonstrate awareness of the need to recycle materials
- Show concern for their safety and that of others in using materials

(*One of the products (carbon dioxide) was able to escape so this would not be able to be weighed at the end of the chemical reaction (combustion)- this is because the system is "open" to the outside world.*)

Scenarios to Solve: Application of Theory

Pose the following scenarios to students:
A box of crayons was left on the back window of a car. In the hot sun it melted. Would you expect the weight of the melted crayons to be the same as the un-melted crayons? *(Yes-only a physical change)*

If the balloon experiment was undertaken in an open beaker where the carbon dioxide gas could escape, would you expect the beaker and its contents to weigh the same as the starting materials before the experiment started?

(*No-there would be some mass lost as carbon dioxide in the air- on a small scale this would be very minimal change in mass though)*

Conservation of mass is an important consideration as astronauts travel in spaceships because of fuel requirements for liftoff, maneuvering in space and landing. Even though there may be chemical changes in the spacecraft, all the products are still part of the weight of the spaceship. Have students do research on four important changes that occur in space travel and report back to the class on their findings. Focus question, how does mass change for these processes and how do the astronauts deal with it?

Burning rocket fuel
Breathing oxygen

Ask students why the water may not weigh the same as the ice? (*Based on our last lesson on the hexagon structure of ice, the air space in the centre of the hexagon means the ice weighs less because it is not all water)*

Explain to students that because there is air space in an ice cube it tends to be less dense with particles than liquid water; this makes it float on top of water.

Ask students whether the ice, chocolate or butter are physical or chemical changes? (*All physical)*

Chemical Change Experiment in a Closed System

(*To be done as a demonstration by teacher with questions as the experiment proceeds)*

Weigh out 1 tsp of baking soda. (____grams)
Weigh out 2 mL of vinegar (_____grams)
Weigh one balloon (_____grams)

What is the total mass of the starting materials? _____grams)

Now place the baking soda inside the balloon. Carefully add the vinegar to the balloon and seal it off immediately by tying a knot in the neck. (*The balloon will inflate as the vinegar and sodium bicarbonate react to generate carbon dioxide gas*)

Ask students what type of change they think this is? (*chemical*)

Ask them why they think it was chemical? *(Gas produced)*

• Appreciate the importance of accuracy and honesty as we collect data • Willingness to observe, question, explore and investigate • Work collaboratively while exploring and investigating	Growing plants Consuming food and passing human waste	Weigh the balloon with its contents. The mass should be very close to the total mass of the starting materials above. Explain to students that even with a chemical change the total mass remains the same. **Chemical Change in an Open System** To be done as a teacher demonstration. Weigh a small birthday candle and the base that it sits upon. Set a stopwatch to measure time of burning, Ask students to record the total mass at time zero. Light the candle wick and allow the candle to melt and burn the wax. Extinguish the candle after it has burned 1/3 the way and measure the time. Reweigh what is left of the candle and its base. Ask students to record the new total mass and the time of burning. Relight the candle and burn it to the ½ way mark. Have students record the total mass and the TOTAL time of burning. (i.e., 1st burn, and 2nd burn) Ask the students to plot a graph of total mass (ordinate) versus time of burning (abscissa) They should find there is less mass as a result of the burning. Ask students what type of a change this is (chemical or physical – chemical)

		Ask students why the combined system weighs less? (*One product of burning is carbon dioxide which escapes into the air. That mass is lost and can't be weighed.)*

Useful Content Knowledge for the Teacher about the Outcome:

A common approach to doing experiments as teacher-led demonstrations is called the POE strategy. Where P stands for Predict, O stands for Observe and E stands for Explain. To promote active discussion, teachers should practice this approach often.

Constructing a graph (labelling axis, assigning units, interpreting shape)

Inclusive Resources and Materials

Use of multisensory activities and materials to assist all learners
Water, butter, sugar, ice, measuring cup, vinegar, baking soda, candle, matches, weighing balance, graduated cylinder, balloon
https://betterlesson.com/lesson/604577/changing-matter-is-weight-the-same-or-different
https://www.google.com/url?physicalandchemicalchangesmatfieldschool.org

Strategies that Support the Curriculum and Assessment Framework

Elements of the Essential Education Competencies that are addressed:

Is an engaged, responsible, caring, tolerant participant in civil society	
Is creative, enterprising, and resilient	
Thinks critically, communicates effectively, and solves problems	Critical analysis of data
Leads a healthy and active life	
Uses literacy and numeracy to understand, appreciate and act in the world	Graphing, data collection
Demonstrates an appreciation for the culture of St. Kitts and Nevis	
Demonstrates technological empowerment	

Elements that are integrated across subjects:
Mathematics: graphing and measurement
Language Arts: discussions and new vocabulary Reading,

Elements from Local Culture, Technology, TVET, Environment that are integrated:

Items of Inspiration (teaching tips, inspirational passages, connections to educational research
Carefully planned experiments can help with child-centred learning

Purpose of the Subject: The study of science encompasses knowledge, processes, and values. Scientifically literate persons will foster an attitude of caring not only for themselves, but as responsible citizens, for the world around them. Their decision making will be enhanced by a systematic study of the structure and behavior of the physical and natural world through observation and experiment. In learning science, students benefit from leveraging and evaluating available technological tools to study and therefore understand the world and their relationship to it

Topic: Structure and Properties of Matter

Essential Learning Outcome: Make observations and measurements to identify materials based on their properties.

Grade Level Guidelines: Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

Specific Curriculum Outcomes

Students are expected to:

Knowledge

- Define
  - Matter
  - Properties
  - Transparent
  - Iron oxide (rust)
  - Solubility
  - Solution
  - Mixture
  - Miscible
  - Immiscible
  - Reflectivity
  - Absorption
  - Thermal conductivity
  - Electrical conductivity
  - Convection
  - Radiation

- Distinguish between the terms solution and mixture by giving examples

Inclusive Assessment Strategies

Written Project for Students to Complete in Groups of 3

Choose an object from the list below and answer the following questions:

1) What is this object made of?
2) What are its properties? (Describe it using a range of words that convey its color, texture, hardness, etc.)
3) How have humans used these properties to solve a problem or make life easier?

a. Chalk
b. Rope
c. Magnetite
d. Methane
e. Paraffin
f. Copper
g. Iron ore
h. Grease
i. Diamond
j. Graphite

Inclusive Learning Strategies

Have students view video on Properties of Matter **https://www.youtube.com/watch?v=NUskg2qWLPQ** (8:29 mins)

Discuss the video by asking the following questions.

1. What is a window made from? Why?
   Ans. Glass. It is transparent and strong.

2. Which material is best used to make a table? Why?
   Ans. Wood. It is hard and rigid.

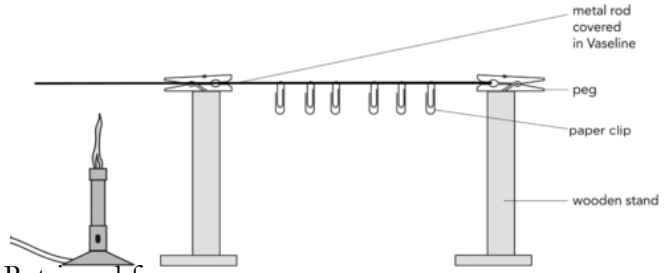
Explain to students that we choose materials with different properties to accomplish different purposes.

Hardness and Strength

Example: A floor or cricket bat is best made with a hard wood rather than softwood because these items have impact from household traffic and balls. A soft wood would easily get marked and not function as they should. Ask students to investigate what woods are used for these purposes in St. Kitts and Nevis

• Distinguish between the terms miscible and immiscible by giving examples <u>Skills</u> • Recognize how humans have leveraged the properties of materials to create useful items in our world. • Contribute to classroom discussions concerning experiments and teacher demonstrations • Record experimental data • Create a graph of temperature vs. time for heat absorption /reflection • Conduct research on the properties of concrete and its composition • Describe the process of heat conduction and convection • Construct a line graph to show the rate at which heat flows through a wire. • Give examples of materials that conduct electricity	Scoring Rubric: 5 Marks for each of the three questions above	Bridges in days gone by were often made from wood because it was readily available but now steel is more common. Ask students why this choice was made? (*Steel is much stronger and will last longer).* What property of steel will even make it break down after some time? *(Hint-salt in the air affects steel- steel will rust-i.e., iron reacts with oxygen to make iron oxide (rust))* Concrete is used to build many structures because of its strength. Ask students to do research on what is used to make concrete and why each component is important for creating the strongest product. Have students report back the next day on their findings. They may access the internet or speak with a local construction employee to find their information. **Reflection and Absorption** Ask students if they noticed that cars in hot climates are often white? Why would that be? Find three empty plastic soda bottles, Paint one white, one black and place aluminum foil around the last one. Fill them with water and place them in the direct sun. Have students measure the change in temperature of the water with time (Get them to plot a graph of temperature (ordinate) versus time (abscissa). They will find that the foil and white bottles heat up the least/slowest because they reflect the light whereas the black bottle absorbs light energy and heats up. Ask them again why we would want white cars? (*They stay the coolest in the hot sun because they reflect the sun's light energy*.)

• Observe how heat travels through different materials • Investigate the effects of heat on matter **Values** • When conducting practical and group work, display sensitivity and offer assistance to peers who may have physical or learning challenges • Work collaboratively while exploring and investigating. • Show concern for the safety of others in planning and carrying out activities and in choosing and using materials. • Appreciate the importance of accuracy. • Develop a predisposition of problem solving to use available materials to make useful items in our world		**Thermal Conductivity** C**onvection**- movement of heat through a liquid Use a candle or alcohol burner to heat a beaker of water. Place the flame so that it is under the centre of the beaker. Make sure that the beaker is one which is approved for heating liquids. Use a wire screen between the flame and the bottom of the beaker to diffuse the flame. Add some black pepper or a pinch of powdered charcoal to the beaker and observe the currents in the water. Explain to students that these currents are caused by movement of heat through the water **Radiation**- movement of heat through the air. Place a lighted candle or alcohol burner in the center of the table. Place an unlighted candle to stand next to the flame about 2 inches away. Allow students to observe what happens to the unlighted as the heat from the flame reaches it. [The candle bends toward the flame as the side closer to the flame becomes soft.] **Conduction** – The movement of heat through a solid. Set up a demonstration of a bridge made of wire with paper clips hanging by wax. Place a candle in a saucer and use it to heat one end of the bridge. (Adjust the height of the bridge so that candle flame will just touch the wire.) Allow students to observe what happens to the paper clips. When all the clips have fallen off, take the candle away and let the wire cool down. Introduce the term conduction.



Retrieved from:
https://intl.siyavula.com/read/science/grade-7/heat-energy-transfer/13-heat-energy-transfer?id=toc-id-2

Conduction of Electricity

Set up a simple circuit with a bulb, a wire and a battery as shown below.

Between points A & B place the following and have students observe whether the bulb lights up indicating conduction of an electric current.
Piece of string (*no conduction*)
A wooden toothpick or matchstick (*no conduction*)
A straightened paperclip (*conduction*)
An elastic band (*no conduction*)
A glass of water (*no conduction*)
A glass of saltwater (*conduction*

Solubility

Set up five glasses of water as a demonstration.
To the first glass add a tablespoon of salt and stir.

		Ask students to observe and describe what they see (*salt disappears in the water*). Introduce the term **solution.** To the second glass of water add a tablespoon of sand and stir. Ask students what they observe (*the sand does not dissolve, it remains separate).* Introduce the term **mixture**. To the third glass add an Alka-Seltzer® tablet and ask the students to observe (*they will see gas being formed as the tablet dissolves- ask them what the gas production suggests (chemical change*)). To the fourth glass add 5 drops of cooking oil. What do the students observe? (*Separates out*). Ask them if this is a mixture or a solution (**mixture**) Explain that some things don't mix well because their chemical structure is different. Introduce the term **immiscible** for those liquids that don't dissolve in each other. To the fifth glass of water add 5 drops of rubbing alcohol and stir. When these have readily formed a clear solution introduce the term **miscible** for those liquids that easily dissolve in each other. **Teachers may also choose to look at local examples of:** ● Insulating materials used to improve life ● Uses of the property of magnetism ● Chemical reactivity of substances (e.g., baking soda, yeast, leavening agents, milk & vinegar, food spoilage)

Useful Content Knowledge for the Teacher about the Outcome:

Glossary

Reflectivity: The property of reflecting light or radiation, especially reflectants as measured independently on the thickness of a material.
Electrical Conductivity: The ability of electric current to flow through a material.

Thermal Conductivity: A measure of the ability of a material to transfer heat.
Magnetic force: Attraction or repulsion that arises between electrically charged particles because of their motion.
Solubility: The ability to be dissolved especially in water.
Electrical conductor: Is a substance in which electrical charge carriers, usually electrons, move easily from atom with the application of voltage.
Conductor: A substance that allows heat or energy to flow through it.

Inclusive Resources and Materials

Use of multisensory activities and materials to assist all learners- Wire, wax paper, clips, candle
https://youtube.com/watchtv?v=ErmhTr0A9pw
everyday material song/science materials for kids
https://youtube.com/watch?v=TzRifxl-Obo
Properties of Materials

Strategies that Support the Curriculum and Assessment Framework

Elements of the Essential Education Competencies that are addressed:

Is an engaged, responsible, caring, tolerant participant in civil society	
Is creative, enterprising, and resilient	
Thinks critically, communicates effectively, and solves problems	Critical thinking interpreting experiments
Leads a healthy and active life	
Uses literacy and numeracy to understand, appreciate and act in the world	Collecting physical and numerical data, interpreting results
Demonstrates an appreciation for the culture of St. Kitts and Nevis	
Demonstrates technological empowerment	

Elements that are integrated across subjects:

Elements from Local Culture, Technology, TVET, Environment that are integrated:

Items of Inspiration (teaching tips, inspirational passages, connections to educational research)

Purpose of the Subject: The study of science encompasses knowledge, processes, and values. Scientifically literate persons will foster an attitude of caring not only for themselves, but as responsible citizens, for the world around them. Their decision making will be enhanced by a systematic study of the structure and behavior of the physical and natural world through observation and experiment. In learning science, students benefit from leveraging and evaluating available technological tools to study and therefore understand the world and their relationship to it

Topic: Structure and Properties of Matter

Essential Learning Outcome: Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Grade Level Guidelines: Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students can demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

Specific Curriculum Outcomes

Students are expected to:

Knowledge

- Define:
  - Physical change
  - Chemical change
  - Reversible process
  - Irreversible process
  - Curdling
  - Precipitate
  - Leavening agent
  - Food spoilage
- Distinguish between physical and chemical changes of substances using examples
- List the indicators of chemical change

Inclusive Assessment Strategies

The steel used for making products like cars and bicycles is very susceptible to irreversible chemical reactions.
The steel is made of iron which under the conditions of salty air will undergo a reaction with oxygen in its surroundings.
Ask students what indicator do we often see of oxidized iron? (*Color change – rust*)

Have students do research to discover why it is dangerous to mix the following cleaning supplies:

- Bleach + Vinegar =. ...
- Ammonia + Bleach =. ...
- Rubbing Alcohol + Bleach =. ...

Inclusive Learning Strategies

The teacher should do a demonstration for students with old milk and tea, coffee, or vinegar. Explain to children…when we add old milk to tea or coffee it sometimes will form blobs in the drink. We call this '**curdling**" of the milk. Scientists often refer to these masses as "**precipitates"**. Formation of new solids or color changes are an indication of chemical change.

Bakers often add yeast or baking soda to their recipe to form bubbles and raise their bread. If you cut a slice of bread, you will notice many holes. This is where the carbon dioxide was formed from these additives and made a bubble in the flour mixture. We call these additives "**leavening agents**" and they produce their result through the process of a chemical change. No matter what we do to the bread we can't get back those agents because they have already been consumed in an "**irreversible chemical reaction**"

Skills • Participate in discussions about demonstrations and experiments • Observe and describe some physical changes • Observe and describe some chemical changes • Research dangerous combinations of chemicals in the household • Creatively use a poster to explain chemical change in food **Values** • When conducting practical and group work, display sensitivity and offer assistance to peers who may have physical or learning challenges • Be conscientious in using chemicals around fellow students • Be mindful of the dangers in combining simple household cleaning supplies	In each case what are the indicators of chemical change? Consider the following physical changes: ice to liquid water to water vapor to liquid water to ice. Ask children why this is different from many chemical changes we see. (Chemical changes are often irreversible whereas physical changes can be reversed) e.g., boiling water can be condensed back to liquid water by placing a cold plate of ice over the boiling pot. Assign a project where students must create a poster that outlines how food spoilage is an example of chemical change when two substances come together to form something new. 1) They should indicate what are the indicators of chemical change 2) They should suggest what the chemical reaction that is happening (in general terms) Rubric: 5 points each for answering questions 1 & 2 above; 10 points for quality of poster (pictures and explanation)	As a demonstration, the teacher should show the students a glass containing a tablespoon of baking soda and a glass containing 10 mL of vinegar. The students should be asked to describe what is in the two glasses *(e.g., a white odorless powder and a clear smelling liquid*) The glass of vinegar can now be poured into the glass of baking soda while students describe what they see happening. (*Bubbling, which means that a gas is formed. The white powder disappears).* The teacher should emphasize that the creation of a gas is one sign that a chemical reaction has occurred. In this instance baking soda (sodium bicarbonate, $NaHCO_3$) has been converted in part to carbon dioxide (CO_2) gas that we breath out every day! What is left in the glass is a cloudy liquid but no powder. Students should be convinced that two substances have combined to produce new products.

Useful Content Knowledge for the Teacher about the Outcome:

https://www.youtube.com/watch?v=37pir0ej_SE **(3.50 mins)**
https://letstalkscience.ca/educational-resources/stem-in-context/physical-and-chemical-changes-in-kitchen (5:23 mins)

Inclusive Resources and Materials Use of multisensory activities and materials to assist all learners

Vinegar, milk, baking soda, water, ice

Strategies that Support the Curriculum and Assessment Framework

Elements of the Essential Education Competencies that are addressed:

Is an engaged, responsible, caring, tolerant participant in civil society	**Yes**
Is creative, enterprising, and resilient	
Thinks critically, communicates effectively, and solves problems	Critical thinking regarding experimental results
Leads a healthy and active life	Food spoilage issues
Uses literacy and numeracy to understand, appreciate and act in the world	
Demonstrates an appreciation for the culture of St. Kitts and Nevis	
Demonstrates technological empowerment	Use of instructional videos

Elements that are integrated across subjects:
Social Studies; Food spoilage

Elements from Local Culture, Technology, TVET, Environment that are integrated:
Use of instructional videos

Items of Inspiration (teaching tips, inspirational passages, connections to educational research)

Topic Two (2)

Matter and Energy in Organisms and Ecosystem

Purpose of the Subject: The study of science encompasses knowledge, processes, and values. Scientifically literate persons will foster an attitude of caring not only for themselves, but as responsible citizens, for the world around them. Their decision making will be enhanced by a systematic study of the structure and behavior of the physical and natural world through observation and experiment. In learning science, students benefit from leveraging and evaluating available technological tools to study and therefore understand the world and their relationship to it

Topic: Matter and Energy in Organisms and Ecosystems

Essential Learning Outcome: **Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.**

Grade Level Guidelines: Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

Specific Curriculum Outcomes

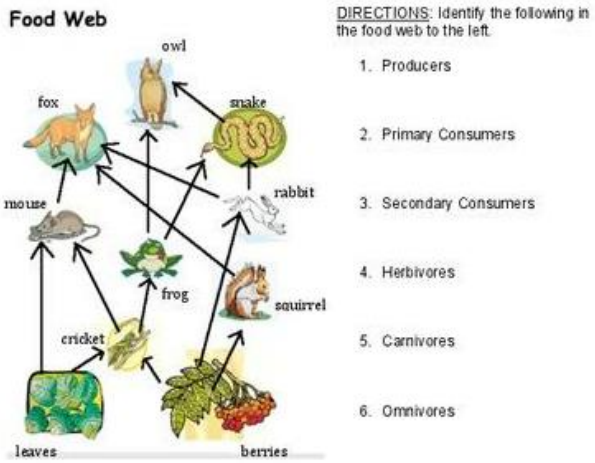
Students are expected to:

Knowledge

- Define:
  - Ecosystem
  - Energy
  - Consumer
  - Producer
  - Decomposer
  - Food chain
  - Food web
  - Niche
  - Habitat
  - Abiotic factors
  - Biotic factor
  - Community
  - Prey
  - Predator

Inclusive Assessment Strategies

Activity for Food Web



7. List two different food chains within this food web.

Food Chain #1:

Food Chain #2:

8. What elements are missing from this food web?

Inclusive Learning Strategies

Have students view a video of an ecosystem. https://www.youtube.com/watch?v=bJEToQ49Yjc (6:22 min)

Have students identify the main features in the video. Use the following questions to guide a discussion:

- What do you notice about the relationship between plants and animals in an ecosystem?
- What do you think will happen if you remove something from an ecosystem?
- Invasive species are living things that often get added to an ecosystem by mistake. What do you think happens to ecosystems when an outside species is added?
- Can you think of an invasive species (plant or animal) that has invaded your community?

Have students name some of the different types of ecosystems (the sea, forest, mangrove, swamp, rainforest)

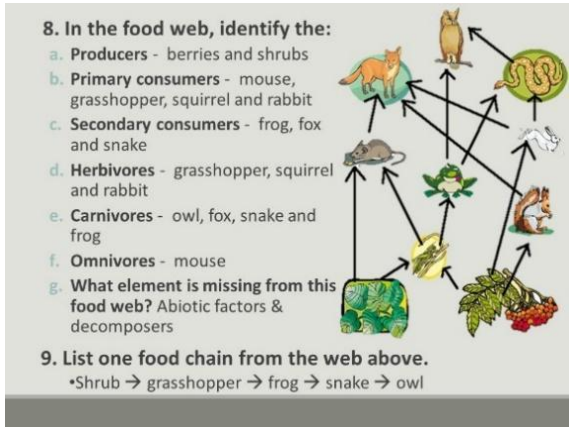
Skills

- Construct a diagram to show how energy is transferred in an ecosystem
- Interpret flow charts showing how energy is utilized in an ecosystem
- Construct simple food chains and food webs
- Classify objects as biotic and abiotic factors.

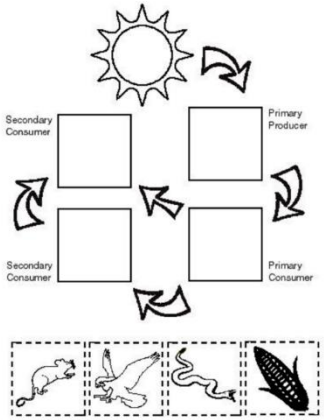
Values

- When conducting practical and group work, display sensitivity and offer assistance to peers who may have physical or learning challenges
- Appreciate the importance of accuracy
- Appreciate that there are different animals around us and their welfare is our responsibility
- Work collaboratively while exploring and investigating

Answer Key



Cut out the pictures below and glue them in the correct order to complete a simple food web.



After watching the following video on food chains, https://www.youtube.com/watch?v=hLq2datPo5M (4:57 min)
students should be able to answer the following questions:

1) Where does all energy come from for living things? (*The sun*)
2) How does the energy get from the sun to animals?
   - the sun is necessary to make plants grow.
   - some animals (herbivores) eat plants.
   - some animals eat other animals that have eaten plants.
   - decayed plants and animals contribute fertilizer to the ground where plants again begin to grow.
3) Suggest why pollution might disturb a food chain
4) Suggest why global warming might disturb a food chain

Students should be required to draw a flow chart that shows how the energy is transferred from the sun to other living things.

Retrieved from: Modern Science and Technology for The Caribbean Book 3 page 80

Biotic and Abiotic Factors

Place students into different groups. Take students in the school yard. Provide students with tools (magnifying glasses, small garden tools for digging, scissors, tweezers, assorted jars and containers with lids, shoe boxes, plastic bags).
Have each group examine their area carefully to find evidence of plant and animal life.

• Show concern for the addition of invasive species to our ecosystems • Show concern for the welfare of "species at risk" of becoming extinct	***Read the poem then answer the questions that follow.*** ***Country Salad*** ***The John Crow peers down at his prey.*** ***The cow grazes- no-time to play-*** ***While birds bring worms up to their nest.*** ***And frogs eat all the flies, then rest.*** ***The worm- he wriggles on the ground.*** ***Checking if there are dead leaves around.*** ***The boys and girls have so much fun*** ***Eating apples and mangoes and playing in the sun.*** ***Suzanne Rich*** a) Make a list of 6 consumers mentioned in the poem and the foods they eat. _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ b) Name ONE herbivore the poet writes about. _____	During the investigation, have students collect samples of organisms for further investigation in the classroom. Students should record the kind and number of each organism found in the school yard. (Indirect evidence of life, such as animal droppings or burrows, should be also noted. Students should try to determine if organic matter on the ground came from plants within the plot or was transported in from elsewhere. The observation may be categorized as follows: a. Date and time of visit b. Vegetation-different types of plants c. Small animals found on the ground d. Large animals found on the ground e. Small animals found beneath the ground f. Large animals found beneath the ground g. Animals found on the vegetation h. Flying animals which are likely to visit the area i. Moving animals which are likely to visit the area j. Animals found in or on water Students will return to the classroom. Have students identify non-living things found in the school yard. **Abiotic factors are the non-living things in an ecosystem.** Have students name the living things that they found. **Biotic factors are the living things in an ecosystem.** Ask them to group the factors within an ecosystem. Students should choose at least 5 living things they have identified and suggest how they are related in the ecosystem.

c) What would happen to dead plants and animals if there were no decomposers in a habitat?

_____

d) What producers were mentioned in the poem?

_____

Choose the letter beside the correct answer.

1. A group of grasshoppers living in a grass field is referred to as a/an
   A. community
   B. niche
   C. population
   D. ecosystem (Ans. C)

   Primary Science for the Caribbean A Process Approach Book 6-page 92

Using the list of words below, classify the objects as Biotic and Abiotic Factors.

rock tree water snail sheep air butterfly soil

Note to teachers: Feel free to add items to the list above.

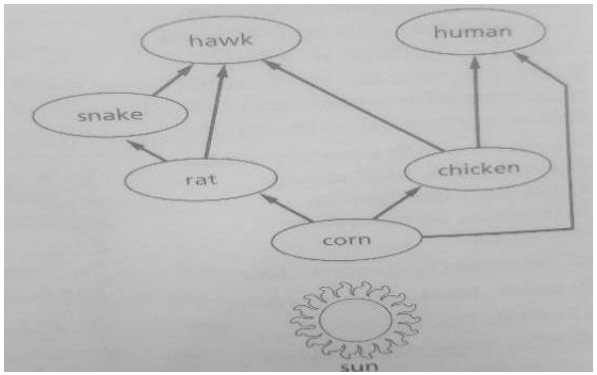
Biotic Factors	Abiotic Factors

In their description, they are expected to use some of the common terminology as outlined below:

Consumer: Animals that feed on producers or other animals.
Herbivore: Eat plants only.
Carnivore: Eat other animals (meat)
Omnivores: Eat both plants and animals
Producers: Plants that make their own food.
Decomposers: Organisms that feed on dead plants and animals, breaking them down into similar substances.
Food chain: A series of organisms each depending on the next as a source of food.
Prey: An animal that is hunted and killed by another for food.
Predator: An animal that hunts and kills other animals for food.
Habitat: a place where animals or plants live or grow.
Biotic factors: The living things in an ecosystem.
Abiotic Factors: The non-living things in an ecosystem.
Ecosystem: The combination of living and non-living organisms
Species: Organisms that are capable of inter-breeding to produce fertile offspring.
Environment: The surrounding and conditions in which plants and animals live.
Photosynthesis: the process by which green plants, with the help of chlorophyll, convert water, carbon dioxide and solar energy into sugars and oxygen.

See video on photosynthesis
https://www.youtube.com/watch?v=3pD68uxRLkM
(4:52 min)

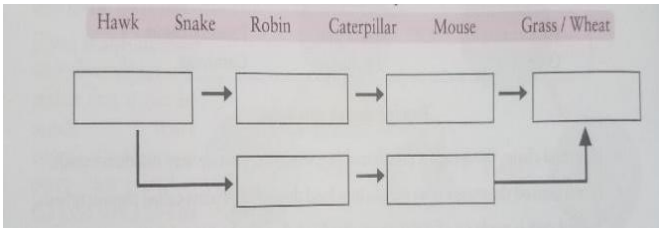
Look at this food web. Answer the following questions.



1. Is the hawk a carnivore or herbivore?
2. Why is the human an omnivore?
3. The health department placed rat poison in the area. All the rats died. What will happen to the snake population?
4. What will happen to the corn population?
5. If all the snakes die or move away, what will the hawks have to do?
6. Do you think all the hawks will survive? Give a reason for your answer.

See modern Science and Technology for the Caribbean book 4 pg. 30

Complete the food web below.



Wheat --- caterpillar ------ robin (bottom)
Wheat-------mouse ------snake …….hawk (top)

Useful Content Knowledge for the Teacher about the Outcome:

Plants make 'food' using energy from the sun.
Plants are called producers.
A food chain begins with a plant.

Food webs: Overlapping food chains in a habitat.

Energy pyramid: A diagram showing how energy passes from producer to consumer in an ecosystem.

Niche: The functional role that an organism plays in an ecosystem.

Community: The sum of all organisms (plants and animals) living in the same area.

Population: A group of organisms of the same species living in the same area.

Inclusive Resources and Materials Use of multisensory activities and materials to assist all learners

(Magnifying glasses, small garden tools for digging, scissors, tweezers, assorted jars and containers with lids, shoe boxes, plastic bags).

Retrieved from: Modern Science and Technology for The Caribbean Book 3 page 80
Modern Science and Technology for the Caribbean Book 3 page 19 – 28; 83-84
Food Chain Games:
https://www.cserc.org/sierra-fun/games/build-food-chain/

https://www.sheppardsoftware.com/content/animals/kidscorner/foodchain/foodchain.htm

https://www.bbc.co.uk/bitesize/topics/zbnnb9q/articles/z93vdxs

see Read Aloud: https://www.youtube.com/watch?v=clcRmZyG5aY

Strategies that Support the Curriculum and Assessment Framework

Elements of the Essential Education Competencies that are addressed:

Is an engaged, responsible, caring, tolerant participant in civil society	Taking care of ecosystem plants and animals
Is creative, enterprising, and resilient	
Thinks critically, communicates effectively, and solves problems	Critical thinking- analysing
Leads a healthy and active life	
Uses literacy and numeracy to understand, appreciate and act in the world	Reading and writing
Demonstrates an appreciation for the culture of St. Kitts and Nevis	
Demonstrates technological empowerment	Use of instructional technology (YouTube) for learning

Elements that are integrated across subjects:

Language Arts: development of vocabulary Poetry=poem about an ecosystem
Social Studies**:** Concern for humans and animals and their well being with respect to food chains

Elements from Local Culture, Technology, TVET, Environment that are integrated:

Balancing food chains-respect for the environment

Items of Inspiration (teaching tips, inspirational passages, connections to educational research)
Teachers can find many games around food chains by searching the web

Purpose of the Subject: The study of science encompasses knowledge, processes, and values. Scientifically literate persons will foster an attitude of caring not only for themselves, but as responsible citizens, for the world around them. Their decision making will be enhanced by a systematic study of the structure and behavior of the physical and natural world through observation and experiment. In learning science, students benefit from leveraging and evaluating available technological tools to study and therefore understand the world and their relationship to it

Topic: Matter and Energy in Organisms and Ecosystems

Essential Learning Outcome: Support an argument that plants get the materials they need for growth chiefly from air and water.

Grade Level Guidelines: Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

Specific Curriculum Outcomes

Students are expected to:

<u>Knowledge</u>

- **Define:**
  - nutrients
  - glucose
  - photosynthesis
  - hydroponics
  - NPK
  - greenhouse effect
  - carbon dioxide
  - chlorophyll

<u>Skills</u>

- Interpret an experiment that demonstrates plant growth comes chiefly from water and air.

Inclusive Assessment Strategies

Plants need nutrients to grow.

We often add fertilizers to soil to help plants grow.
Ask students to research what elements fertilizers often contain.
Bags of fertilizers often have three numbers on them. Ask students to research what those numbers mean.
NPK (nitrogen content: phosphorus content: potassium content)

Next have students visit the following website and answer the question:
Why are these three nutrients most important?

https://www.tfi.org/the-feed/fertilizer-101-big-3-nitrogen-phosphorus-and-potassium

Inclusive Learning Strategies

Students, many of you have grown plants before or at least seen plants being grown by farmers. Describe how plants are grown from seeds.

(*Seeds are placed in soil, given water and sunlight and they sprout into something with leaves*)

That is a very good description but there is a little more to the story. Why do you think soil is necessary?
(*There are probably things in the soil that help it grow*)

We call those parts of the soil necessary for plant growth **nutrients**.

But there is something else about the soil that is very helpful for plant growth.

Seed Experiment as a Demonstration
Conduct a demonstration experiment for the students.
Note: The experiment should be set up in advance of the lesson in which students will be engaged in discussion pertaining to the outcome of the experiment.

- Identify the nutrients that are important for plant growth
- Account for the importance of the sun in the production of food for a plant
- Account for the importance of maintaining rainforests as a source of oxygen meanwhile mitigating the contribution of carbon dioxide to global warming
- Create a hydroponics garden

Values

- Participate actively in classroom discussions of experiments and demonstrations.
- When conducting practical and group work, display sensitivity and offer assistance to peers who may have physical or learning challenges
- Work collaboratively while exploring and investigating
- Consider their own observations and ideas as well as those of others during investigations and before drawing conclusions

Application Questions

Watch the video below about photosynthesis https://www.youtube.com/watch?v=Iln136eMl4g (5:31 mins)

During photosynthesis, plants take in carbon dioxide (what animals breathe out).

The plants then use photosynthesis to produce oxygen for us to breath in.

1. Ask students why it is so important for us to preserve our rainforests? (*Trees use up carbon dioxide and produce oxygen for us to breath.*) Why is it important they use up carbon dioxide? (*Carbon dioxide is a gas produced by burning fuels and it contributes to global warming through the greenhouse effect)*
2. Why would it be a good idea to place a plant in a hospital room? (*It will produce fresh oxygen for the patient during the day-and it makes them happy!*)

Hydroponics

As a class project, have student groups create a hydroponics garden using plastic soda bottles. Instructions for simple hydroponics here:

https://www.epicgardening.com/hydroponics-for-kids/ (7:09 mins)

https://www.youtube.com/watch?v=87A06gzcZZ0 (2:37 mins)

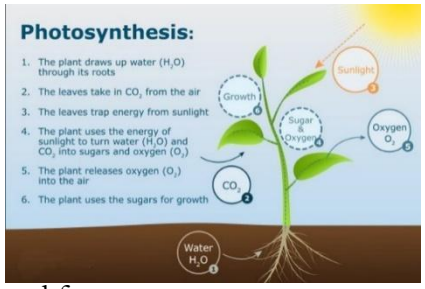
Students could also be asked to predict the outcome of the experiment prior to setting it up.

1. Place a radish or lettuce seed in a cup of soil and add water to dampen the soil. Place the cup by the window in full sunlight.
2. Boil water to remove all gases and then let it cool. Place a seed in a cup of that water and add 1 mL of vegetable oil and again put the cup in full sunlight.
   (Repeat 1 & 2 above) in 2 more pairs of cups and talk about the importance of multiple trials in science)
3. Continue to add water to both soil and soilless cups. The seeds will crack and begin to sprout. The seed in the water cup will sprout and leaves will remain covered with water and eventually die, whereas the soil cup will have a little plant growing.
   **This experiment can also be conducted with wet paper towels in Ziplock bags)

Ask students what they noticed about the two cups? (*The soil plant lived, and the water plant died.)*

Retrieved from: https://www.giftofcuriosity.com/seed-experiment-3-do-seeds-need-air-to-grow/

• Record accurately what has been seen or measured when collecting evidence • Show concern for the environment by applying the ideas of photosynthesis to the problem of global warming	**Research Project** Students will research the importance of **chlorophyll** in the process of photosynthesis and write a one-page explanation with a picture to supplement their description. Rubric: Rationale-explanation 5 points/Picture 5 points/punctuation & grammar 5 points **Food for Plants** Students will now know that plants produce the sugar glucose for food. Have them do research to find out what elements make up the molecule glucose. ➢ $C_6H_{12}O_6$	Ask students why they think the water plant died? (*No nutrients like the soil*) But we know that plants are sometimes grown with just water in greenhouses. They call that **hydroponics**. They must add nutrients to the water to help the plant grow. But students, there is something else that is different. The water/oil that was added to the seed in the cup without soil kept air away from the leaves. Do you think maybe air is important for plant growth? To grow, plants need food just like humans. You probably thought the sun was important because it helped keep the plant warm? Plants need sun to make their food. The energy from the sun is captured by leaves to convert water and carbon dioxide (a part of air) to make something called **glucose,** which is a sugar that the plant can use as food. This process is called **photosynthesis;** it allows the plant to get food to grow. In the cup of water, the plant had no access to carbon dioxide and limited access to the energy from the sun so it couldn't make food for itself. So, what have we determined in this experiment? • Plants need access to nutrients either through the soil or through water that has been supplemented with nutrients (hydroponics) • Plants need access to the sun because the energy is used to make food for the plant to grow (photosynthesis) • Plants need access to air because it contains carbon dioxide which can be converted to glucose which is food for the plant.



Retrieved from:
https://www.hortidaily.com/article/9197158/faster-plant-growth-through-more-efficient-photosynthesis/

Useful Content Knowledge for the Teacher about the Outcome:

https://www.youtube.com/watch?v=3pD68uxRLkM (4:52 mins)

https://www.youtube.com/watch?v=D1Ymc311XS8 (3:41 mins)

Inclusive Resources and Materials Use of multisensory activities and materials to assist all learners

A variation of the experiment can be conducted by placing a seed in a wet paper towel in a zippable plastic bag (open or closed)
See: http://msluces4kclass.weebly.com/uploads/6/4/2/9/6429191/mylittlesprouthousetemplate.pdf

Strategies that Support the Curriculum and Assessment Framework

Elements of the Essential Education Competencies that are addressed:

Is an engaged, responsible, caring, tolerant participant in civil society	Care of the environment
Is creative, enterprising, and resilient	No
Thinks critically, communicates effectively, and solves problems	Critical thinking- analysing results of experiments
Leads a healthy and active life	Yes- learning to grow your own food
Uses literacy and numeracy to understand, appreciate and act in the world	Reading & critiquing information. Writing short papers/explanations
Demonstrates an appreciation for the culture of St. Kitts and Nevis	No
Demonstrates technological empowerment	Use of video for learning/reviewing new concepts

Elements that are integrated across subjects:
Language arts: reading & writing, critical thinking
Social Studies: impacts of global warming, food production issues

Elements from Local Culture, Technology, TVET, Environment that are integrated:
Environmental concerns
Food production techniques

Items of Inspiration (teaching tips, inspirational passages, connections to educational research)
A scaffolded discussion around a demonstration can be a powerful pedagogy

Purpose of the Subject: The study of science encompasses knowledge, processes, and values. Scientifically literate persons will foster an attitude of caring not only for themselves, but as responsible citizens, for the world around them. Their decision making will be enhanced by a systematic study of the structure and behavior of the physical and natural world through observation and experiment. In learning science, students benefit from leveraging and evaluating available technological tools to study and therefore understand the world and their relationship to it

Topic: Matter and Energy in Organisms and Ecosystems

Essential Learning Outcome: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Grade Level Guidelines: Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s**).**

Specific Curriculum Outcomes

Students are expected to:

Knowledge

- Define:
  - Food Chain
  - Energy Transfer
  - Fertilize
  - Decompose
  - Bacteria
  - Fungi
  - Compost
  - Herbivore
  - Carnivore
  - Nutrients
  - Ecosystem
  - Decomposers
- Explain what it means by transfer of energy from sun to animals
- Using an example account for the importance of the decomposers

Inclusive Assessment Strategies

Match the organism on the left with its correct description on the right

A. 

Eat plants and/or animals to obtain energy.

B 

Break down dead plants and animals &release nutrients into soil

C. 

Make their own food using energy from the sun

Inclusive Learning Strategies

As a review discuss with students the following ideas: Cows and goats get energy to live by eating grass that has grown because of rain and energy from sunshine. This is **energy transfer.**

As humans we get energy by eating meat and vegetables.

When animals like cow process food they create waste. The manure can be used to **fertilize** the growth of more plants. This is a cycle of plants being eaten and being grown again.

Plants that die and begin to break down are said to **decompose**. This decomposition is assisted by **bacteria** and **fungi** (e.g., mushrooms). This puts **nutrients** back into the soil. (See soil nutrients here https://www.soils4teachers.org/lessons-and-activities/teachers-guide/soils-food-health)

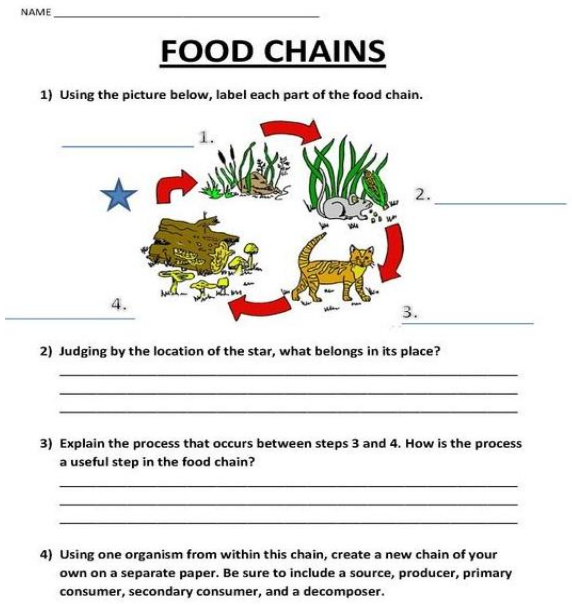
One product of decomposition is called **compost.** This broken-down vegetable matter can also be used for fertilizer to grow more plants.

Skills

- Construct a food chain that includes decomposers
- Interpret relationships between living things in energy and matter cycles
- Predict impacts when food chains are interrupted by new species or removal of species
- Develop new vocabulary
- Identify components of the ecosystem that fall into the categories of herbivore, carnivore, and decomposer.
- Create a simple composter for gardening

Values

- When conducting practical and group work, display sensitivity and offer assistance to peers who may have physical or learning challenges
- Actively participate in class discussions
- Consider their own observations and ideas as well as those of others during investigations and before drawing conclusion



NAME _____

FOOD CHAINS

1) Using the picture below, label each part of the food chain.

_____ 1.

2. _____

4. _____

3. _____

2) Judging by the location of the star, what belongs in its place?

_____

_____

_____

3) Explain the process that occurs between steps 3 and 4. How is the process a useful step in the food chain?

_____

_____

_____

4) Using one organism from within this chain, create a new chain of your own on a separate paper. Be sure to include a source, producer, primary consumer, secondary consumer, and a decomposer.

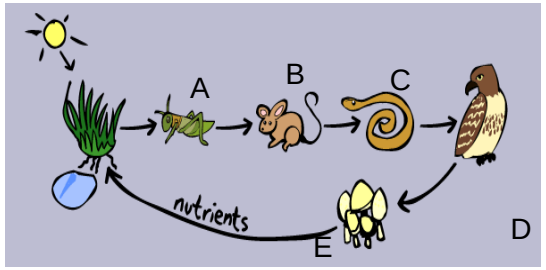
Scenario to pose to students.

When trees are cut down in a forest or fall during a storm, there is much waste in the form of branches and leaves and wood. It is important that some of this be left on the ground. Ask students why?

(*The waste product will begin to decompose and become part of the forest floor providing organic soil and nutrients for new growth.*)

In many industries (e.g., cocoa and nuts) when they remove shells to access the desired food, the shells are often recycled as fertilizer.

Have students study the food chain below. The teacher will ask the following questions:



a. What name is given to the diagram above?
Ans. Food chain

b. Identify the type organisms labelled A- D in the diagram

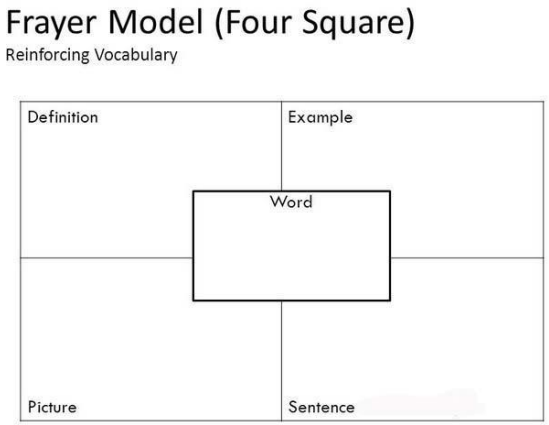
Ans.
A: herbivore – grasshopper
B: carnivore – rat
C. carnivore – snake
D. carnivore - eagle

c. Picture E is a mushroom. To which group of organisms does it belong?
Ans. Decomposers

Decomposers are organisms that breakdown or feed on dead and decaying matter or organisms.

- Base conclusion on evidence rather than preconceived ideas or hunches
- Work collaboratively while exploring and investigating
- Proactively consider the impact of invasive species on an ecosystem

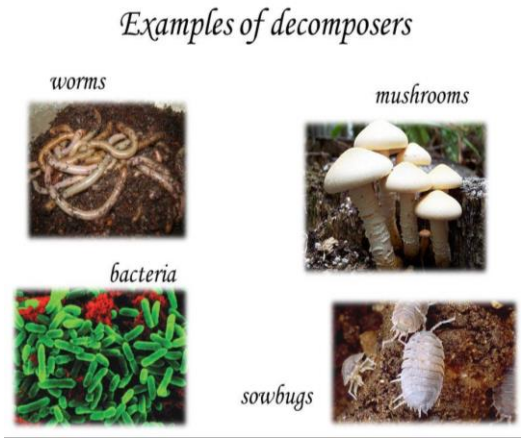
Have students create a Frayer Square with **food chain** in the centre



Invasive Species:

St. Kitts and Nevis were once populated with Mongoose from outside to control rat and snake populations. They have since been found (https://link.springer.com/article/10.1007/s00436-018-5773-2) to carry certain parasites that might be dangerous to humans. In a one-page format, research and discuss how this example and others in the Caribbean, upset food chains and ecosystems. How can we control and be more systematic in our choices as we manage our ecosystems? You can use diagrams to discuss your examples also.

Have students give some examples of decomposers:

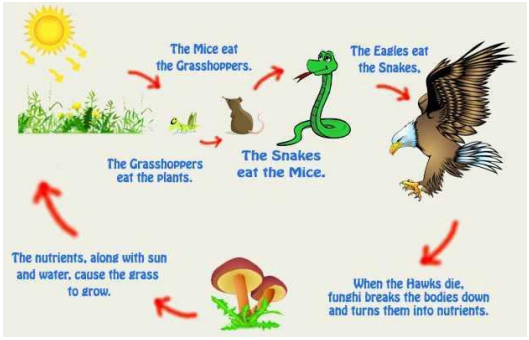


Explain why you think that decomposers are important in a food chain or ecosystem

Ans: When the decomposers break down the dead matter it acts or serves as **nutrients** that are absorbed by plants as food.

Ask students to align the following components in a cycle of energy and matter transfer.
Eagle; snake; mushroom; rat; grass; sunshine; grasshopper

After you have shown them, the cycle below asks them two questions.



		1. What has happened to this ecosystem because of bringing in vervet monkeys to St. Kitts and Nevis? 2. What would happen if humans began killing the eagles or eating all the mushrooms? As a class project, have students construct a school humus (compost) pile to create fertilizer for a small garden on the school grounds. They can: ● Designate a location ● Create information posters to direct their peers to add organic matter to their pile ● Dig a growing plot to use their decomposed fertilizer Creating a Compost pile instructions: https://www.youtube.com/watch?v=Q5s4n9r-JGU (5:19 min)

Useful Content Knowledge for the Teacher about the Outcome:

Definition of decomposer see: https://images.app.goo.gl/LAYuUxrAtdQHaF6J7decomposer.com

See Food chains video: https://www.youtube.com/watch?v=hLq2datPo5M (4:47 mins)

Inclusive Resources and Materials Use of multisensory activities and materials to assist all learners

Compost materials, poster paper or Bristol board

Strategies that Support the Curriculum and Assessment Framework

Elements of the Essential Education Competencies that are addressed:

Is an engaged, responsible, caring, tolerant participant in civil society	Care for our ecosystems
Is creative, enterprising and resilient	
Thinks critically, communicates effectively and solves problems	Critically analysing online resources; studying food chains critically
Leads a healthy and active life	Care for humans in the food chain
Uses literacy and numeracy to understand, appreciate and act in the world	Reading and writing about food chains
Demonstrates an appreciation for the culture of St. Kitts and Nevis	Invasive species
Demonstrates technological empowerment	Use of instructional video for learning

Elements that are integrated across subjects:
Language Arts: new vocabulary
Social Studies: Impacts of Food chains
Health & wellness: parasites/diseases brought to the islands by invasive species

Elements from Local Culture, Technology, TVET, Environment that are integrated:
Care for our food chains/ecosystems

Items of Inspiration (teaching tips, inspirational passages, connections to educational research)
Capitalize on students desire to draw when analyzing food chains

Topic Three (3)

Earth's System

Purpose of the Subject: The study of science encompasses knowledge, processes, and values. Scientifically literate persons will foster an attitude of caring not only for themselves, but as responsible citizens, for the world around them. Their decision making will be enhanced by a systematic study of the structure and behavior of the physical and natural world through observation and experiment. In learning science, students benefit from leveraging and evaluating available technological tools to study and therefore understand the world and their relationship to it

Topic: Earth's System

Essential Learning Outcome: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Grade Level Guidelines: Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

Specific Curriculum Outcomes

Students are expected to:

<u>Knowledge</u>

- Define:
  - Geosphere
  - Biosphere
  - Hydrosphere
  - Atmosphere
- Describe the Earth's systems/spheres.
- Discuss ways how the Earth's systems/spheres interact.
- Identify the human activities that impact earth's systems/spheres.

Inclusive Assessment Strategies

Definition	**Characteristics**
Impact on Humans	**Examples and pictures**

Complete a Frayer Model for each of Earth's Systems:

geosphere, biosphere, hydrosphere, atmosphere

Inclusive Learning Strategies

While the earth system seems to be one sphere, it is made up of several distinct spheres that are all interconnected. As you watch the video (https://www.youtube.com/watch?v=N3EqcUNdIl8 (7:47 mins)

Students should write down their own definitions of:

a. Biosphere
b. Geosphere
c. Hydrosphere
d. Atmosphere

Students should also look for answers to the following questions:

1. Why does the atmosphere have so much carbon dioxide present compared to many years ago? (*Burning fossil fuels)*
2. How does carbon dioxide in the atmosphere become part of the biosphere? (*Added to calcium it forms calcite which contributes to shells of organisms*

- Explain how human activities affect earth's systems/spheres.

Skills

- Differentiate between the earth's systems/spheres.
- Conduct research on the different systems of the earth.
- Critically evaluate online information

Values

- Participate actively in class discussions
- Collaborate to investigate the properties or characteristics of earth's systems.
- Display sensitivity and offer assistance to peers who may have physical or learning challenges when conducting group work.
- Develop a caring attitude for the earth and its systems

Name: _____ **Date:** _____

Earth's Four Spheres

Choose the best option for the following question.

1. The biosphere is the nonliving part of Earth.
   a. True
   b. False

2. The hydrosphere relates to water.
   a. True
   b. False

3. Which best describes the relationship between Earth's four spheres?
   a. System
   b. Isolated
   c. Separate
   d. Unchanging

4. What of Earth's spheres is composed of a mixture of gases?
   a. geosphere
   b. hydrosphere
   c. atmosphere
   d. biosphere

5. Which is an example of a human impact on the geosphere?
   a. burning fossil fuels
   b. mining for mineral ores
   c. building a dam for hydroelectric energy
   d. hunting an animal to extinction

3. How does the calcite contribute to the geosphere? (*The shells, coral and limestone etc. die and get compacted into soil in the earth's geosphere)*

4. What % of the water on earth is saltwater oceans? *(~97%)*

5. How does the atmosphere interact with the biosphere? (*Through photosynthesis carbon dioxide contributes to the growth of plants*)

While students watch the video https://www.youtube.com/watch?v=hXZPRocjXsU (5:49 mins), they should
   a. write down at least three ways that the different spheres interact
   b. write down 2 ways that mass and energy are exchanged with the rest of the universe

After discussing, the teacher will place students into four groups. Each group will be given the task of researching a system.

Students can use books, magazines, and computers/computer labs to assist in the research. Each group will be given chart paper or manilla paper.

Students explore various materials found in the different spheres to be able to describe and define each sphere.

	6. Earth's outermost sphere is called the a. biosphere. b. atmosphere. c. lithosphere. d. hydrosphere. 7. Which is an example of a human impact on the biosphere? a. burning fossil fuels b. mining for mineral ores c. building a dam for hydroelectric energy d. hunting an animal to extinction 8. Earth's hydrosphere is best described as a. the relatively thin layer of rock found above Earth's mantle. b. the hot liquid rock located in Earth's outer core. c. the very dense rock located in Earth's inner core. d. all of Earth's water. 9. Increase in human population impacts which of Earth's spheres? a. biosphere only b. biosphere and hydrosphere only c. biosphere, hydrosphere, and atmosphere only d. biosphere, hydrosphere, atmosphere, and geosphere 10. Which of Earth's four spheres is involved when a volcano erupts? You may select more than one answer if needed. a. biosphere b. geosphere	Teacher will provide students with the following questions to guide the research: 1. What does the prefix on your word mean? • Hydro- • Geo- • Bio- • Atmo- 2. Where is your system located? 3. What makes up your system? 4. Are there numbers or data related to your system? 5. How does your system impact us? https://betterlesson.com/lesson/resource/3210509/guiding-questions Each group will present their findings as they will become experts in the systems researched. Students think about different ways two or more spheres interact through Earth's systems and processes. Students develop simple models (labeled sketches). Students think about the humans in the biosphere and how our actions impact all of Earth's spheres. Reference is made to their country.

	c. atmosphere d. hydrosphere https://www.helpteaching.com/tests/658474/earths-four-spheres Answers: 1. b. False 2. a. True 3. a. System 4. c. Atmosphere 5. b. Mining for mineral ores 6. b. Atmosphere 7. d. Hunting animals to extinction 8. d. All of Earth's water 9. d. Biosphere, hydrosphere, atmosphere, atmosphere, and geosphere 10. a, b, c, d	

Useful Content Knowledge for the Teacher about the Outcome:

Definitions:

System:
A system is a term used for any complex whole, with smaller connected parts working together.

Earth's Sphere:
Everything on Earth can be placed into one of four major subsystems: land, water, living things, and air. These four subsystems are called "spheres." Specifically, they are the "geosphere" (land), "hydrosphere" (water), "biosphere" (living things), and "atmosphere" (air).

Hydrosphere:
The hydrosphere includes all the water parts on the planet. It includes water on the surface, sub-surface, and water vapour in the atmosphere. The word "Hydro" means water.

Geosphere:
The geosphere is all of Earth's rocks and minerals that make up its surface. The word "Geo" means Earth.

Biosphere:
The biosphere is all living components of the earth (humans, plants, animals, bacteria, fungi, protists, and all microscopic organisms on land, in the air and in the oceans). The word "Bio" means life.

Atmosphere:
The atmosphere is all the gases surrounding Earth. That includes the air we breathe. The word "Atmos" means air.

ATMOSPHERE: Air (made up of many gases)
HYDROSPHERE: Sea, lagoon, icesheets and icecaps, rainwater, etc.
BIOSPHERE: Fish, trees, and other life forms
GEOSPHERE: Rocks, mountains, sediments on the sea floor, etc.
https://eschooltoday.com/earth-system/the-atmosphere.html
https://www.generationgenius.com

Inclusive Resources and Materials Use of multisensory activities and materials to assist all learners

https://www.youtube.com/watch?v=N3EqcUNdIl8 (Video)
https://www.youtube.com/watch?v=hXZPRocjXsU (Video)
https://www.pinterest.com/pin/501588477241446060/?lp=true (image)
https://betterlesson.com/lesson/resource/3210509/guiding-questions (Guiding research questions)
Books, magazines and computers/computer labs, chart paper or manilla paper.

Strategies that Support the Curriculum and Assessment Framework

Elements of the Essential Education Competencies that are addressed:

Is an engaged, responsible, caring, tolerant participant in civil society	Understanding interactions helps us care for our earth environment
Is creative, enterprising, and resilient	
Thinks critically, communicates effectively, and solves problems	Critically evaluating the interactions of earth systems
Leads a healthy and active life	
Uses literacy and numeracy to understand, appreciate and act in the world	New vocabulary, reading and writing about the various spheres
Demonstrates an appreciation for the culture of St. Kitts and Nevis	
Demonstrates technological empowerment	Learning from instructional video

Elements that are integrated across subjects:
Language Arts: new terminology
Social Studies: care for the earth

Elements from Local Culture, Technology, TVET, Environment that are integrated:
An understanding of the interactions of the spheres helps us to better manage the earth resources and protect misuse.

Items of Inspiration (teaching tips, inspirational passages, connections to educational research)
Active watching of videos using a question sheet can be an effective pedagogy

Purpose of the Subject: The study of science encompasses knowledge, processes, and values. Scientifically literate persons will foster an attitude of caring not only for themselves, but as responsible citizens, for the world around them. Their decision making will be enhanced by a systematic study of the structure and behavior of the physical and natural world through observation and experiment. In learning science, students benefit from leveraging and evaluating available technological tools to study and therefore understand the world and their relationship to it

Topic: Earth's Systems

Essential Learning Outcome: Describe and graph the amount of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

Grade Level Guidelines: Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

Specific Curriculum Outcomes

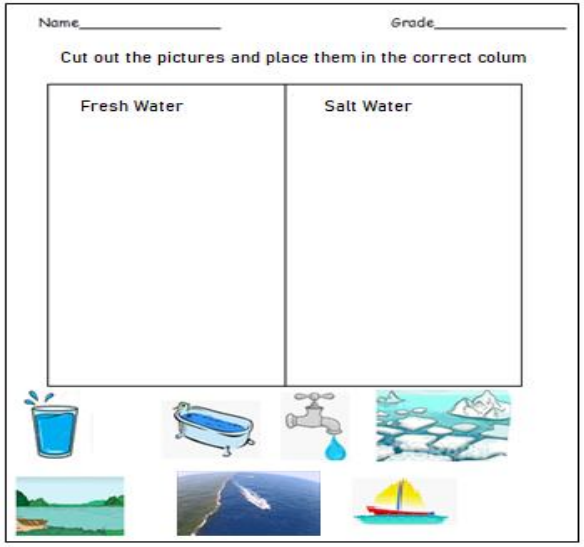
Students are expected to:

Knowledge

- Define the terms:
  - Water Cycle
  - Hydrologic Cycle
  - Reservoirs
  - Fresh water
  - Salt water
  - Desalination
  - Glaciers
  - Iceberg
- Identify reservoirs of water on the earth
- Describe the proportion of water in the various reservoirs on earth.
- Identify reservoirs that store fresh and salt/ saline water.

Inclusive Assessment Strategies

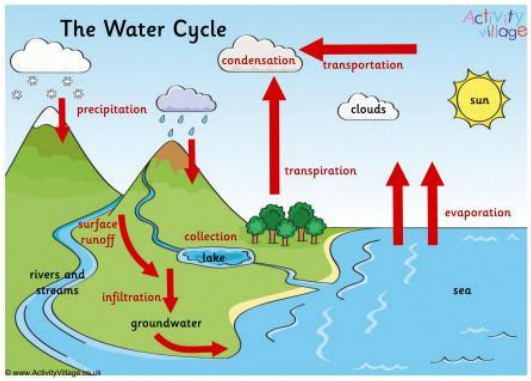
Classify freshwater and saltwater



Inclusive Learning Strategies

Before discussing the distribution of water on the earth it is worthwhile reviewing the water cycle using the following video and diagram.

The Water Cycle or Hydrologic Cycle
See vide review here:
https://www.youtube.com/watch?v=IO9tT186mZw
(2:53 mins)



Skills

- Classifying fresh and saltwater.
- Construct a graph showing the amount of salt water and fresh water on the earth.
- Do percentage calculations.
- Draw a picture of the desalination process.
- Predicting the amounts and types of water worldwide
- Account for the nature of the iceberg

Values

- Work respectfully with others in describing and graphing the amounts of fresh and salt water in various reservoirs on the earth.
- Display sensitivity and aid peers who may have physical or learning challenges when conducting practical and group work.
- Be an active participant when sharing and discussing with peers during discussions and group activities

Graphing Water Distribution

In small groups, have students draw a graphical representation (bar graph, pictograph, etc.) of the amounts and distribution of water on earth. Use data in the table below.

Distribution of Water on the Earth	
Salt water in the oceans	97%
Fresh water in ice	2%
Fresh water in lakes, ground, etc.	1%

Rubric: labelled data 5 marks/ clear representation 5 marks

Problem Solving

If a 5000 mL bucket of water is 97% salt water, how much is salt water?
(0.97 x 5000 mL) = 4850 mL

Recovering Fresh Water
Fresh water is often difficult to access for island nations.
Have students research the process of "desalination" as a way of recovering fresh water. Have them prepare a one-page report with a drawing to accompany the explanation of the process.

What are icebergs?
It is a common misconception that icebergs in the ocean of the North Atlantic are salt water because they float in salt water.

Water on Earth: A Simulation Experiment

Arrange students in small groups and distribute the following containers of water:

Group 1 - 970 mL of water in a bottle *(Approximately 194 teaspoons* - representing all the salt water on Earth)

Group 2 - 1 drop (0.05 mL) of water in a cup (Representing all the freshwater on Earth in the form water vapor)

Group 3 - 9 mL of water in another cup (Approximately 2 teaspoons - representing all the freshwater on Earth in liquid form)

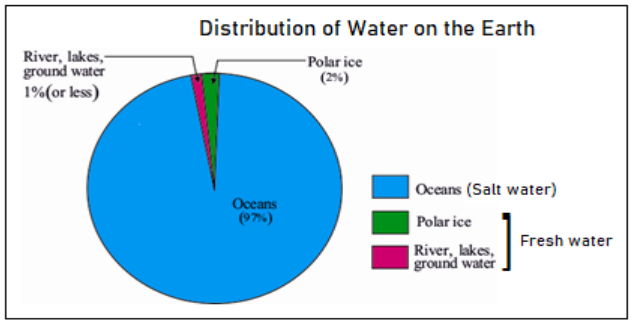
Group 4 - 21 mL of water in a final cup (Approximately 4 teaspoons - representing all the freshwater on Earth in frozen form)

Have students estimate the number of teaspoons of water in the container and identify the group with the largest and smallest amounts of water

Tell students the actual measurements of water given to each group and that they add up to 1000 mL (1 liter) of water, representing ALL the water on Earth.

Have students in each group calculate out of 1000mL, the percentage of water given to their group and share with the class.

E.g.
Group 1 % of water=9701000mL X 100% = 97%

• Show appreciation for the small amounts of freshwater on earth by developing habits of conservation of water.	Show your students the iceberg flipping over in this video. https://www.youtube.com/watch?v=Sh271FAVZ0o (1:38 mins) Ask them what type of water they believe the iceberg is made of, and how they account for their guess. Explain to them the concept of glaciers and that icebergs are pieces that have broken off and floated away.  Retrieved from: https://oceanwide-expeditions.com/blog/majestic-glaciers-and-icebergs-of-the-arctic-and-antarctica Have students visit the website below for homework and bring back one interesting fact about glaciers and icebergs. https://oceanwide-expeditions.com/blog/majestic-glaciers-and-icebergs-of-the-arctic-and-antarctica **Water Conservation** Students should review their water usage in the home and write a one-page essay including consumption data and a plan for reduction.	***Group 2*** - % of water=0.051000mL X 100% = 0.005% ***Group 3*** - % of water=91000mL X 100% = 0.9% or 1% ***Group 4*** - % of water=211000mL X 100% = 2.1% or 2% The teacher should write on the chalkboard the information the learners communicated and have them compare. Display a chart showing the distribution of water on the earth and ask the groups to observe, discuss and compare with their information. E.g., *Group 1- container of water represents salt water in the ocean* **Sample Chart**:  Retrieved from: https://media.cheggcdn.com/study/e65/e65cdd32-b832-4a05-b352-58024b82daa5/4918-3-1rq-i1.png **Chart Questions** Use the "**numbered heads together**" group strategy *(see in resources and materials)* for students to answer questions based on the chart and the group activity.

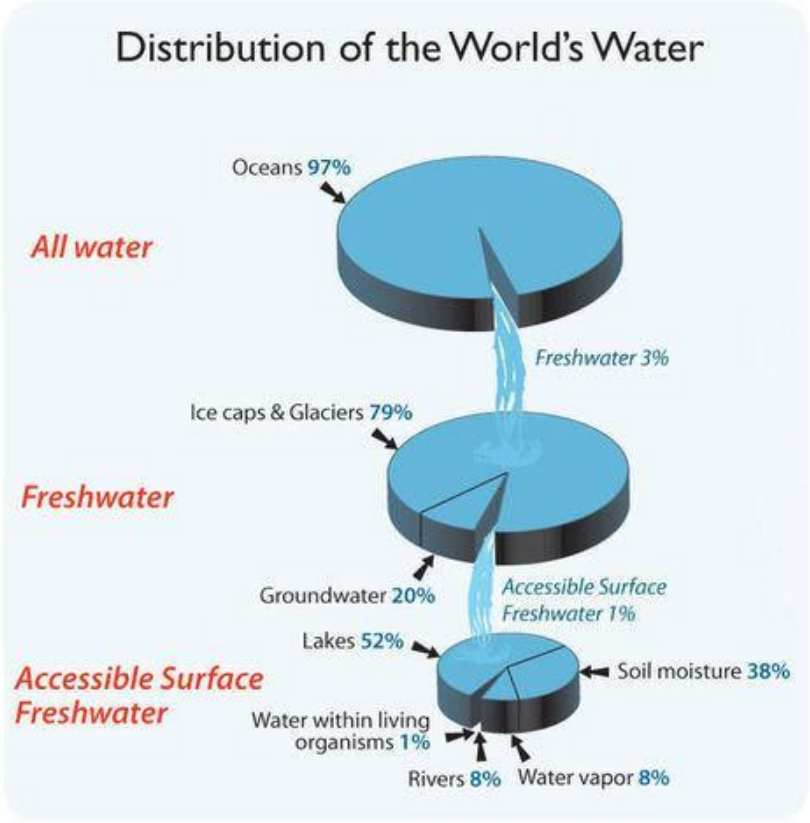
	Rubric: data collection 5 marks reduction ideas 5 marks grammar spelling punctuation 5 marks	E.g. - How many types of water are available on earth? What are they? *(2, saltwater and freshwater)* – Which reservoir has most of the earth's water? State the name of one. *(Oceans. Atlantic, Pacific, Indian.)* - Which type of water is stored in such a reservoir? (Salt water) - What do the terms saltwater and freshwater mean? *(Salt water has lots of dissolved salt in it while, fresh water has very little salt dissolved in it.)* - How much of the earth's water is salty and how much is fresh? - How much of the earth's freshwater is available for us to use? Give a reason for your answer. (1% because the other 2% is stores as ice in glaciers and ice caps) - What are some examples of reservoirs that store fresh water for our use? *(Rivers, lakes, creeks, wetlands/ swamps, ground)* - Knowing that only a very small amount of the earth's water is available for us to use, what are some of the ways we can show appreciation for this small amount of water? *(Answers should be in relation to conservation of water.)* As a review of water distribution, the teacher may decide to us ethe following video: https://youtu.be/48KuPTBuYmE?t=24 (4:22 mins.)

Useful Content Knowledge for the Teacher about the Outcome

- A reservoir is a place where water is collected and stored.
- Water covers 70-75% of the earth's surface; most of it is in the world's oceans (97 %) in the form of salt water, which cannot be used to support life on land because of its salinity (salt content).
- 2% of the remaining water is frozen in ice caps and glaciers. Although this is freshwater, it is also unavailable to plants and animals that live on land because it is frozen.

- The remaining fresh water on earth – approximately 1% – is found in groundwater, freshwater lakes, streams, wetlands and as water vapor in the atmosphere.

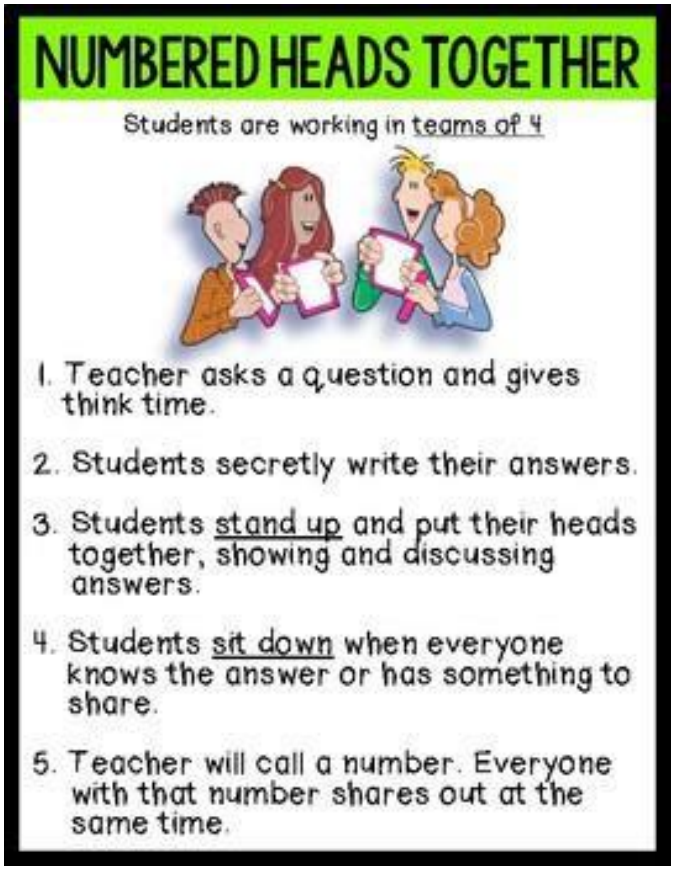
Information website on glaciers and icebergs: https://oceanwide-expeditions.com/blog/majestic-glaciers-and-icebergs-of-the-arctic-and-antarctica



Inclusive Resources and Materials

Use of multisensory activities and materials to assist all learners

Primary Science for the Caribbean Book 6 pages 56 & 57
https://www.google.com/imgres?imgurl=https%3A%2F%2Fdryuc24b85zbr.cloudfront.net.watercycle


NUMBERED HEADS TOGETHER
Students are working in teams of 4
1. Teacher asks a question and gives think time.
2. Students secretly write their answers.
3. Students stand up and put their heads together, showing and discussing answers.
4. Students sit down when everyone knows the answer or has something to share.
5. Teacher will call a number. Everyone with that number shares out at the same time.

Strategies that Support the Curriculum and Assessment Framework

Elements of the Essential Education Competencies that are addressed:

Is an engaged, responsible, caring, tolerant participant in civil society	Respect for water supply
Is creative, enterprising, and resilient	Essay on water consumption
Thinks critically, communicates effectively, and solves problems	Critical understanding of limited water supply
Leads a healthy and active life	
Uses literacy and numeracy to understand, appreciate and act in the world	Mathematical problem solving; researching & critically evaluating information on the internet
Demonstrates an appreciation for the culture of St. Kitts and Nevis	Water consumption habits
Demonstrates technological empowerment	Instructional technologies for learning

Elements that are integrated across subjects:

Language: listening, speaking, reading, comprehension and paragraph writing. Essay writing on water consumption

Mathematics**:** Measurements, constructing, analyzing, and interpreting graphs and charts, percentage, addition, and subtraction

Social Studies: Place – People in different places of the earth experience reservoirs of fresh and salt water.

Elements from Local Culture, Technology, TVET, Environment that are integrated:

Water supply concern for the environment

Items of Inspiration (teaching tips, inspirational passages, connections to educational research)

Purpose of the Subject: The study of science encompasses knowledge, processes, and values. Scientifically literate persons will foster an attitude of caring not only for themselves, but as responsible citizens, for the world around them. Their decision making will be enhanced by a systematic study of the structure and behavior of the physical and natural world through observation and experiment. In learning science, students benefit from leveraging and evaluating available technological tools to study and therefore understand the world and their relationship to it

Topic: Earth's System

Essential Learning Outcome: Obtain and combine information about ways individual communities use Science ideas to protect the Earth's resources and environment.

Grade Level Guidelines: Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

Specific Curriculum Outcomes

Students are expected to:

Knowledge

- **Define:**
  - Environment
  - Conservation
- List the resources in the environment that should be conserved.
- Suggest ways in which earth's resources and environment can be protected/conserved.
- Write a letter to a News agency or representative outlining the state of the natural resources in the community and suggest ways to protect or conserve the resource.

Inclusive Assessment Strategies

Refer to the Teacher's Resource section below for the rubrics for each assignment.

Assessment 1

Have students work in groups (the same group as for the panel discussion) to investigate their communities and combine their observations on how air, water, soil, fuel. The students should record if these resources are conserved or not. If there are measures in place for their conservation, these should be outlined; if not, the students should propose measures that can be used. Students should take pictures or make drawings to illustrate their findings and proposed measures.

Each group will compile its information and create a big book, a video presentation, a slide show presentation, or a PowerPoint presentation. Each group will make their presentation to the class.

Rubric:
Use Oral Presentation Rubric 24 marks

Inclusive Learning Strategies

The Grim State of Our Environment

Skills

- Create a Big Book or anchor chart highlighting the conservation of earth's natural resources.
- Investigate and report on the state of natural resources in their communities.
- Create value added products from garbage collected.
- Make presentations on findings.
- Graphing

Values

- Demonstrate a willingness to change their behaviour to protect the environment.
- Consider cause-and-effect relationships that exist in environmental issues.
- Willingly suggest how we can protect the environment.
- Collaborate to investigate the properties or characteristics of earth's systems.

Assessment 2

Have students work in their groups to compose slogans to sensitize the community on the importance of protecting our resources.

Use Slogan Rubrics (9 marks)

Assessment 3

Have students create signposts for their communities and posters for areas in the school. These signs should be about a specific aspect of the topic such as the three Rs (reducing, recycling, and reusing) and how (whichever topic chosen) can benefit the environment. **Use Poster Rubric (20 marks)**

Assessment 4

Have students carry out clean up campaigns: in their schools, communities or a designated beach then write a report on the activity and its benefit to humans and the environment.

Use Cooperative Learning Rubric (16 marks)

Assessment 5

Have students put bins or garbage bags in designated areas in the school or community to collect plastic bottles for recycling. Have students weigh the bottles collected and record their data over a specified period, for example every week for a month. Have them analyse the data, write a report on it.

Use cooperative Learning Rubric (16 marks)

Assessment 6

Have students use some of the garbage collected to create art and craft products or value-added products which they can display or sell.

Pictures retrieved from a google search.

Have students view each picture and make a note of the impression it creates on their minds.
Have students write down three words that help them describe their impressions.
Allow students to share their words.
Review to establish background knowledge of students and the overlap in their thinking.
Elicit from students the meaning of the term environment.

(*The environment is everything around us.*)
Have students sketch and label the main components of their environment. (*Air, water, soil.*)

Ask students why these (air, water, and soil) are important and should be conserved.
Have students work in small groups to brainstorm 3 negative impacts of not guarding our air, water, and soil. Share and review their lists on the board asking them to explain their examples using a spokesperson from each group.

Read the following passage to students and ask them to surmise what the word conservation must mean based on the context in the passage.

• Display sensitivity and offer assistance to peers who may have physical or learning challenges when conducting group work. • Actively participate in discussions	**Use Peer Evaluation Form (32 marks)** **<u>Assessment 7</u>** Have students write a letter to the editor of a newspaper, their area representative; the Premier or the Prime Minister about the pollution of our beaches with one- use plastics. **Use Essay Rubrics (16 marks)** **<u>Assessment 8</u>** Have students plant a tree in the school yard, at home or in the community and care for it. Students should record the growth of their tree over time. **Use of Rubrics for Journal (12 marks)**	"Felix was really worried. His garden was not doing well. At the beginning of the growing season the rains came, and everything seemed to grow well. But he did not conserve water in a barrel or bucket and now, with no rain and a dry well, he had virtually no water left to nourish his plants. He realized too late that conservation of resources like water is very important in agriculture." Through discussion arrive at a working definition for conservation and ways in which resources in the environment can be conserved. (*Conservation refers to the methods used to prevent wasteful use of a resource.*) *Examples of resources in our environment that should be conserved are water, soil, and fossil fuels.* Refer to the pictures supplied at the onset of the class. Divide the class into 8 groups where two groups each get a single picture to think about. Ask them to work in their group to respond to the following questions: 1. Can you identify the main environmental concern? 2. Have you seen a similar concern in your community? 3. What are the causes of this problem? 4. What are the action items you might undertake to help solve the problem?

		A Research Activity Place students in groups of not more than 5. Each group will discuss and research how one of the following based on the questions below a. fresh water source b. saltwater source (beach, bay) c. soil d. Air e. fossil fuels Focus questions • How is this resource affected by man's actions? • How can this resource be conserved/protected? • What are the implications of not conserving /protecting it.? Each group is required to make an anchor chart as a part of their presentation. A panel discussion will ensue. A member from each group will sit on the panel. Each of the panelists will make a presentation then questions will be taken from the floor. The chairperson of the panel will summarize. **Rubric**: Research of background information 5 marks Graphics 5 marks Quality of discussion 5 marks General Preparation 5 marks Review conservation by having the students view the following video: *https://www.youtube.com/watch?v=uA7c0mFrGyA* *(*6:00 mins)

		While students watch the video, they are required to make notes on the following three questions: 1. Name 3 ways to conserve water resources. 2. What are 3 alternatives to traveling by cars that pollute the air? 3. What are the 3 r's? 4. What are 3 ways to conserve energy? The pictures below were drawn from this site: https://docs.google.com/document/d/1CFvzivaGv7RRLmszNA0VI5qntUlFYDOHcvjf13yGEMI/edit   

		Attitudes Towards Caring for the Environment- Real Data Have students view and freely share what they think is happening in the pictures above. Discuss with the class the importance of the pictured activity that the students are engaging in. During the discussion ask the students if they think that the young people are enjoying the process – to highlight the attitude that students should have about protecting their environment. Talk about the responsibility of each generation to provide a better world for their children. This includes a clean world where we conserve and care for limited natural resources. Place students in the same groups. Have students make a list of items that they think the young people in the pictures might have collected. Also have them predict the abundance of the items. Allow each group to share their list and give reasons for their predictions. Give each group a sheet with the data for beach clean-up in St. Kitts 2018 (see table below) Have students: (i) identify the item found that was (a) most abundant; (b) least abundant (ii) list the top ten items (ii) suggest reasons why these items were found on the beach; how they got there. (iii) suggest the impact these items would have on the environment if they were allowed to remain on the beach or in the sea. (iv) suggest ways in which pollution of the beach can be prevented.

Useful Content Knowledge for the Teacher about the Outcome:

Natural resource- things occurring in nature like air, water, sunlight, and crops that can be used to fulfill a need.
Renewable resources- natural resources that will replenish themselves by reproducing or growing again: for example, plant and sunlight.
Non-renewable resources - resources that cannot grow back (for millions of years) once they have been used up; for example: oil, bauxite, and gold
Replenish- restore to the former level or condition; for example: water cannot replenish or refill itself as fast as humans are consuming it.
Conserve- to use wisely; to protect from harm or destruction.
Reduce- to use less of; as in to reduce consumption, keeps from using natural resources.
Reuse- to use something repeatedly, to keep from using natural resources.
Recycle- to turn something old into something new, keeps from using natural resources.

We protect the air by PROTECT THE AIR BY KEEPING IT CLEAN/CLEAR OF POLLUTANTS SUCH AS GASES and SOOT. We preserve the quality of our air by planting trees and other vegetation.
We protect soil by carrying out soil conservation practices. We ensure that plant cover is maintained to hold the soil and prevent its loss by erosion by wind or water; maintain the fertility of the soil.
We should also prevent pollution of soil by not dumping harmful chemicals or oil in the soil.
Indiscriminate dumping of garbage on empty plots of land and in guts and other natural waterways should be prevented.
FRESHWATER/ SALTWATER

- PREVENT POLLUTION- FROM GARBAGE DISPOSAL, LEACHING OF FERTILISERS INTO THE WATER SOURCE
- DUMPING GARBAGE INTO WATER SOURCE EG DUMPING GARBAGE IN THE SEA LIKE PLASTICS

2018 Top Ten Items — St Kitts

Item	Total	Percent
Bottle Caps (Plastic)	2409	23.12%
Plastic Pieces	1986	19.06%
Beverage Bottles (Plastic)	1454	13.95%
Rope (1 yard/meter = 1 piece)	1023	9.82%
Other Plastic Bottles (oil, bleach, etc.)	642	6.16%
Foam Pieces	456	4.38%
Other Plastic/Foam Packaging	370	3.55%
Fishing Net & Pieces	362	3.47%
Lids (Plastic)	263	2.52%
Other Plastic Bags	184	1.77%
Beverage Bottles (Glass)	128	1.23%
Forks, Knives, Spoons	120	1.15%

Cups, Plates (Plastic)	116	1.11%
Bottle Caps (Metal)	100	0.96%
Straws, Stirrers	94	0.90%
Fishing Buoys, Pots & Traps	81	0.78%
Appliances (refrigerators, washers, etc.)	66	0.63%
Food Wrappers (candy, chips, etc.)	56	0.54%
Take Out/Away Containers (Foam)	49	0.47%
Construction Materials	48	0.46%
Glass Pieces	47	0.45%
Fishing Line (1 yard/meter = 1 piece)	42	0.40%
Grocery Bags (Plastic)	40	0.38%
6-Pack Holders	39	0.37%
Take Out/Away Containers (Plastic)	34	0.33%
Cups, Plates (Foam)	33	0.32%
Beverage Cans	30	0.29%
Paper Bags	29	0.28%
Tires	25	0.24%
Cigarette Lighters	22	0.21%
Cups, Plates (Paper)	22	0.21%
Fireworks	12	0.12%
Strapping Bands	12	0.12%
Condoms	6	0.06%
Syringes	5	0.05%
Tobacco Packaging/Wrap	3	0.03%
Balloons	3	0.03%
Tampons/Tampon Applicators	3	0.03%
Cigarette Butts	3	0.03%
Cigar Tips	3	0.03%
Diapers	1	0.01%
Toys	0	0.00%
Fishing Gear (Clean Swell)	0	0.00%
Personal Hygiene (Clean Swell)	0	0.00%
Other Packaging (Clean Swell)	0	0.00%

Other Trash (Clean Swell)	0	0.00%
TOTALS	**10421**	

https://www.google.com/search?q=pictures+of+air+pollution&rlz=1C1JZAP_enKN871KN871&sxsrf=ALeKk03WCptGWYhAC3O2d5nPYkzA84pXgw:1620391908724&source=lnms&tbm=isch&sa=X&ved=2ahUKEwiL0vagzrfwAhVKTTABHQTOC6IQ_AUoAXoECAEQAw&biw=455&bih=208&dpr=3

https://www.google.com/search?q=pictures+of++water+pollutionpollution&tbm=isch&ved=2ahUKEwi2sdrK0rfwAhVHeDABHUViClIQ2-cCegQIABAA&oq=pictures+of++water+pollutionpollution&gs_lcp=CgNpbWcQA1CZowJYx6kCYM-6AmgAcAB4AIABjQKIAaEGkgEFMC40LjGYAQCgAQGqAQtnd3Mtd2l6LWltZ8ABAQ&sclient=img&ei=bjyVYLbCBMfwwbkPxcSpkAU&bih=208&biw=455&rlz=1C1JZAP_enKN871KN871#imgrc=cOiX00YLGQ25PM&imgdii=aFTPjKljgheNrM

https://www.google.com/search?q=pictures+of+beach+pollutionpollution&tbm=isch&ved=2ahUKEwier5Xf0rfwAhWheTABHTIeAogQ2-cCegQIABAA&oq=pictures+of+beach+pollutionpollution&gs_lcp=CgNpbWcQA1DevihY1vYoYI79KGgBcAB4AIAB0wGIAYgLkgEGMS4xMC4xmAEAoAEBqgELZ3dzLXdpei1pbWfAAQE&sclient=img&ei=mDyVYJ6DPKHzwbkPsryIwAg&bih=208&biw=455&rlz=1C1JZAP_enKN871KN871

https://www.google.com/search?q=pictures+of++soil++pollutionpollution&tbm=isch&ved=2ahUKEwipm_nh1bfwAhUPtlMKHUvQBVkQ2-cCegQIABAA&oq=pictures+of++soil++pollutionpollution&gs_lcp=CgNpbWcQA1DVOli2fWCHggFoAHAAeACAAZQBiAGPCJIBAzAuOZgBAKABAaoBC2d3cy13aXotaW1nwAEB&sclient=img&ei=xD-VYKmpB4_szgLLoJfIBQ&bih=208&biw=455&rlz=1C1JZAP_enKN871KN871

Inclusive Resources and Materials

Use of multisensory activities and materials to assist all learners

Slogan Rubric

	3 marks	2 marks	1 mark
Content	Message contains accurate and relevant information.	Message contains somewhat accurate information.	Message is unclear and the information is inaccurate.
Creativity	Slogan is 'catchy' and depicts content accurately	Slogan is original however message is a little vague	Slogan is unoriginal. Lacks appeal. Poor depiction of content.
Presentation	Neatly presented with relevant supporting images	Neatly presented no use of supporting	Slogan is difficult to read.

Poster Rubric

Criteria	4 marks	3 marks	2 marks	1 mark
Title	Title can be read from 6 ft. way and is quite creative	Title can be read from 6 ft. away and describes content well.	Title can be read from less than 6 ft. away or does not describe content well	Title is too small and/or does not describe content well.
Required Elements	Poster includes all required elements as well relevant additional information.	All required elements are included	Most of the required elements are included.	Several of the required elements were missing.
Creativity	Poster is unique in terms of design, layout, and neatness	Poster is in terms of design, layout, and neatness.	Poster displays creativity though it may be a bit messy.	Poster is poorly designed and/or messy. It displays little creativity.
Content	Content is accurate and relevant.	Content is accurate and mostly relevant.	Content is adequate. Provides accurate information but is not relevant.	Content is inaccurate and not relevant.
Use of Class Time	Used time well during class. Focused on getting the project done. Did not distract others.	Used time well during each class. Usually focused on getting the project done. Did not distract others.	Used some of the time well during the class. There was some lapse in focus and occasionally distracted others.	Did not use class time effectively or and distracted others.
Total				

Oral Presentation Rubric

Criteria	4 marks	3 marks	2 marks	1 mark
Organization	Student presents information in logical, interesting sequence which audience can follow	Student presents information in logical sequence which audience can follow	Audience has difficulty following presentation because students jump around.	Audience cannot understand presentation because there is no sequence of information.
Subject Knowledge	Student demonstrates full knowledge (more than required) by answering all class questions with explanations and elaboration.	Student is at ease with expected answers to all questions but fails to elaborate.	Student is uncomfortable with information and is able to answer only rudimentary questions.	Student does not have grasp of information; student cannot answer questions about subject.
Supporting Materials Used in (Hand-out/AV, PowerPoint, etc.)	Student graphics explain and reinforce presentation and screen text	Student's graphics relate to text and presentation	Student occasionally uses graphics that rarely support text and presentation	Student use unnecessary/ irrelevant graphics or no graphics
Mechanics	Presentation has no grammatical errors or misspellings.	Presentation has very little grammatical errors and/or misspellings.	Presentation has some grammatical errors and/or misspellings.	Student's presentation has many grammatical errors and/or misspellings.
Eye Contact	Student maintains eye contact with audience, seldom returns to notes.	Student maintains eye contact most of the time but frequently returns to notes.	Student occasionally maintains eye contact and reads most of their notes.	Student does not maintain eye contact with audience and reads all of their notes.
Elocution	Student uses a clear voice and correct, precise pronunciation of terms so that all audience members can hear presentation.	Student voice is clear and pronounces most words correctly. Most of audience can hear presentation well.	Student's voice is low. Student incorrectly pronounces words most of the time. Audience has difficulty hearing presentation.	Student mumbles and incorrectly pronounces terms and speaks too quietly for the audience to hear presentation well.

Cooperative Learning Rubric

Student Name: _____ Grade: _____ Date: _____

Category	4	3	2	1
Contribution to Group Goals	Consistently and actively works towards group goals; willingly accepts and fulfills individual role within the group	Works towards group goals without occasional prompting; accepts and fulfills individual role within the group	Works toward group with occasional prompting.	Works toward group goals only when prompted.
Consideration of Others	Shows sensitivity to the feelings and learning needs of others; values the knowledge, opinion, and skills of all group members.	Shows and expresses sensitivity to the feelings of others; encourages the participation of others.	Shows and expresses sensitivity to the feelings of others	Needs occasional reminders to be sensitive to the feelings of others.
Contribution of Knowledge	Consistently and actively contributes knowledge, opinions, and skills without prompting or reminding.	Contributes knowledge, opinions, and skills without prompting or reminding.	Contributes information to the group with occasional prompting and reminding.	Contribute information to the group only when prompted.
Working and sharing with others	Helps the group identify necessary changes and encourages group action for change; does assigned work without reminders.	Willingly participate in needed changes; usually does the assigned work and rarely needs reminding.	Participates in needed changes with occasional prompting; often needs reminding to do the assigned work.	Participates in needed changes when prompted and encouraged; always or often relies on others to do the work

Peer Evaluation Form

Name_____ **Grade**_____ **Date**_____

Write the names of your group members in the numbered boxes. Assign yourself a value, using the values below, for each listed attribute. Finally, do the same for each of your group members. Calculate totals for each member of the group, including yourself.

Values: **1=**Strongly Disagree **2=** Disagree **3=** Agree **4=**Strongly Agree

Attribute	**Group Member 1 Self**	**Group Member 2** _____	**Group Member 3** _____	**Group Member 4** _____	**Group Member 5** _____
Willingly accepted assigned tasks.					
Contributed positively to group discussions					
Completed work on time					
Helped others with their work when needed					
Did work accurately and completely					
Contributed fair					
Worked well with other group members					
Overall was valuable member of team					
TOTAL	___/32	___/32	___/32	___/32	___/32

Essay Rubric

	4 marks	**3 marks**	**2 marks**	**1 mark**
Elements	Response is a well-developed informative/explanatory text that examines a topic and depth and conveys ideas and information clearly based on as stimulus	Response is a complete informative/explanatory text that examines a topic and presents information clearly based on a text as a stimulus	Response is an incomplete or oversimplified informative/explanatory text that cursorily examines the topic	Response is weak attempt to write an informative/explanatory text that examine
Introduction of Ideas	Effectively introduces a topic	Introduces a topic	Attempts to introduce a topic	May not introduce a topic or topic is unclear
Development of Ideas	Effectively develops the topic with multiple, relevant facts/concepts related to the topic	Develops a topic with few facts/concepts related to the topic.	Attempts to develop a topic with too few details	Topic development is unclear.
Conclusion	Provides a strong concluding statement that follows from the information presented	Provides a concluding statement and	Provides a poor summary	Provides little to no summary of information present

https://www.rcampus.com/rubricshowc.cfm?sp=yes&code=E752BA&

Written Descriptions	**Poor** Students have written descriptions of the plants for some of the days over the two-week period.	**Fair** Students have written descriptions of the plants most days, their description was vague.	**Good** Students have detailed written descriptions about the plants every school day over the 3-day period.	**Total points**
Pictures	**Poor** Student have less than three pictures of the plants. In no detail.	**Fair** Students have at least 2 pictures of the plants. With detail.	**Good** Students have all 3 pictures of the plants. With great amounts of detail.	**Total points**
Measure	**Poor** Students measure the plants and record the data for some of the days and have no units.	**Fair** Students measure the plants and record the data some of the days and have units.	**Good** Students measure the plants and record the data all three days and use the correct units.	**Total points**
Explanations	**Poor** The student gives one-word answers to how to help the plant and to "why" questions.	**Fair** Students give some descriptive answers to "why" questions and to explaining.	**Good** The student is able to explain in detail and explain why in full sentences.	**Total points**
Total	**Poor**	**Fair**	**Good**	**Overall points Grade=**

Strategies that Support the Curriculum and Assessment Framework	
Elements of the Essential Education Competencies that are addressed:	
Is an engaged, responsible, caring, tolerant participant in civil society	Caring for the environment
Is creative, enterprising, and resilient	Solving community problems with creativity
Thinks critically, communicates effectively, and solves problems	Communication through projects
Leads a healthy and active life	Outdoor learning
Uses literacy and numeracy to understand, appreciate and act in the world	Working with statistics
Demonstrates an appreciation for the culture of St. Kitts and Nevis	Protecting the environment for future generations
Demonstrates technological empowerment	Use of video technology for learning

Elements that are integrated across subjects:
Language Arts; Reading, writing, listening.
Social Studies: study of littering habits, making choices about energy duress

Elements from Local Culture, Technology, TVET, Environment that are integrated:
Use of technology

Items of Inspiration (teaching tips, inspirational passages, connections to educational research)

Topic Four (4)

Space Systems

Purpose of the Subject: The study of science encompasses knowledge, processes, and values. Scientifically literate persons will foster an attitude of caring not only for themselves, but as responsible citizens, for the world around them. Their decision making will be enhanced by a systematic study of the structure and behavior of the physical and natural world through observation and experiment. In learning science, students benefit from leveraging and evaluating available technological tools to study and therefore understand the world and their relationship to it

Topic: Space System

Essential Learning Outcome: Support an argument that the gravitational force extended by Earth on objects is directed down.

Grade Level Guidelines: Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

Specific Curriculum Outcomes

Students are expected to:

Knowledge

- Define:
  - Gravity
  - Air resistance
  - Tides

- Explain what causes objects such as a ball fall downwards towards the Earth when thrown upwards into the air.

- Explain why different (varying size/ mass/ shape) fall to the Earth at the same time when released from the same height.

Inclusive Assessment Strategies

Formative: participation team activities, research, verbal response, observations, experiments, interactive notebooks, Summative: Interactive Science assessments, formal lab sheets, experiments

Assessment 1

The diagram below is drawn from https://www.google.com/search?q=picture+of+a+ball+thrown+upwards&source=lnms&tbm=isch&sa=X&ved=2ahUKEwi5oJLauuLuAhVHRjABHYkvDlMQ_AUoAXoECAwQAw&biw=725&bih=287#imgrc=DlKD9KqtaZlPkM

Inclusive Learning Strategies

Introduction:

The teacher will read the short excerpt below to students.

Simon launched a toy rocket is parents had bought for him. As it slowly ascended into the sky, he wondered just how high it could go. "I am worried I will never see it again" he said. His parents told him: "*What goes up must come down*, it will fall back down to the earth eventually. Then you can collect it up and launch it again"

Students will suggest reasons as to why what goes up must come down and fall to the Earth eventually.

(Expected responses: gravity pulls them down or gravity causes them to fall to the Earth).

Have students stand and jump.

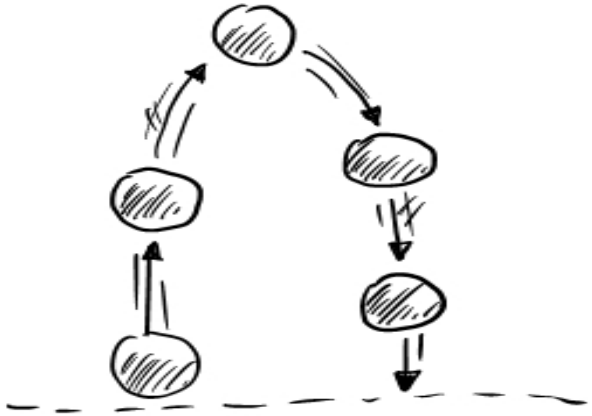
Ask students why they did not just stay in the air when they jumped.

(Expected response because gravity pulls us back down).

Skills

- Listen to competing ideas and methods pertaining to the effect of Earth's gravitational pull-on objects.
- Predict the results of experiments
- Compare, competing ideas and methods based on their merits.
- Critique explanations proposed by peers by citing relevant scientific evidence pertaining to Earth's gravitational pull-on objects.
- Use demonstrations and or models to show the direction of the gravitational force exerted by Earth on objects.
- Investigate the effect of Earth's gravitational force on objects of different sizes, masses and shapes released simultaneously from the same height.
- Conduct research on Galileo's experiment.
- Demonstrate that air resistance sometimes affects the rate at which objects fall to the Earth.

Carefully examine the picture below and then answer the questions that follow.



1. The diagram above demonstrates

   _____

   _____

   Ans: The effect of Earth's gravitational force on a ball thrown into the air. (2marks)

2. Describe what is happening in the diagram above.

   _____

   _____

   Ans: A ball that was at rest on the ground, was thrown into the air(1mark), it travelled upward (1mark) and then downwards and fell back to the ground (1mark).

3. Explain the events shown in the diagram above.

   _____

   _____

Further discussion:

1) Can you see gravity? (No, it is an invisible force)
2) Does gravity pull all objects to the surface? (Yes, it doesn't matter what the object is made of- wood, metal, rocks etc.)
3) We know another invisible force is magnetism. Why is the force of magnetism different from gravity? (Magnets only attract certain things like some metals; it also attracts in all directions, not just downward.

Class discussion on what is gravity.

Gravity is a force pulling objects to Earth's surface. Gravity prevents objects from floating off into space.

Every object in the world (everything with mass) has an attractive force that draws other objects to it. The bigger the object, the bigger that force of attraction is that draws other objects to it. The Earth is a large object that has a great mass (the amount of matter in a body) because of this, its force of attraction that pulls objects to it is very strong. This force of attraction pulls objects constantly towards the Earth. This force is called gravity. That is why when we jump up into the air, we fall back down. That is also why Simon's parents told him that the toy rocket would fall back to the Earth.

Extension Discussion: The moon is very large too. It has its own gravity, but it isn't as big as the earth, so its gravity is less. Did you know that the moon's gravity is strong enough to pull on the water in our oceans? This is what causes our ocean tides! And when the sun and moon line up, their combined gravity makes our ocean tides very high.

Have a student throw a ball into the air.

- Critically reflect on video information to construct new understandings.

Values

- Collaborate to investigate the effect of Earth's gravitational force on objects.
- Display sensitivity and offer assistance to peers who may have physical or learning challenges when conducting group work.
- Actively participate in classroom discussions

Ans: When the ball is thrown upwards into the air, the downward force (1mark) of gravity (1mark) gradually slows(1mark) the ball and brings it back down(1mark) again.

4. John's birthday balloon was accidentally released into the air while walking home from school. John cried as he ran trying to catch it as it sailed away higher, and higher. John's friend Paul told him that trying to catch the balloon was futile. Do you agree with Paul? Give a reason for your answer.

_____

_____

Ans: Yes, the balloon will continue rising but it will eventually burst and fall to the ground again. (2marks)

Total: 10 marks

Assessment 2

Students will view the video below and then answer the questions that follow.

Hammer vs Feather - Physics on the moon https://www.youtube.com/watch?v=KDp1tiUsZw8 Duration: 1:22

1. The video shows the man on the _____ (moon 1 mark)
2. He is about to _____ (drop 1mark) a ____ (hammer 1mark) and a _____ (feather 1mark).
3. One object is_____ (heavy 1mark) and the other is_____ (light 1mark).

Students will suggest why the ball falls back down.

The downward force of gravity, gradually slows the ball, stops it, and then brings it back down making it fall faster and faster. Without gravity (and air resistance) the ball would go on travelling upwards in the direction it is thrown in.

Galileo's falling body experiment

Pose Question: What effect does Earth's gravitational force have on different objects? A man named Galileo did experiments to try to understand differences. Show students two objects such as two small water bottles of the same type and size (one filled with water and one empty). Ask students what will happen if they are released at the same time from the same height. Would they hit the ground at the same time, or would one hit before the other? Why? Have students record their predictions and explain their thinking. Allow students to share some of their predictions and reasonings.

Have two students drop the bottles simultaneously from a high place while the others observe. Students can repeat the experiment to ascertain their observations.

(The two bottles: one filled with water and the empty one, will hut the ground at the same time. No matter the weight of the object, it is being pulled down towards the Earth at the same speed because the force of gravity acting on them is the same time)).

Have students share their thinking on the observations.

Group Activity

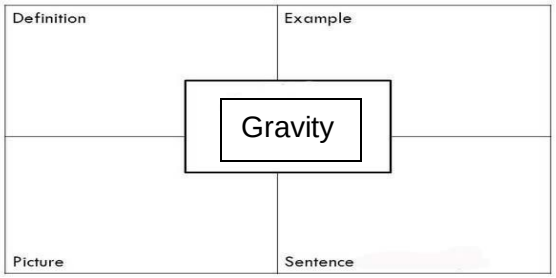
Place students in cooperative groups with individuals assuming different roles (a recorder, investigators, researcher etc.,).

	4. He dropped both objects, from the _____ (same height 1mark)) at the_____ (same time 1mark) 5. What happens when he drops both objects? _____ (They hit the ground at the same time 1mark). 6. If both objects were dropped from the same height, at the same time in the playground, would you get the same results? Give a reason for your answer. _____ _____ Ans: No(1mark). On the moon, the hammer and the feather will hit the ground at the same time(1mark) however, on the playground, the hammer will hit the ground before the feather. (1mark) This will happen because there is no air resistance on the moon but there is air resistance on the playground. (1mark) **<u>Assessment 3</u>** Create a lapbook to 1. demonstrate that when objects are thrown upwards, they eventually fall back to the Earth. 2. show if shape, size, and mass affect the rate at which objects released from the same position fall back to the Earth 3. show the effect of the presence and absence of air resistance on objects released at the same time from the same height.	Students will plan and execute how to determine the effect of Earth's gravitational pull on the objects to be investigated. Materials for groups Set 1 a tennis ball an apple grapes pencil eraser Closure: The teacher will ask students what they noticed about the length of time it took for objects to fall Set 2 Two sheets of the same type of paper: Students will roll one of the sheets into the shape of a ball and the other will remain flat. Within the groups, individual students will predict what would happen when the different shapes of paper are dropped from the same height simultaneously. They will share their predictions and reasoning behind their thinking with group members. The group will then investigate to determine what happens when the papers are simultaneously released. Discussion: The ball of paper fell faster than the sheet of paper. Why do you think that happened? (The sheet of paper floated down rather than dropping fast.) What was it floating on? (The air was keeping it up longer). We call that effect "air resistance". When we put our hand out an open car window, we can feel air pushing on our hand- we call that air resistance too. Let us watch this video to reinforce our understanding of air resistance. https://www.youtube.com/watch?v=O-KYLXp2MG4 (3:58 mins)

	4. draw an emoji to show what you think of this topic. **Assessment 4** People have used air resistance for many different things including the making of parachutes to allow skydivers to control the speed of their descent as gravity pulls them down from the sky. View the video below and see how to make a parachute. https://www.youtube.com/watch?v=QFooUXyN-pA (5:49 mins) Research the use of parachutes to control the descent of spaceship modules on the moon and earth. Collect pictures on the internet and make a PowerPoint presentation for your classmates to view. You should explain: 1) how the resistance of the atmosphere helps to fill the parachute and slow down the falling spaceship. 2) Why is parachute design s difficult for spaceships? **Assessment 5** Demonstrate your understanding of the new vocabulary by completing the four squares below 	Let us write a sentence that captures what we have observed. When there is air resistance, objects will not fall to the ground at the same rate, the air slows down some objects. Let us watch the following video and see what happens when we drop a feather and a hammer on the moon where there is no air and therefore no air resistance- what do you predict will happen? (The hammer will fall quicker) https://www.youtube.com/watch?v=KDp1tiUsZw8 (1:22 mins) Let us write a new sentence about what we now know. In the absence of air resistance, objects fall to the surface of that planet at the same rate. This invisible force is called gravity.

Frayer Model (Four Square)

Reinforcing Vocabulary



Useful Content Knowledge for the Teacher about the Outcome:

The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.
Acceleration due to gravity is constant regardless of mass.
In practice the speed that objects fall may vary, because air resistance will act on objects pushing them up slightly, in opposition to gravity. The greater the surface areas of an object the more surface for air to push up against and so air resistance will act upon a falling object, slowing its fall. The amount of air resistance acting upon something is dependent upon its shape and size.

Inclusive Resources and Materials

Use of multisensory activities and materials to assist all learners

paper
water bottle
a tennis ball
an apple
grapes
pencil
eraser

Strategies that Support the Curriculum and Assessment Framework	
Elements of the Essential Education Competencies that are addressed:	
Is an engaged, responsible, caring, tolerant participant in civil society	How does gravity affect their lives?
Is creative, enterprising, and resilient	Project base learning
Thinks critically, communicates effectively, and solves problems	Critical thinking- analysing and explaining observed phenomena
Leads a healthy and active life	
Uses literacy and numeracy to understand, appreciate and act in the world	Reading and critiquing online information
Demonstrates an appreciation for the culture of St. Kitts and Nevis	
Demonstrates technological empowerment	Use of instructional video

Elements that are integrated across subjects:
Language Arts: Reading, writing, new vocabulary
Mathematics: Measuring, collecting, and interpreting data

Elements from Local Culture, Technology, TVET, Environment that are integrated:
Use of technology for measuring data and online video for information.

Items of Inspiration (teaching tips, inspirational passages, connections to educational research.
Gravity is all around us, but there are common misconceptions about its effects on different-shaped objects.

Purpose of the Subject: The study of science encompasses knowledge, processes, and values. Scientifically literate persons will foster an attitude of caring not only for themselves, but as responsible citizens, for the world around them. Their decision making will be enhanced by a systematic study of the structure and behavior of the physical and natural world through observation and experiment. In learning science, students benefit from leveraging and evaluating available technological tools to study and therefore understand the world and their relationship to it

Topic: Space System

Essential Learning Outcome: **Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.**

Grade Level Guidelines: Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

Specific Curriculum Outcomes

Students are expected to:

Knowledge

- **Define:**
  - Light year
  - luminous object
  - Star
  - Apparent brightness
- Explain how distance affects the appeared brightness of stars
- Explain how size of a star impacts brightness

Skills

- Analyse data to determine how distance from Earth impacts apparent brightness of stars.

Inclusive Assessment Strategies

Assessment 1

Stargazing:
Homework - Students will ask an adult (parent) to download the augmented reality App: Star walk on a phone. During the night, the child will stargaze using this App on the phone. The student will upon returning to class present a description of what was seen. This presentation could be written, sketches with description, or a narrated video.

Assessment 2

Have students fill in each section of the stellar scale below with a star that fit the description in each quadrant.
cc68f757a465a3/t/5e18a7f91ef6301d8e88c668/1578674169186/5-ESS1-1+Stellar+Scales%28Student+Version%29.pdf

Inclusive Learning Strategies

To introduce the lesson

Play the song Twinkle, Twinkle Little star. while Song: Twinkle, Twinkle little Star https://www.youtube.com/watch?v=QjrQ1rmS44M (2.06 mins)

Ask students why they think stars twinkle? (The light from stars travels through air of different densities- so it bends in different directions)

See full explanation here: https://theconversation.com/curious-kids-why-do-stars-twinkle-81188

Students view the video below muted.

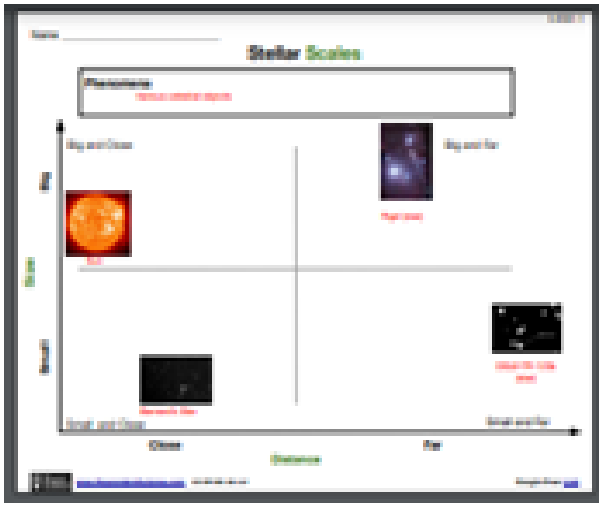
Star gazing at Siding Spring Observatory https://www.youtube.com/watch?v=2Ueo1cqwUgU (2:50 mins)

Have students share their reaction to the scenes of the starry sky and their thoughts about stars.

- Demonstrate how distance from Earth affects the brightness of stars.
- Create a model to support the claim that distance impacts the apparent brightness of stars.
- Write a friendly letter
- Give evidence to support the claim that distance impacts apparent brightness of stars.

Values

- Actively participate in class discussions
- Work collaboratively to analyse data
- Work collaboratively to demonstrate how distance from Earth affects the apparent brightness of stars.
- Display sensitivity and offer assistance to peers who may have physical or learning challenges when conducting group work.



Assessment 3

Your friend in Antigua tells you that some stars are brighter than others and it does not matter how far away from Earth they are.

Alternatively, students can be asked: What do you think about stars?
(ESR: Stars are found in the sky
There are billions of stars
Stars are seen at night
Stars produce light)

Read the book Stargazers by Gail Gibbons to the point indicated on the video below or have students view the video to the stated point.

Stargazers by Gail Gibbons
https://www.youtube.com/watch?v=JdmnK0CjVVc (7:17 mins)
0 - 3:14

Have students listen for specific details.

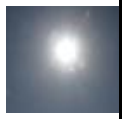
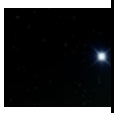
1. When does the sky become dark? After sun set
2. What can be seen in the sky on a clear night? points of light
3. What is the name given to these points of light? Stars
4. What makes stars shine? stars give off heat and light because of their hot gases which makes stars shine
5. Who are stargazers? people who watch the night sky
6. What are some stargazers called? Astronomers
7. There are ___ (small) stars and ___(big) stars but most are very large.
8. The _____(sun) is a yellow star that is over a ___(million) times larger than our planet.

	Write a letter to your friend in Antigua to convince him/her that the distance between the stars and Earth are what makes some stars look brighter than others. **<u>Assessment 4</u>** **Group Activity** Use circular shapes of different sizes and torch lights/similar battery-operated lights to demonstrate how distance and apparent brightness of stars are related. Use a suitable scale to distance the celestial bodies.	9. Why do all the other stars in our planet look tiny? because they are very far away Stars are so far away from Earth that their distance is measured in_____ (light years) 10. The sun is ____ (8) light minutes from us. 11. The next star is ____ (4) light years from us. 12. Some stars are ____(billions) of light years away. 13. A____ (light year) is the distance light travels in one year. 14. One ___ (light year) is about 6 trillion miles. 15. ____(Light) travels at 186000 miles in a second. 16. Some stars look ___ (brighter) than others. 17. Red stars are the ____(cooler) stars, yellow stars are the ___(warmer) stars and bluish-white stars are the ___(hottest) stars. 18. Why do stars appear to twinkle? because of the atmosphere, as starlight travel through the atmosphere, it appears to twinkle 19. Are there stars in the sky during the day? Yes 20. Why can't stars be seen during the day? because of the bright sunlight

		Elicit from student's oral responses to questions. Big Question: Why do you think the sun looks so bright in the sky? Allow the students to share their thinking on this question. (ESR: the sun is so bright because it is close to earth). Have students stand in one corner of a dimly lit or darkened classroom. Turn on a flashlight where they are standing then gradually move the light until it is at the far end of the room. Have students return to their seats and turn back on the lights. Have the students describe how the brightness of the light varied as it was moved further away from them. When the light was closest to you it looked brightest, as it gradually moved further away from you, it gradually appeared less bright/ fainter. That is just how it is with stars and Earth. The further away from Earth stars are, the fainter their light appears Planets and Stars' size comparison https://www.youtube.com/watch?v=7T1LO6nOUdw View: 0.20 - 1.22mins Have students note the names of the stars in sequence. Names of stars in sequence as seen in the video: The Sun Sirius A

Pollux
Arcturus
Aldebaran
Rigel
Pistol Yildizi
Antares A
Mu Cephei
VY Canis Majoris
(ESR: the size of the stars increases as you progress through the sequence)
Have students comment on the relative size of the stars and how bright each is.

https://docs.google.com/document/d/1uObeBQc5Uz8VU1XtizrS_rgGGzLkjCMYaUF6iL8N03k/edit#
The tables below were sourced from the site above.

Sun	Sirius	Canopus	Rigil Kentaurus	Arcturus
				
Vega	Capella	Rigel	Procyon	Archernar
				

Top 10 Brightest Stars in the Sky

Star	Distance to Earth (Light years)	Apparent Brightness	Stellar Radius (Solar radius)
Sun	.0001	560000000 00	1.0
Sirius	8.6	3.86	1.7
Canopus	74	1.95	7.1
Rigil Kentaurus	4.3	1.28	1.2
Arcturus	34	1.04	25.4
Vega	25	.97	2.3
Capella	41	.93	11.9
Rigel	1400	.90	79.9
Procyon	11.4	.70	2.0
Achernar	69	.65	7.3

Give students a copy of the tables above.

Have students work in pairs to carefully examine and discuss the information (how far stars are from Earth and how their apparent brightness varies in relation to this).

Discuss with students the distance of each Star from Earth and the size of each Star and its apparent brightness from Earth.

		The sun is closer to Earth than any other star, so it appears much larger and brighter than any other star in the sky. *Although stars are immensely large compared to Earth, they appear small and dim because they are so far away.*

Useful Content Knowledge for the Teacher about the Outcome:

- The sun looks so bright in our sky because we are close to it.
- Earth is about 92 million miles away from the sun.
- The sun is the closest star to Earth.
- The next closest star to Earth, Proxima Centauri, is 4.2 light years away.
- Each light year is about 5.8 trillion miles.
- The farther away from Earth a star is, the fainter it looks in the sky.
- A luminous object close to a person appears much brighter and larger than a similar object that is very far away from a person.
- A star is a natural body that gives off its own light. The sun is therefore a star.
- The sun is many times larger than Earth but appears small because it is very far away.https://www.scholastic.com/teachers/articles/teaching-content/all-about-stars/
- Our Stars - https://www.youtube.com/watch?v=cQogsbFHkQw
- Distance to Earth - distance to the star measured in the distance light can travel in one year.
- Apparent Brightness - brightness of a star as seen from Earth. The Sun has a brightness of 56 billion
- Stellar Radius-the radius of a star compared to the Sun's radius

Glossary

- **Light year:** a light-year is the distance that light travels in vacuum in one Julian year. (365.25 days

Inclusive Resources and Materials

Use of multisensory activities and materials to assist all learners

https://www.youtube.com/watch?v=QjrQ1rmS44M (video)
https://www.youtube.com/watch?v=2Ueo1cqwUgU (video)
https://www.youtube.com/watch?v=JdmnK0CjVVc (video)
https://docs.google.com/document/d/1uObeBQc5Uz8VU1XtizrS_rgGGzLkjCMYaUF6iL8N03k/edit# (tables)
https://static1.squarespace.com/static/59c3bad759 (table)

Strategies that Support the Curriculum and Assessment Framework	
Elements of the Essential Education Competencies that are addressed:	
Is an engaged, responsible, caring, tolerant participant in civil society	
Is creative, enterprising, and resilient	Critical thinking- analysing
Thinks critically, communicates effectively, and solves problems	
Leads a healthy and active life	Analyzing data/critically reviewing online information/writing a letter
Uses literacy and numeracy to understand, appreciate and act in the world	Star gazing as a pass time
Demonstrates an appreciation for the culture of St. Kitts and Nevis	Use of technology for gathering and recording data
Demonstrates technological empowerment	Demonstrating actively the light brightness activity with a flashlight
Elements that are integrated across subjects:	
Language Arts: new vocabulary, letter writing **Mathematics**: working with large numbers, interpreting data **Elements from Local Culture, Technology, TVET, Environment that are integrated:** Use of technology- stargazing phone application. **Items of Inspiration (teaching tips, inspirational passages, connections to educational research)** Having children get outside to view stars is motivational in terms of outdoor learning.	

Purpose of the Subject: The study of science encompasses knowledge, processes, and values. Scientifically literate persons will foster an attitude of caring not only for themselves, but as responsible citizens, for the world around them. Their decision making will be enhanced by a systematic study of the structure and behavior of the physical and natural world through observation and experiment. In learning science, students benefit from leveraging and evaluating available technological tools to study and therefore understand the world and their relationship to it

Topic: Space System

Essential Learning Outcome: Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Grade Level Guidelines: Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

Specific Curriculum Outcomes

Students are expected to:

Knowledge

- Define:
  - Shadow
  - Sundial
  - Phases of the Moon
  - Constellation
  - Signs of the Zodiac
  - Line graph
  - Bar graph (histogram)

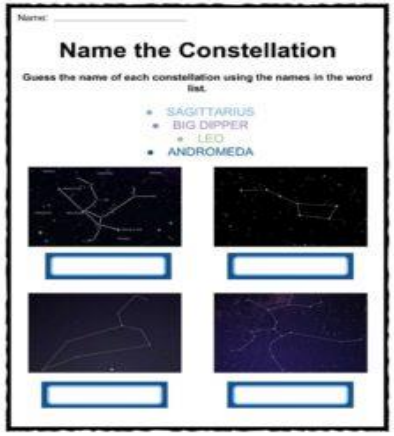
- Explain how we create shadows.

- What characteristics of the shadow change with a change in the position of the light source? (Length, direction)

Inclusive Assessment Strategies

Identifying Constellations
After students have investigated the video (https://www.youtube.com/watch?v=1sZ15SUeS9w, (3:44 mins) they should be able to respond to the challenge below

The following are four groups of stars. Write the names on the space provided.



Retrieved from:
https://kidskonnect.com/science/stars-constellations/

Inclusive Learning Strategies

To start the class time, you should promote active listening by getting students to consider the following questions as they listen to the poem called "My Shadow**"**.

1. What is the poem about?
2. How does the shadow behave?
3. What time of day is the shadow difficult to see?

My Shadow
I have a little shadow that goes in and out with me,
And what can be the use of him is more than I can see.
He is very, very like me from the heels up to my head.
And I see him jump before me when I jump into my bed.

The funniest things about him are the way he likes to go.
Not at all like proper children, which is always very slow.
For he sometimes shoots up taller like an Indian rubber ball, and he sometimes gets so little that there's none of him at all.

Skills

- Draw the position of shadows.
- Use measurement and a graph to predict the time during daylight
- Develop skills for observation.
- Observe and illustrate stars in terms of groupings and patterns as seen on a clear night.
- Investigate to determine the position of the sun and the length and direction of the shadow formed.
- Plot and interpret graphs depicting length of shadows for several times during the day. Make a sundial.

Values

- Question, explore and investigate.
- Show concern for their safety
- Display sensitivity and offer assistance to peers who may have physical or learning challenges.

Assessment 1

As an extension of the sundial activity where students drew a line graph, have them now draw a bar graph (histogram) of the same data.

Construct and present a bar graph (using the data collected during the investigation) showing the pattern of the hourly changes in the length of the shadow during the school day from 9am to 3pm.

Assessment 2

Items 1-4 are based on the situation below.

A Grade 5 class drew around the shadow of a pole in the school yard every half-hour. They measured the length of the shadow each time and put their results in this table.

Time	Length of Shadow(cm)
8:30 am	340
9:00	210
9:30	145
10:00	107
10:30	88
11:00	79
11:30	74
12:00	72

He hasn't got a notation of how children ought to play,
And can only make a fool of me in every sort of way.
He stays so close besides me, he's a coward you can see.
I'd think it's a shame to stick to nursie as that shadow sticks to me.

One morning, very early, before the sun was up,
I rose and found the shining dew on every buttercup.
But my lazy little shadow, like an arrant sleepy head,
Had stayed at home behind me and was fast asleep in bed.

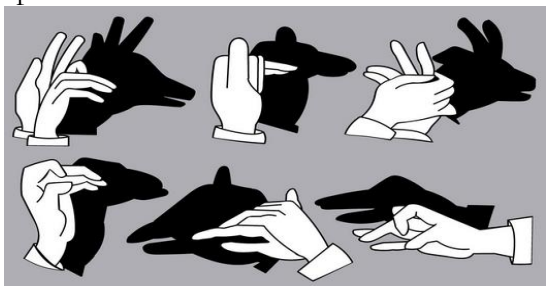
Robert Lewis Stevenson

Read Aloud here:
https://www.youtube.com/watch?v=fUuGV-JvHXw (1:37 mins)

Shadow Stories

Take students outside in the school yard to observe and discuss shadows of objects or themselves. Have students work in groups of 4 or 5. Ask students to use their hands to create shadows on a wall and create a short story with their hand shadows.

Sample Shadows



Retrieved from: https://www.vecteezy.com/vector-art/116969-set-of-shadow-hand-puppets-vector-elements

• Willingly observe and listen to opinions of others in planning and carrying out activities and in choosing and using materials. • Actively participate in in class discussions	1.What do you notice about the shadow? The shadow got. A. darker B. longer C. lighter D. shorter 2. How would the shadow behave in the afternoon? It will A. darker B. longer C. lighter D. shorter 3. What will the length of the shadow likely be at 1:30 in the afternoon A. 70 cm B. 80cm C. 90cm D. 100cm 4. Which hour measures the shortest shadow? A. 12:00noon B. 1:30pm C. 3:30pm D. 4:00pm 5. How does the rotation of the earth produces day and night A. the sun shines on the earth. As the earth rotates the same area receives sunlight B. As the earth rotates the moon reflects sunlight onto different parts of the earth making it day C. As the moon rotates around the earth it reflects light from the sun onto the earth causing, it to be day.	See other shapes here: https://www.reddit.com/r/coolguides/comments/f4thno/guide_for_hand_shadows/ Ask students: How is a shadow formed? (*The object blocks the light from the sun).* Shadows are dark shapes created when an object blocks out light. Shadows are formed because light does not go around an object and light up the areas behind them. This does not occur because light travels in a straight line. **Demonstration of Shadow Movement** Students, if we take a flashlight (torch) and we shine it in an object we see a shadow behind the object. If we change the angle or slant of the flashlight, what do we notice? (*The shadow changes also*) But how does it change? (*It is taller or shorter sometimes*)  Name **Shifting Shadows** Objects that block light cast shadows. Does a shadow always fall in the same place? Try this activity and see for yourself. **What you need:** flashlight • paper cup • piece of white paper • a dark place **What you do:** 1. Look at the way the flashlight is being held in the picture. Where do you think the cup's shadow will fall? Circle the picture. 2. Now put the paper cup on the paper. Hold your flashlight in the same way. Where does the shadow fall? Circle the picture. Was your guess right? 3. Can you make the shadow fall in the places shown below? Use your flashlight. Mark an X over each picture to show where you held the flashlight to make each shadow. **Shadows on the Move:** When you play outside, your shadow looks different at different times of the day. Why do you think this is so? 8 Retrieved from: https://www.google.com/search?q=shifting+shadow+worksheet

D. The side of the earth facing the sun experiences day and the side away from the sun experiences night.

Answer Key:

1: D 2: B 3: B 4: A 5: D

Practicing Vocabulary
In order to practice new vocabulary, teacher may assign this
word search

CONSTELLATION

P	Q	Z	F	C	O	G	P	N	N	P	R	C	O	N
A	P	A	C	K	R	U	X	H	L	K	E	A	G	W
W	I	I	C	F	I	H	V	E	A	S	P	N	R	O
N	D	E	H	A	O	Q	I	V	E	O	P	I	I	F
D	R	N	P	D	N	A	S	R	U	B	I	S	V	D
A	Z	U	I	O	D	I	A	V	X	X	D	M	N	B
K	X	D	T	E	I	T	S	M	D	L	G	I	X	E
Q	H	P	S	A	N	S	X	M	Q	F	I	N	Q	S
B	I	X	K	A	S	B	S	J	A	J	B	O	N	K
D	A	E	X	F	Q	Y	H	A	S	J	H	R	J	Z
I	P	V	C	X	M	P	N	F	C	O	O	D	D	E
S	I	R	A	L	O	P	S	B	Y	X	F	R	V	W
L	I	T	T	L	E	D	I	P	P	E	R	J	R	I
S	R	E	T	S	I	S	N	E	V	E	S	E	H	T
Y	K	V	Y	L	A	N	S	C	O	R	P	I	O	S

Antares	big dipper	Canis major
Canis major	Cassiopeia	little dipper
Orion	Pleiades	Polaris
Virgo	Scorpio	the seven sisters

Centuries ago, before watches and clocks, people realised that the shadow of objects like trees consistently changed length and angle as the sun crossed the sky. This coincided with the length of the day, and it became quite useful to judge how the day progressed timewise. This led to the creation of something called a **sundial**. Watch this video to see a modern-day explanation of the sundial:

https://www.youtube.com/watch?v=Hu3Pb6RNyy4How To Make A Sundial or Sun Clock At Home Very Easy (7:40 mins)

Making the sundial
Have students make sun dials and place them in the sun. check the sundial every hour and mark the position of the tip of the shadow. (Materials for sundial: unsharpened pencil, paper plate, black marker, glue gun)

Have students draw a circle in the centre of the cardboard square and mark the letter N on the edge of the circle to represent the North Pole. Push the pencil through the centre of the circle and tape it upright. Use the compass to find North and turn the cardboard so the N faces the North Pole. Mark the position of the centre of the pencil's shadow on the circle and write the time there.
Repeat the previous step several times during the day and then use the sundial to tell the time of day.

Graphing the Shadows Using the Sundial

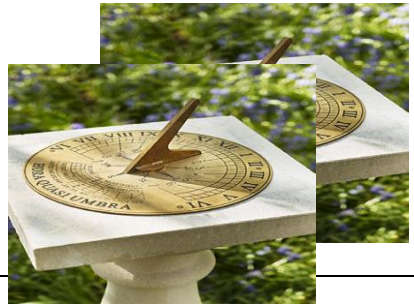
Students should set up their sundial outside in the bright sun such that they get a measurable-size shadow. They should fill in the table below with centimeter measures of the shadow length for designated times.

Time of Day	Length of Shadow (cms)
9 AM	
10 AM	
12	
1 PM	
3 PM	

After students have collected/tabulated the data through the day, they should plot a line graph of shadow length (Y axis) versus Time of Day (x axis)

The next day they should check their shadow lengths by referring to their graph at select times and determining what the length should be.
The students should also draw a pattern on a circle of paper that shows the direction that the shadow progressed.

Retrieved from:
https://www.generationgenius.com/activities/earths-orbit-and-rotation-activity-for-kids/

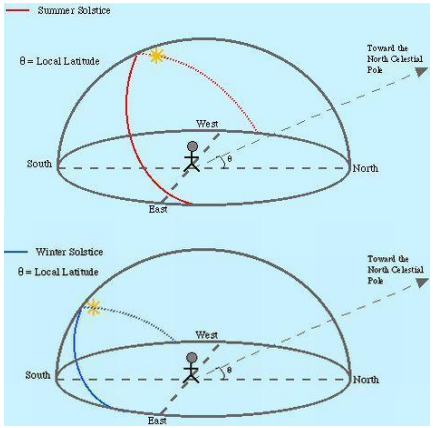


Retrieved from:
https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.chilstone.com

Variation in the Suns' Path

The seasons in the equatorial regions do not vary substantially in terms of heat from the sun as it shines directly near the equator the entire year. But in other parts of the world like the Northern Hemisphere, the sun tracks across the sky very high in the summer months (May-Aug) and low in the winter months (Nov-Mar). This has the effect of longer days in the summer and shorter days in the winter. In many regions, the time is adjusted to account for this so that people experience more daylight during their working hours.

Sun's Path Across the Northern Hemisphere Sky



Retrieved from:
https://livingonsolarpower.files.wordpress.com/2013/03/summer-winter-solictice.jpg

		Nighttime Sky When the sun disappears for the day, it is because the earth is rotating away from the direct rays. We know it continues to shine because we see the reflection of its light off of the moon. Depending on the position of the moon, earth and sun, the reflection of that light on the moon looks different. We call those the (see: http://socrates.acadiau.ca/courses/educ/GMacKinnon/EDUC4143/graphics/moonactivity.pdf) . That same positioning in the universe allows us to see light reflecting off of stars and planets at different times of the year. **phases of the moon** Common star patterns called constellations **are the signs of the Zodiac. A description can be seen in this video: The Zodiac Constellations: Crash Course Kids #37.1 (4:08 mins)** **Guide to Constellations in the Sky:** This Week's Sky at a Glance, August 18 – 26 - Sky & Telescope

Useful Content Knowledge for the Teacher about the Outcome:

Shadows are dark shapes created when an object blocks out light. Shadows are formed because light does not go around an object and light up the areas behind them. This does not occur because light travels in a straight line.

The Big Dipper which can be observed in the northern sky. It is useful because it helps you to locate the north polar star. Once you face the pole star (Polaris) you are facing the direction north. The other direction can then be found. The Big Dipper can be seen high in the sky between 7:00 p.m. and 9:00 p.m. (and later) between March and June. The stars of the Big Dipper which point to the north star are called the pointers.

Cassiopeia, shapes nearly like a W or an M, can usually be seen high in the northern sky early at night between October and February at a time when the Big Dipper is too low (on the horizon) to be easily seen. It can also be used to find the north star.

Orion is very too easy to locate in the sky. It would usually be seen between November and March first in the eastern sky and progressively in the western sky early at night.

The Pleiades (they are also called (Seven Sisters) appear as a small group of seven stars. They are easily seen high in the sky around Christmas or between November and January.

Children would easily recognise the shape of Scorpius. It is shaped like a scorpion. It is best observed between July and September, first in the southeast moving progressively to the west. It is particularly famous for its big red star known as Antares.

Inclusive Resources and Materials

Use of multisensory activities and materials to assist all learners

https://www.youtube.com/watch?v=N3EqcUNdIl8 (Video)
https://www.youtube.com/watch?v=hXZPRocjXsU (Video)
https://www.pinterest.com/pin/501588477241446060/?lp=true (image)
https://betterlesson.com/lesson/resource/3210509/guiding-questions (Guiding research questions)
Books, magazines and computers/computer labs, chart paper or manilla paper.
Resources needed to construct sundial, unsharpened pencil, paper plate, black marker, glue gun
Resources used to show day and night, table, flashlight, dark shirt, small hand mirror, small dark room
http://peepandthebigwideworld.com/en/kids/games/html5/2/shadow-shapes/

Glossary- Definition of Terms

Shadow
A shadow is a dark area where light from light from a light source is blocked by an opaque object

Sundial
An instrument showing the time by the shadow of a pointer cast by the sun onto a plate marked by the hours of the day.

Phases of the moon
Phases of the moon are the different ways the moon looks from the earth over about a month. As the moon orbits the earth, the half of the moon that faces the sun will be lit up. The different shapes of the lit portion of the moon that can be seen from the earth are known as the phases of the moon.

Constellation
A group of stars which make up an imaginary outline or pattern in the night sky (the celestial sphere). Usually, they are said to represent an animal, mythological person, or creature in shape.

Line graph
A graph which uses lines to connect individual data that display quantitative values over a specified time interval.

Bar graph
A diagram in which the numerical values or variables are represented by the height or length of lines or rectangles of equal width.

zodiac of signs
An imaginary belt of the heavens, extending about 8 degrees on each side of the ecliptic, within which are the apparent paths of the sun, moon, and principal planets. It contains 12 constellations and hence 12 divisions called signs of the zodiac.

Strategies that Support the Curriculum and Assessment Framework	
Elements of the Essential Education Competencies that are addressed:	
Is an engaged, responsible, caring, tolerant participant in civil society	
Is creative, enterprising, and resilient	Creativity- in projects and presentations
Thinks critically, communicates effectively, and solves problems	Critical thinking- filtering information on the web
Leads a healthy and active life	Yes-star gazing
Uses literacy and numeracy to understand, appreciate and act in the world	New vocabulary, reading books, writing, tabulating data, filtering data and information, interpreting poetry
Demonstrates an appreciation for the culture of St. Kitts and Nevis	Yes -The use of the sun to tell the time
Demonstrates technological empowerment	Use of technology for learning such as YouTube and websites

Elements that are integrated across subjects:
Language Arts: Reading/interpreting Poetry, listening to others, speaking one at a time about the topic
Social Studies: Using cardinal directions in locating shadows
Mathematics: Measurement, data tabulating, graph, extrapolating

Elements from Local Culture, Technology, TVET, Environment that are integrated:
Making a sundial

Items of Inspiration (teaching tips, inspirational passages, connections to educational research)
The history of the sundial and human pursuit to track time, is very interesting

Topic Five (5)

Engineering Design

Purpose of the Subject: The study of science encompasses knowledge, processes, and values. Scientifically literate persons will foster an attitude of caring not only for themselves, but as responsible citizens, for the world around them. Their decision making will be enhanced by a systematic study of the structure and behavior of the physical and natural world through observation and experiment. In learning science, students benefit from leveraging and evaluating available technological tools to study and therefore understand the world and their relationship to it

Strand (Topic): Engineering Design

Essential Learning Outcomes: – 1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
– 2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
– 3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Grade Level Guidelines: Students in kindergarten through fifth grade begin to develop an understanding of the four disciplinary core ideas: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** ● Describe the situation that needs to be changed in terms of a problem that must be solved. **(ELO 1)** ● Identify possible solutions to the problem that needs to be solved based on observations and research (Knowledge of the materials available). **(ELO 2)** ● Describe the properties of the materials that would be used to solve the problem based on scientific information, materials available and limitations. **(ELO 2)**	Strategic Questioning: - What is the problem that needs to be changed? - What situation has caused the problem? - How do you think this problem can be solved? Present completed tables with results from lab tests for: - Opacity - Magnetism - Elasticity - Conductivity - Density (NB. Refer to the activity sheet with scenarios for tables.)	**In small groups:** ● Hand out the Desert Island Scenario worksheet to the class *(see copy below resources and materials)*. Discuss the scenario as a class, making sure each learner understands the premise of the activity. ● Review the list of materials, restrictions, and building requirements for each structure. ● Show the learners where the research stations have been set-up in the classroom. Demonstrate and explain how to test and measure the various properties of matter at each station. Show the learners how to record their data on their lab sheets. ● Once the data is collected, review as a class the building requirements and how to properly draw and label each structure.

- Demonstrate an understanding of how to improve a design or plan based on tests. **(ELO 3)**

Skills

- Sketch or develop a plan/ design of the solution to the problem to be changed or solved (consider: the materials to be used, difficulties that may exist and the results/ impact of the solution).
- Conduct investigations to gather information about the properties of the materials.
- Interpreting observations from investigations to make judgements for selection of the better design solution to solve the same problem
- Investigate and test to compare the strengths and weaknesses in the designs to solve the same problem.
- Observe and compare classmates' design solutions to the problem.
- Communicate orally and through sketches/ drawing and models that the materials used depend on their properties to solve a given problem.

Present completed sketches of the design solution for:

- Shelter
- Road
- Boat

The materials used for each design solution must be identified. Groups must justify the reason for the selection of materials through an oral presentation. (Areas to be assessed: type of materials, reason for selection (properties).

(NB. Refer to activity sheet for guidelines for design sketches).

- 'Show and tell' sketch/ diagram or model of solution design to solve the problem for shelter, boat, or road.

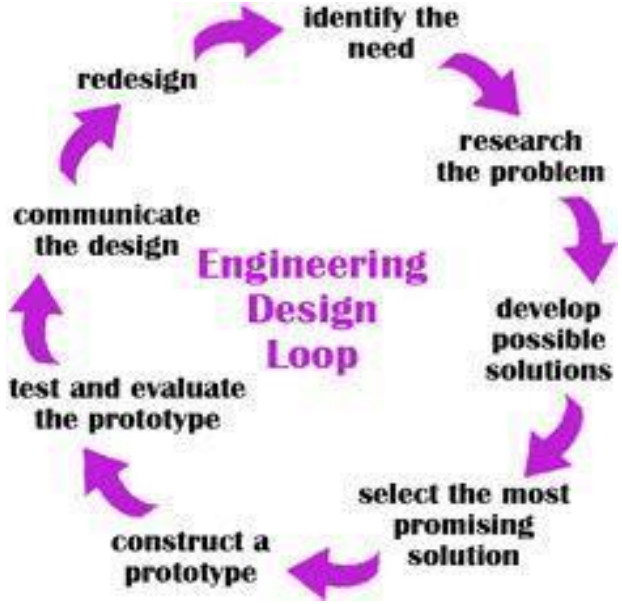
Rubric/ Areas for assessment

- *Description of the design, (10 marks)*
- *How does it solve the problem? (5 marks)*
- *Why is it important to solve the problem? (5 marks)*
- *Can the same design be used for another problem? (5 marks)*
- *creativity, (7 marks)*
- *speaking with confidence (3 marks)*

Review what properties of the materials they want to consider in making building choices. Remind them to take into account the natural elements of the island, such as lightning, rain, waves, etc. when deciding which materials will work best.

NB. Groups may use an engineer design loop/ worksheet to complete one of the three assignments, e.g., some may be assigned to work on the shelter while other groups are assigned the boat or road.

Example of an engineer design loop,



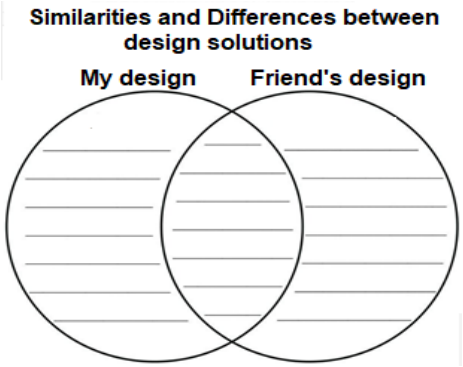
Retrieved from: https://www.pinterest.ca/pin/331788697534595207/

- Have each group present their structures to the class; explaining why they chose the materials they did for the various parts. (*NB. You may have the class present questions or concerns about material choices. Discuss)*

Values

- Display sensitivity and offer assistance to peers who may have physical or learning challenges as they are engaged in the engineering design process to share ideas and cooperate to construct and test the design solutions.
- Express the desire to understand the problem and find solutions by asking many questions during group work.
- Work respectfully with others in identifying and sharing ideas of how to solve the problem and making sketches of design solutions to solve the problem
- Demonstrate a willingness to consider other student's ideas and designs as they seek to use materials to construct a tool or object to solve the problem identified.
- Appreciate the importance of finding solutions to everyday problems and of objects and tools created/ used to solve problems.
- Participate actively in classroom discussions

- Complete Venn diagram to compare design solutions e.g.



- Brainstorm as a class what difficulties they encountered when trying to build their shelter, path, and boat on the desert island. Which natural elements did they find challenging? What materials did they wish that weren't on the island? Did some groups find after their question/answer session with the class that some of their materials weren't sufficient for the elements or challenges of the island?
- Have each learner choose a problem or challenge that either they encountered, or the class brainstormed to solve. Explain that they are to find a solution to their problem by creating a new material that has never been invented. It can be a material that combines any number of physical properties they have learned about (example: wood that conducts electricity that you can see through or is sticky enough that you don't have to use nails when building things, etc.). Encourage the learners to be as creative as possible, thinking outside normal physical limitations.
- Learners will draw a sketch of their new material, and a sketch of how the new material would be used to solve their problem on the island (which structure it would be a part of, why, where etc.). Have the learners include a description of their new material in terms of its magnetism, conductivity, density, opacity, buoyancy, and elasticity.
- Learners share their new material ideas with the class or display the sketches where they have a chance to check out their friends' new materials.

		See Useful Content for links to gain more ideas of needs and wants/ problems to be solved. ***Try to have more local communities' needs and wants/ problems.*** E.g. **Impure water**- Filtration mechanism **Water pollution**- Mechanism to clear trenches of garbage **Dark classrooms** in the cases of power outage- Translucent roofs or classrooms with more natural light **Lack of water at school**- water collection system for the school roof

Useful Content Knowledge for the Teacher about the Outcome:

- Different types of materials have different ***properties*** that make them useful for different jobs.
- A **fair test** involves controlling (keeping the same or constant) all but one variable when attempting to answer a scientific question. Only changing one variable allows the person conducting the **test** to know if that variable affects the results.
- SEE FULL ACTIVITY ATTACHED BELOW: Scenario "Stranded on a Deserted Island" (Adapted from Children's Museum of Houston, Pre/Post Classroom Activities) https://sharemylesson.com/teaching-resource/stranded-island-247411

More ideas of needs and wants/ problems to be solved. Try to brainstorm local communities' needs and wants/problems.
Visit the following website and choose an activity.
see: https://www.teachengineering.org/standards/ngss/grades3-5

Inclusive Resources and Materials

(See below)

Copy of scenario: stranded on a deserted island, Leaves- palm , Rocks- all varieties and sizes, Wood- small planks, Rope, Paper, Styrofoam- long flat sheets, Rubber- in the form of long, wide strips, Fabric- cotton, gray, Plastic- almost clear, like the kind used for milk cartons, Metal Sheets- can be cut, but not bent, Glass- pieces found from a broken window in the science lab, Cardboard- old boxes found in the science lab.

Strategies that Support the Curriculum and Assessment Framework

Elements of the Essential Education Competencies that are addressed:

Is an engaged, responsible, caring, tolerant participant in civil society	Problem solving in our communities
Is creative, enterprising, and resilient	Creative modeling of problem solutions
Thinks critically, communicates effectively, and solves problems	Critical thinking around design
Leads a healthy and active lifestyle	
Uses literacy and numeracy to understand, appreciate and act in the world	Formulating models, collecting data
Demonstrates an appreciation for the culture of St. Kitts and Nevis	
Demonstrates technological empowerment	Use of internet for research on problem background

Elements that are integrated across subjects:
Literacy: Vocabulary, listening, speaking, reading Scenario "Stranded on a Deserted Island" (Adapted from Children's Museum of Houston, Pre/Post Classroom Activities) https://sharemylesson.com/teaching-resource/stranded-island-247411

Mathematics: Geometry: Shapes of materials, properties of shapes, Measurement – lengths of different materials, perimeter, area **Social Studies**: Identity – shapes of objects identify their functions as needed to solve a given problem. Diversity in the shape of objects with similar functions. Variety in the shape of people that forms humans.
Expressive Arts: Sketching and drawing shapes of objects with specific functions.
TVET: Design and create appropriate models and sketches of design solutions; assembling models to test variables for science investigations.

Elements from Local Culture, Technology, TVET, Environment that are integrated:
Use of instructional videos.
Design technology and engineering
Environmental problems in the community

Items of Inspiration (teaching tips, inspirational passages, connections to educational research)
Problem-based learning situated in communities has great potential for improving relevance of public-school education

Scenario: Stranded on a Deserted Island

(Adapted from Children's Museum of Houston, Pre/Post Classroom Activities)
Retrieved from: https://sharemylesson.com/teaching-resource/stranded-island-247411

Due to a series of unfortunate events which resulted in an emergency plane landing, you and a small group of your peers have been stranded on a tropical desert island. As you explore the island, you find no people except for an old abandoned scientific laboratory. Several research stations remain set up, although most of the equipment is falling apart. Various scrap materials are scattered throughout the lab and its surrounding area. Further exploration of the island reveals a large, vicious herd of wild pigs, the only natural large predators on the island. You barely escape their attack by quickly climbing up a palm tree. They appear unable to climb or knock down the palm trees. As they retreat into the thick jungle, it begins to rain heavily. Several days after your arrival, you realize that this weather is typical for the late afternoon and is usually accompanied by large amounts of lightning. Luckily your group finds plenty of wild fruits and nuts to eat but is in dire need of shelter. You decide to make an S.O.S. sign on the beach out of large rocks and discuss plans for survival and rescue. After several hours of discussion and taking inventory of the island's resources, your group comes up with a plan to survive and hopefully escape the island. You decide there are three (3) essential things you need:

1. a **shelter**
2. a **boat and**
3. a **road** from the shelter to the beach, where the boat is anchored to allow for a quick exit should an escape option presents itself.

As you look at your list of materials on the island and science lab, you realize you don't know very much about the materials you have. Your team decides to go to the abandoned science lab to perform tests on the materials to better understand their properties and how they can best be used to build your shelter, boat, and path.

Needs for survival on the island

1. Go to the abandoned lab and perform tests at the different research stations on the island's materials to learn more about their magnetism, conductivity, density, opacity, buoyancy, elasticity, and adhesiveness. Record your data on the appropriate lab sheet.

2. Look at your list of restrictions, the materials list, and the data from your research and decide which materials you will use for the different parts of each structure. Discuss with your team the properties of each material and how it can best be used in your structures. Write down which materials you will use and why. This is the most important element to your survival. If a material isn't up to snuff for your structure, you might not make it through to the next day.

3. Make a sketch of each structure, labeling which materials were used for each part. Be prepared to present your structures to the entire class and answer questions regarding why you chose the materials you did for the various parts. You need to be able to explain how various properties of the materials made them either good or bad for different parts of your structures.

List of Materials and Requirements

Materials- This list of materials can be found and be used to build your structures

- Leaves- palm
- Rocks- all varieties and sizes
- Wood- small planks
- Rope
- Paper
- Styrofoam- long flat sheets
- Rubber- in the form of long, wide strips
- Fabric- cotton, gray
- Plastic- almost clear, like the kind used for milk cartons

- Metal Sheets- can be cut, but not bent
- Glass- pieces found from a broken window in the science lab
- Cardboard- old boxes found in the science lab

Restrictions- Listed are a set of rules that must be followed when building your structures

1. No material can be used more than twice (because you only have scraps).
2. Every material must be used at least once. You will need everything you have.
3. Your shelter must be built up in the trees to keep you safe from the wild boars.
4. Your shelter cannot be too heavy because the trees are not very strong.
5. Your shelter must have some way (window, hatch, etc.) to let light in without letting the rain in.
6. The path leading from your shelter to your boat must be covered in stones that are stuck together to prevent them from being washed away by the rain.
7. Your boat needs to have something anchoring it to the ocean floor (do not forget something to attach the boat to the anchor).
8. Do not pick a material unless you have a good reason.

Building Requirements

Shelter Parts

- Must be built in the trees, at least 5 feet off the ground.
- May need stairs or a ladder to reach it.
- 4 or more walls
- 1 floor
- 1 roof
- 1 door

Path/Road

- Constructed with stones latched or stuck together.
- Wide enough for one adult.
- Lead from shelter to boat.

Boat

- 1 bottom
- 2 sides
- 2 oars
- 1 anchor

Hints

- Dense materials tend to be heavier, so think about that when building your shelter; the trees are not too strong.
- Don't forget about the lightning (extremely strong source of electricity) that can hit trees or water, when deciding what material, you will use for your boat and shelter, especially the roof.
- Wind, rain, and waves will be a factor in how well your structures stand up. Plan for these elements.

Opacity Research Station

This section involves testing how opaque the materials at this station are. Remember, if something is opaque, it does not let light or heat through.

Instructions:

1. Find the darkest section of wall you can. Measure out two feet from the wall with the yard stick. This is where you will hold the material you are testing.
2. Hold the material and flashlight up so the material you are testing is in between the wall and flashlight. Turn on the flashlight and observe how much light passes through the material onto the wall. Write your observations in the chart below. Record the amount of light moving through as either: no light, some light, or lots of light.
3. Repeat the test for each object 3 times. (Your data is made more accurate in case you mess up on some of the tests)

Material	Trial 1	Trial 2	Trial 3	
				No light
				Some light
				Lots of light
				No light
				Some light
				Lots of light
				No light
				Some light
				Lots of light
				No light
				Some light
				Lots of light

Magnetism Research Station

This section requires testing various materials to see if they are magnetic, or if they are attracted to something with a magnetic field such as a magnet.

Instructions:

1. Hold the magnet in one hand and bring each object towards the magnet to see if there is a magnetic attraction (if the object will stick to the magnet).
2. In the chart below, list the materials, then tick/ check either the 'magnetic' or 'non-magnetic' box for each trial depending on the materials reaction to the magnet.
3. Repeat the test for each object three (3) times. (Your data is made more accurate in case you mess up on some of the tests).

Material	Trial 1	Trial 2	Trial 3	
				Magnetic
				Non-Magnetic
				Magnetic
				Non-Magnetic
				Magnetic
				Non-Magnetic
				Magnetic
				Non-Magnetic
				Magnetic
				Non-Magnetic
				Magnetic
				Non-Magnetic
				Magnetic
				Non-Magnetic

Elasticity Research Station

You will be measuring the elasticity of 4 balls, made of different materials by measuring how high the ball bounces back up when dropped the same height. It is important to drop the balls, all from the same height to ensure accuracy of your measurements.

Instructions

1. You will be dropping each ball from 1 yard off the ground. Use your yard stick to make sure you drop the ball from 1 yard up (the top of the yard stick). Take turns dropping each ball from 1 yard off the ground, measuring how high the ball bounces back with the yard stick.
2. Record each ball's bounce height in the chart below.
3. Remember to drop and measure each ball THREE (3) times. (This allows for data to be more accurate, in case there are any problems with some of the tests).

Balls in Order of Elasticity (from least to most elastic):

Ball Type	Trial 1	Trial 2	Trial 3	
				Bounce Height
				Bounce Height
				Bounce Height
				Bounce Height

Conductivity Research Station

This section requires testing materials to see if they can conduct electricity or allow electricity to flow through them. If tests are positive, then such materials are called conductors.

Instructions:

1. Set up your electric circuit with the two exposed ends touching each other to make sure the circuit is working. The light bulb should come on when the exposed ends touch.
2. Take each material and touch both exposed ends to the material; making sure that the exposed ends are not touching each other. If the light bulb turns on, the material is a conductor.
3. List and record whether each material is a conductor in the chart below by writing 'yes' if the material conducts electricity, 'no' if it does not.
4. Each material is to be tested THREE (3) times and trials recorded (This will allow results to increase the precision of your experiment)

Material	Trial 1	Trial 2	Trial 3	
				Is it a Conductor?
				Is it a Conductor?
				Is it a Conductor?
				Is it a Conductor?
				Is it a Conductor?
				Is it a Conductor?
				Is it a Conductor?
				Is it a Conductor?

Density Research Station

This section looks at testing the density (how much and how tightly substance is packed into an object) of three different blocks made of different materials.
Note: The more substance present or the denser something is, the more it weighs.

Instruction

1. Make sure the scale when empty reads 0. If it does not, ask the teacher to help you adjust it, so your readings are accurate.
2. Take each block and place it on the scale, observing its weight and recording the measurement in the chart below.
3. Make sure to measure and record each block's weight THREE (3) times. (This increases the precision of your data)
4. List the three block types in order of density, from least to most dense.

Blocks in Order of Density (from least to most dense):

Block Type	Trial 1	Trial 2	Trial 3	
				Weight
				Weight
				Weight

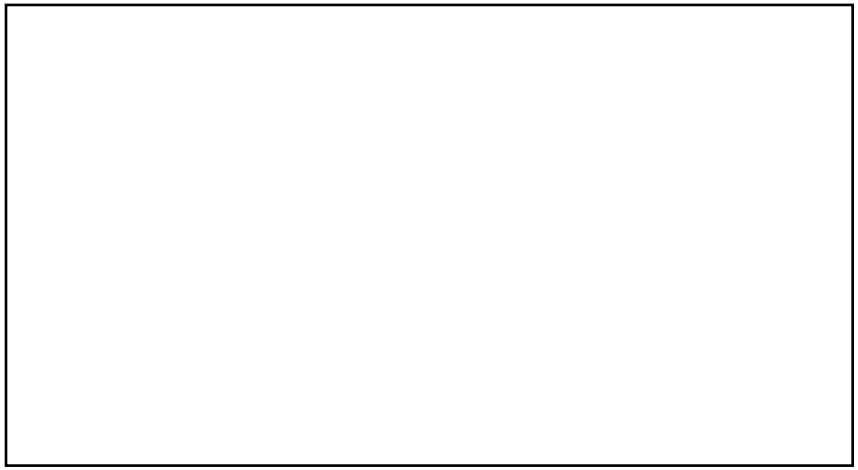
Structural Sketch for Shelter

Draw a picture of your shelter. Make sure to label what material each part is made of. Be sure to remember the rules and the elements of the island you need protection from.

Shelter Parts

Must be built in the trees, at least 5 feet off the ground.
May need stairs or a ladder to reach it.

- 4 or more walls
- 1 floor
- 1 roof
- 1 door



Sketch for Boat

Draw a picture of your boat. Make sure to label what material each part is made of.

Boat Parts

- 1 bottom
- 2 sides
- 2 oars
- 1 anchor

Structural Sketch for Pathway

Draw a picture of your pathway. Make sure to label what material you use for each part.

Pathway Rules

- Constructed with stones latched or stuck together.
- Wide enough for one adult.
- Lead from shelter to boat.