

Unit Planner

Overview			
Subject:	Chemistry	Topic:	Matter
Unit Overview:	This unit introduces the concept of matter to grade four students. When the unit is complete, the students will be able to use appropriate scientific terminology to explain that the world around them is made up of matter and how it can change. During this unit, students will be able to independently use their learning to hypothesize, observe, infer, classify, and communicate findings. This unit can be taught before or after the grade four science unit on energy; both of the units can be combined by focusing on the main understanding that everything in the universe is made up of matter and energy.		
Grade:	4		
Unit Duration:	3-6 Weeks	Date:	January 4 2017

Stage 1 – Desired Results

Big Ideas

Matter has mass, takes up space, and can change phase

Core Competencies

Communication

- Acquire, interpret, and present information

Thinking

- Question and Investigate

Personal and Social

- Solving Problems in Peaceful Ways

Concepts	Unit Understandings	Transfer Goals	Essential Questions
<ul style="list-style-type: none"> Matter Phase Change 	<p>Students will understand that...</p> <ul style="list-style-type: none"> everything in the universe is made up of matter and energy. matter is anything that has mass and occupies space (volume). matter has different states and can change phase 	<p>Students will be able to independently use their learning to...</p> <ul style="list-style-type: none"> Observe physical things in our environment in order to predict and infer how they may change states. Classify items as solids, liquids, or gases using their properties Communicate findings by representing patterns using tools and tables Use their understanding to make the connection between phase changes and the water cycle. 	<p>Students will keep considering...</p> <ul style="list-style-type: none"> What role does matter have in the universe? PART A: How are observations different from inferences? PART B: In what ways can matter be classified? PART C: In what ways might matter change state? <p>As an overview or if you wish to combine the units in Grade 4 Science, an overarching essential question to consider:</p> <p>In what ways might matter and energy have a role in the universe?</p>

First Peoples Principles

Learning involves patience and time

→ **Alignment Check:** ←

Are your concepts, unit understandings, transfer goals, and essential questions connected and supportive of your Big Idea?

Curricular Competencies	Content
<p>Students will be skilled at...</p> <p>Questioning and Predicting</p> <ul style="list-style-type: none"> Observe objects and events in familiar contexts Make predictions based on prior knowledge <p>Planning and Conducting</p> <ul style="list-style-type: none"> Collect simple data <p>Processing and Analyzing Data and Information</p> <ul style="list-style-type: none"> Sort and classify data and information using drawings or providing tables Use tables, simple bar graphs, or other formats to represent data and show simple patterns and trends Compare results with predictions, suggesting possible reasons for findings <p>Evaluating</p> <p>Make simple inferences based on their results and prior knowledge</p>	<p>Students will know that...</p> <ul style="list-style-type: none"> Phases of matter The effect of temperature on particle movement <ul style="list-style-type: none"> Elaborations: Solids, liquids, and gases change with heating (e.g. boiling point, melting point [melting chocolate]) and cooling (freezing point [making ice cream]) and these physical changes are reversible

Stage 2 – Evidence: Assessing for Understanding

Assess: Understanding

Summative:	Formative:
Culminating Performance Task(s) at the end of the unit to show understanding	Checkpoints for understanding during the unit
Teachers should consider how assessment should be differentiated to meet students' diverse needs, interests, and learning styles.	Teachers should consider how formative assessment is ongoing, varied, and central to the instructional learning cycle.

AUTHENTIC PERFORMANCE TASK: Assessing for Understanding

Students will be able to demonstrate their understanding by:

What is a **GRASPS** task?

G R A S P S	
Goal	Design and perform an experiment effectively to classify the mystery substance.
Role	You are a scientist and have been given a mystery substance by your mad scientist boss (teacher) who has managed to mix up all of the labels. Individual or Group Assignment (Based on student strength and needs)
Audience	Your mad scientist boss (teacher)
Situation	Solve the mystery by designing an experiment to classify the mystery substance as either a solid, liquid, or gas. Focus on identifying properties of matter using your senses (except taste!).
Performance or Product	You will submit your lab report to your mad scientist boss. It will include the procedure you used to classify the state of your mysterious substances. Please include a hypothesis before you begin your experiment. Please include your observations in a table format and explain any patterns that you found. Finally, you may make a inference/conclusion to classify the state of the mystery substance. In your journal, you can write changes that were made to your original hypothesis during the process of conducting your experiment as you gathered more information.
Standards	Your lab report should include all components (hypothesis, procedure, observations, data, inference/conclusions). You will also include a journal where you will write about your thoughts and ideas (as they may progressively change) during the experiment. Criteria is written on left sidebar.

OTHER EVIDENCE: Assessing for Knowledge and Skills

Students will show they have acquired Stage 1 knowledge and skills by:

FORMATIVE ASSESSMENT

- Science Journal (Self-Reflection; Self-Assessment) - See Lessons 1 – 10**
- Entrance Slips (Pre-assessment) - See Lessons 1, 3**
 - See-Think-Wonder - **See Lesson 1**
 - MATTER Acrostic - **See Lesson 3**
- Exit Slips (Formative Assessment) - See Lessons 1 - 10**
 - I used to think, and now I think - **See Lesson 2**
 - Why does matter Matter? - **See Lesson 3**
 - Framer Model for Matter - **See Lesson 4**
 - Matter and the Water Cycle - **See Lesson 7**
 - MATTER Acrostic - **See Lesson 10**

Differentiation:	<p>As per individual needs, students who require assistance will be given a basic outline of procedures that they might choose to use when designing their experiment. Also, they can have the option of a few different labels of possible mystery substances to help them narrow down the classification of the mystery substance. Students may record, use a scribe, type, or use visuals to create their lab report as necessary. According to the needs, students may also work in pairs/groups.</p> <p>Extension: Students can predict the identity of the item and inquire into its properties (boiling point, melting point, freezing point).</p>
-------------------------	---

G R A S P S	
Goal	Create a story to explain the life of a water droplet in the water cycle to a primary student.
Role	<p>You are a water droplet that is a part of the ocean and are about to start your journey.</p> <p>Individual or Group Assignment (Based on student strength and needs)</p>
Audience	The grade 2 class (Gr 2 Science - Water Cycle)
Situation	Create a story that depicts the experience of a water droplet as it changes state through various phase changes as part of the water cycle. Be sure to write from the point-of-view of a molecule.
Performance or Product	You will tell your story (choose either to write it as a narrative, create a comic, create an iMovie or PowerPoint or use ShowMe with explanations, or record it orally). Whatever your chosen format, please provide an outline of the important factual information about the water cycle that you have included in your story.
Standards	<p>Your story has to be factually accurate and to be told from the perspective of a water droplet. Include the names of the states of matter, name of all of the phase changes, and explanations of what is occurring in these states or phases from the molecular point of view.</p> <p>Criteria is written on left sidebar.</p>
Differentiation:	<p>As per individual needs, students will be given a basic outline of the water cycle (including website and video links) that they can then further explain in their story. Students have a variety of options to select from to create their final product (as listed above).</p> <p>Extension: Students can choose a type of performance or product that extends their thinking (learning how to use iMovie or a different technological format).</p>

Assess: Know & Do

Summative: Final assessments of knowledge and skill at the end of the unit	Formative: Checkpoints for students to show their knowledge and skills during the unit
Teachers should consider how summative assessments should be based on clear criteria and include a variety of ways for students to show demonstrate their learning	Teachers should consider how this ongoing assessment is clear, specific, and timely in order to support student progress
<p>SUMMATIVE ASSESSMENT (Teacher may use these examples as formative assessments)</p> <ul style="list-style-type: none"> • Ice Cube Experiment Lab Report - See Lesson 8 • Odd One Out for Properties of Matter <ul style="list-style-type: none"> ○ Science Formative Assessment by Page Keeley (p. 144) ○ Teacher will provide a T-Chart with a set of words listed on one side under the heading "Which is the Odd One?" and an empty side under the heading "Why it is the Odd 	<p>Quizzes</p> <p>Chapter questions</p> <p>Vocabulary activities</p>

One Out?" The students have to describe why one word out of the set of words is the Odd One Out. Examples of sets of words: weight, density, length, colour and length, volume, temperature, mass

Stage 3 – Executing the Learning Plan

These learning events/activities are suggested activities. Some activities may span over several lessons. Teachers should add, revise, and adapt based on the needs of their students, their own personal preferences for resources, and a variety of instructional techniques.

PART A: How are observations different from inferences?

Lesson 1: Observations vs. Inferences - How are observations different from inferences?

- Hook: Read **Look, Listen, Taste, Touch and Smell: Learning About Your Five Senses by Pamela Hill Nettleton**
Discussion and Science Journal - What do you know about your 5 senses? Why do we have them? In what ways might they be useful in science?
- Setup **Thinking Routine: See-Think-Wonder** in their Science Journal
- Turn off the lights of the classroom and take the class through the Edible Candle Experiment, pause to have students write their ideas as described below. (A) (M)
Edible Candle Experiment - www.e-missions.net/elabs/style/doc/PremissionLessonEdibleCandle.pdf
Discuss and write in Science Journal
 - Ask: "What do you see?" - After teacher lights the edible candle in the dark, students can write their 'observations'
 - Ask: "What do you think it is?" - Students can write their predictions before you take a bite of the edible candle. Again, provide time for students to add/change their predictions after you have taken a bite of the edible candle
 - Ask: "What questions do you wonder about that might help you check your prediction?" - Students can brainstorm questions that they would want to ask to be able to predict the identity of the edible candle
- Discuss the difference between observations and inferences. (A)
- Science Journal: How might not having clear observations lead to inferences that are not accurate? How might we make reliable observations? How might our inferences change as we gain more knowledge? (M)
ELL/Adaptations: Provide or allow for visuals (to help with describing observations), allow for short oral answers or scribing
Extension: Describe an item using their senses and see if a peer is able to identify the item.

Lesson 2: Making Observations Using Our Senses - What information about the properties of matter can be gathered by observations?

- Hook: Wear a lab coat and bring in a magnifying glass. Explain to the students that you have a mystery item in your box. They may ask questions (in relation to their senses) that might help them identify the mystery item.
- Teacher will review the concept of making observations vs. making inferences in relation to the edible candle. Ask the students: Can they connect observations and inferences to the Scientific Method? (A) (T)
- Teacher will need to provide 5-6 mystery items in separate small boxes. Students will work in groups to collect simple data about their mystery item using their five senses (colour, shape, lustre, clarity, texture, odour, sound, etc.) and record their observations. (A)
- In groups, students will share their data with the class. The class will make inferences based on the results (observations) being shared and their prior knowledge. (M)
- Re-visit the discussion about the difference between observations and inferences; connection to Scientific Method. (A)
- Exit Slip - **Thinking Routine: I used to think...and now I think...** self-reflection in relation to topic of observations (M)
ELL/Adaptations: Provide or allow for visuals (to help with describing observations), allow for short oral answers or scribing
Extension: Continue Activity - Describe an item using their senses & see if a peer is able to identify the item.

PART B: In what ways can matter be classified?

Lesson 3: Defining Matter - What is matter?

- Hook: Write down the word MATTER as you would setup an Acrostic Poem. Have the students write down as much as they can about the word matter - with each sentence starting with a letter from the word MATTER.
- Discuss the definition of the word matter: *Something that has mass, takes up space, and exists as a solid, liquid, or gas* (A)
- Review the idea of making observations and connect it to how we can understand the term matter. Have students break the words into smaller parts and tackle a specific term in two groups: mass and space. Teacher can use the following discussion questions: How do you know if something takes up space? How do you know if something has volume? What do we use to measure mass? What do we use to measure volume? (A) (M)
- Setup stations: students can measure the volume of solid objects, students can measure the mass of solid objects, and students will spend time finding ways to explain these terms (matter, mass, and volume) to their peers: visual drawings, songs, actions, mind map, etc. (A) (M)
- Exit Slip: Why does matter matter? In what ways have you seen mass and volume applied in the real world? (T)
- Science journal: (self-reflect) Which method did you choose to remember the terms today? Why does it work for you? (M)
ELL/Adaptations: For audio-visual learners, students can understand the concept of matter by watching: **Science for Kids- Measuring Matter Video https://www.youtube.com/watch?v=e_gGCunofgl**
Extensions: Inquire: How does matter change in different parts of the universe?

Lesson 4: Are These Matter? - How do you know which things are not made of matter?

- Hook: Read **What's the Matter in Mr. Whiskers' Room? by Michael Elsohn Ross**
- Review the term matter. Provide a few different examples of matter (some solids, liquids, and gas) for the students to consider. (A)
- Setup stations: students can test specific items to see if they are examples of matter. (M)
Questions for each station:
Predict if item is made of matter using prior knowledge. Test: Does the item take up space? Does the item have mass?
Collect simple data in the form of observations. Write down your inference to answer: Is the item made of matter?
Stations
 - Pushing an empty cup into a cup full of water
 - Pushing a rock or another solid object into a cup full of water
 - Turning on a flashlight into a cup full of water
 - Pouring water into a cup full of water
- Discuss and Science Journal: What items are made of matter? Which items are not made of matter? If they are not made of matter, what are they? How do you know which things are not made of matter? (M) (T)
*Discuss the concept of energy. Depth of the conversation may relate to whether the Gr 4 Science Big Idea on energy (Energy comes in a variety of forms that can be transferred from one object to another) has been studied prior to or after this unit.
- Exit Slip: Students will fill out a Frayer Model (Operational Definition, Characteristics, Examples, and Non-examples) for the term Matter. (M)
ELL/Adaptations: Use visuals, simple words, or scribe for the Frayer Model or adapt it to only include some components: Operational Definition & Characteristics.
Extensions: Continue Inquiry: How does matter change in different parts of the universe?

Lesson 5: States of Matter - How can you classify the three states of matter?

1. Hook: Is it Matter? Provide students with a list of items and have them check-off the items that they believe are examples of matter. Have them write the 'rule' or reason that helps them decide whether something is or is not matter.
 2. Provide students with visuals or hands-on objects (some examples of solids, liquids, gases) and have them sort these objects into groups by trying to identify a common pattern. Once they have grouped their objects, have them create the 'rule' or reason that they used to group these objects. (M)
 3. Discuss the findings and 'rules'. Ask: Are all these items made of matter? Explain the concept of the three states of matter - *Matter has three forms: solid, liquid and gas.* (A) (M)
 4. Now, provide the students with a 3-way Venn Diagram: Solids, Liquids, and Gas. Ask the students to sort and classify the objects according to these three states. (M)
 5. Discuss (or Exit Slip): What are the 'rules' or common properties that these objects share for each specific category? How can you classify the three states of matter? (M)
 6. Science Journal: How did your 'rules' change in comparison to before you knew about the 3 States of Matter to after you knew about it? How did you troubleshoot problems that came up when trying to sort the items? Self-assess how well you used your science skills (observing, classifying, inferring) today. In what ways might your math skills have helped you today? (M) (T)
- ELL/Adaptations:** Provide hands-on objects or visuals for which it is easier to recognize the pattern.
- Extensions:** Inquire: What could happen if a material could be in two states at the same time?

Lesson 6: Comparing the States of Matter - What properties of solids, liquids, and gases make them different?

1. Hook: Watch **Matter Chatter**: <https://www.youtube.com/watch?v=C33Wdl64FiY>. Discuss how the connections are made between observations, matter, and three states of matter.
 2. Setup Stations: Provide students with some materials at each of the following stations, so they can investigate the mass and volume of materials that belong in each state. (M)
What is a solid? What is a liquid? What is a gas? (**Science Works for Kids Simple Chemistry by Evan-Moor Corp. on p. 11, p. 13, & p. 15**)
 3. Now we are going to look a little deeper at what is happening to the molecules in each of these states. (A)
Movement Activity: Students will move according to the state of matter: Solids - stand still, close together, & elbows touching, Liquids - move slightly with elbows/wrists touching occasionally, Gas - freely move around touching rarely (**Matter and Energy by Evan-Moor Corp. on p. 9**)
 4. Define the properties of the three states of matter. Cut & Paste: 3-way Venn Diagram with Solids, Liquids, and Gas: Have the students sort (have cut-outs of all of the properties - including what is happening at the molecular level) the properties of matter into the appropriate part of the Venn Diagram. (M)
 5. Science Journal: How can you explain the properties of the three states of matter to your friends? (M)
 6. Exit Slip: Critique the following sentence: water is the only example of matter that exists in more than one state. (T)
- ELL/Adaptations:** Students choice (visuals, oral, etc.) to complete exit slip.
- Extensions:** Inquire: Are there more than three states of matter? What are the other examples of items that also exist in three states? (These students might want to inquire into this portion sooner, so they can help the class to better understand the concept for the Exit Slip).

PART C: In what ways might matter change state?

Lesson 7: Changing States of Matter - Can matter change state?

1. Hook: Show the class a melted chocolate bar. Ask the students: What state is this chocolate bar in? What are the states that chocolate can exist in?
 2. Review the properties of the three states of matter (A)
 3. Sort and Classify: Provide pictures of objects made of matter that have changed state: ice and water, melted chocolate and solid chocolate, etc. Ask the students to make inferences based on their prior knowledge and discuss: How are these objects similar? How are these objects different? (M)
 4. Discuss: We know that matter has three states, but how does matter change state? (A)(M)
 5. Science Journal: The students can reflect on the progress they have made so far in this unit. (M)
 6. Exit Slip: Apply the way in which matter changes state to the water cycle. (T)
- ELL/Adaptations:** Student choice (visuals, oral, etc.) to complete exit slip.
- Extensions:** Inquiry: Prove that matter can change directly from solid to gas or gas to solid?

Lesson 8: Temperature and Matter - Can temperature affect matter?

1. Hook: Hand out popsicles to the students. Ask the class: "On a warm sunny day, why do you have to eat your popsicle so quickly?"
 2. Review the concept of matter changing states (A)
 3. Ice Cube Experiment: Tell the students that they will be measuring how long it takes for ice to melt in a few locations: in the classroom, under the sun (outside of the classroom), and two other locations that the students select. The students should predict which location they think the ice will melt in first. Thereafter, the students will place the ice in the various locations and measure how long it takes to melt. After the students have collected the simple data, they will create a bar graph with the results and share their findings with the class. (M) (T)
 4. Discuss how heat causes ice to melt faster (phase change: solid to liquid). Collect the findings to find the average and create a class bar graph for inside the classroom vs. outside the classroom. (M)
 5. Connections: Discuss how the concept of heat is related to energy. How do matter and energy interact? (T)
 6. Submit lab report and share findings. Science Journal: Was your hypothesis accurate? If not, why not? What factors related to the scientific method did you have to consider when trying to conduct your experiment? Did you have to troubleshoot while conducting your experiment? What would you do differently next time? (T)
- ELL/Adaptations:** For the audio-visual learners, to help students better understand how changes can happen in states of matter, students can watch: **Bill Nye the Science Guy S01E07: Water Cycle** - <https://www.youtube.com/watch?v=ae4K4WConhM>
- Extensions:** Further inquiry into what role do energy and matter play in the universe?

Lesson 9: Water Cycle - How does matter change phase?

1. Hook: **Watch Bill Nye the Science Guy S01E08: Phases of Matter** - <https://www.youtube.com/watch?v=lvT2IT31WDY>
 2. Setup Demo: water in a glass, water into an ice tray and ice taken out of the fridge (freezing), ice melts in a glass (melting), boil water in a kettle and watch the water vapor (evaporation), boil water in a kettle close to a cold window (condensation)
Have the students make predictions before each demonstration and then record their findings after the demonstration. Make a connection from last class: How does matter change phase? (M)
 3. Explain that the *name of each change in state is phase change*. Ask the students: Can you name each phase change? See if the students are able to relate it to the water cycle; perhaps, some might want to change their inferences from their Exit Slip in Lesson 7. (A)
 4. Movement Activity: Review the way molecules in a solid, liquid, and gas move from Lesson 6. Introduce the concept of heat, which is the vibration of molecules through wiggling. Students only start bumping if they are touched by another wiggling molecule. (**Matter and Energy by Evan-Moor Corp. on p. 13**) (A)
 5. Science Journal: In what ways might temperature affect gas? (T)
 6. Exit Slip: The students will use a method of choice (drawing, writing, singing, acting, etc.) to explain what happens to the molecules in the states of matter as they go through phase change. (M)
- ELL/Adaptations:** For the audio-visual learners, to help students better understand how changes can happen in states of matter, students can watch: **Bill Nye the Science Guy S01E07: Water Cycle** - <https://www.youtube.com/watch?v=ae4K4WConhM>. Students can also have the diagram of the water cycle to label and use to explain their understanding.
- Extensions:** Inquire: Does the effect of temperature differ for different items?

Lesson 10: Ice Cream Matters! - How do changes in temperature affect phase change?

1. Hook: Tell students they will be making ice cream today.
2. Define and give examples of the terms of melting point, boiling point, and freezing point. (A)
3. Ice Cream Matters Lab: Have the students work through an ice cream making lab. They will need a thermometer, half & half cream, sugar, vanilla,

rock salt, lots of ice, and some Ziplock bags. The students should make ice cream in pairs and record the temperatures at various points so they can better understand the way in which matter is undergoing phase change. (M)

Make Ice Cream - <http://www.kidzworld.com/article/26683-science-project-make-homemade-ice-cream>

4. Science Journal: Explain how melting point and freezing point played a role in creating your ice cream? (T)

5. Exit Slip: MATTER Acrostic. Return to the activity the students did at the beginning of the unit. This time they should create a new MATTER Acrostic and write about all that they have learned throughout this unit. (M)

ELL/Adaptations: Students might need to be paired strategically in order to make ice cream.

Extensions: Inquire: Pick a material of interest - Find the melting point, boiling point & freezing point

Resources:

Picture Books

Look, Listen, Taste, Touch and Smell: Learning About Your Five Senses by Pamela Hill Nettleton

What's the Matter in Mr. Whiskers' Room? by Michael Elsohn Ross

Videos

Science for Kids: Measuring Matter Video - https://www.youtube.com/watch?v=e_gGCunofgl

Matter Chatter Video - <https://www.youtube.com/watch?v=C33Wdl64FiY>

Bill Nye the Science Guy S01E08: Phases of Matter - <https://www.youtube.com/watch?v=lvT2IT31WDY>

Bill Nye the Science Guy S01E07: Water Cycle - <https://www.youtube.com/watch?v=ae4K4WConhM>

Useful Resources For Planning of Unit

Science Formative Assessment: 75 Practical Strategies for Linking Assessment, Instruction, and Learning by Page Keeley

Making Thinking Visible by Ron Ritchhart, Mark Church and Karin Morrison (Thinking Routines will be found in here!)

Grade 7 Science Probe Textbook

Grade 3-6 Properties and Behaviour: Matter & Energy - by Evan-Moor Corp.

Grade 4-6 Simple Chemistry - by Evan-Moor Corp.

Websites

Edible Candle - www.e-missions.net/elabs/style/doc/Pre-missionLessonEdibleCandle.pdf

Make Ice Cream - <http://www.kidzworld.com/article/26683-science-project-make-homemade-ice-cream>

States of Matter - http://www.chem4kids.com/files/matter_states.html

States of Matter - <http://idahoptv.org/sciencetrek/topics/matter/facts.cfm>

Water Cycle - http://www.windows2universe.org/earth/Water/water_cycle.html&cd=false&cdp=/windows3.html&art=ok&frp=/windows3.htm

Teacher: Unit Reflection

What aspects of the unit went well?

What did students struggle with?

What did you struggle with?

What would you add/revise the next time you taught this unit?

Were there any unintended outcomes?

Were students engaged?