Unit: Structure and Properties of Matter

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School: Campus Community School

Grade/Course: 2nd Grade Science

Rationale:

It is important to become productive citizens that are scientifically literate. To become scientifically literate students must be exposed to science in an authentic and genuine way. Students must be allowed and able to manipulate and form their own ideas through hands-on activities. Learning about the structure and properties of matter flows into higher science standards including but not limited to: chemical reactions, irreversible changes, scientific observations, chemistry, an objects intended purpose, and conducting research and experiments. This unit helps students engage in science at a level they can comprehend and build on. This unit has the building blocks for the rest of their science career.

In addition to the disciplinary core ideas related to the structure and properties of matter, students will engage in science and engineering practices and explore bigger concepts like patterns, cause and effect, and energy and matter.

CONTENT

Unit Focus Questions:

- How do scientists plan and conduct investigations?
- How do scientists analyze and interpret data?
- How do scientists use evidence to answer a question?
- What is matter?
- How can matter be described and classified?
- What effect does heating or cooling have on a substance?
- Why do a material's properties matter?
- How can different objects be made from the same parts?

Content Summary:

- Different kinds of matter exist and many of them can be either solid or liquid, depending on the temperature. Matter can be described and classified by its observable properties. (2-PS1-1)
- Different properties are suited for different purposes. (2-PS1-2; 2-PS1-3)
- A great variety of objects can be built up from a small set of pieces. (2-PS1-3)
- Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4)

- **Matter** - any physical substance that occupies space
- **Solid** – the state of matter where a substance is firm and holds its own form
- **Liquid** - the state of matter where a substance is flowing and fluid, having a consistency

similar to water, and conforms to the shape of its container

- **Property** - a characteristic used to describe something
- **Purpose** – the role of something; its main "job"
- **Heating** - to cause a rise in temperature ; may change the state of matter
- **Cooling** - to causes a decrease in temperature; may change the state of matter
- **Reversible Change** – can be undone; can go back to the original form
- **Irreversible Change** – cannot be undone; cannot go back to the original form

Content Standards:

Next Generation Science Performance Expectations:

- **2.PS1.1-** Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- **2.PS1.2-** Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- **2.PS1.3-** Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.
- **2.PS1.4-** Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

Common Core ELA:

- **W.2.7-** Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- **W.2.8-** Recall information from experiences or gather information from provided sources to answer a question.

SEQUENCE of INSTRUCTION

Projected Length of Time: 9 class periods (each approximately one hour in length)

Lesson	**Lesson Focus Questions**	**Key Concepts / Vocabulary**	**Formative Assessment**	**Summative Assessment**
Lesson 1: Observable Properties Timeframe: 2 class periods	What is matter? What are observable properties and how can they be used to describe different materials? How do scientists plan and conduct an investigation?	Matter Observable Property Color Shape Observation Investigation	Science Journal – individual description of observable properties	See lesson 3
Lesson 2: Testing the Hardness of Materials Timeframe: 1 class period	How can a material's hardness be tested and described?	Hardness Flexibility	Science Journal – investigation plan and results	See lesson 3
Lesson 3: Investigating Liquids Timeframe: 1 class period	Is all matter solid? How are liquids and solids similar and different? How can we describe a liquid?	Solid Liquid	Science Journal – descriptions of methods and observable properties for the 4 liquids	Matter and Observable Properties Venn Diagram
Lesson 4: Choosing the Best Material Timeframe: 2 class periods	How do we decide what the best material is for an intended purpose? How and why do scientists test their ideas? How do scientists use data and evidence to answer questions?	Properties Purpose Hypothesis Data Evidence Absorbency	Journal and discussion from Day 1	Graphic organizers from Day 2 experiments
Lesson 5: Changing Matter - New Objects Timeframe: 1 class period	How are different objects created from the same set of pieces? How are objects from the same set of pieces alike and different?	Assemble Disassemble Reassemble Data Evidence	Journal entries Summarizing Strategy - discussion about "evidence"	See lesson 6
Lesson 6: Changing Matter - Cooling and Heating Timeframe: 2 class periods	How can cooling and heating change materials?	Solid Liquid Heating Cooling Reversible Irreversible Data Evidence	Observations from day 1 recorded in science journal; Group discussion on day 2 about reversible and irreversible changes	Structure and Properties of Matter Assessment ~ Arguments and Evidence

Lesson 1: Observable Properties

Lesson Focus Questions:
What is matter? What are observable properties and how can they be used to describe different materials? How do scientists plan and conduct an investigation?

Standards:

Science:

- **2.PS1.1-** Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

ELA:

- **W.2.7-** Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- **W.2.8-** Recall information from experiences or gather information from provided sources to answer a question.

Learning Targets:
I can define and give examples of matter.
I can describe and classify different kinds of materials by their observable properties.

Key Concepts/Vocabulary:
Matter
Observable Property
Color
Shape
Observation
Investigation

Activating Strategy:

1. Explain to students that in this unit, they will be scientists investigating matter. Remind them that scientists do a lot of investigating and observing to figure out why things work the way they do. Tell them that they will be recording their observations and ideas in a science journal. Go over the expectations for the science journal and how it will be used.

2. Introduce the focus questions for the lesson. Share the definition of *matter*. Point to many different objects in the classroom and say, "This is matter." Make sure students understand that matter is everywhere and that all objects and substances are considered matter. Say, "Today we will be figuring out how we can describe matter."

Learner Activities:

Day 1

Students will need the following materials for this lesson: 1 tray of solid objects, some with similar shapes and/or colors (markers, cups, marbles, cubes, etc.) and science journal.

1. Let students know that in this lesson, they will examine, sort and describe a set of objects. Remind students that all of these objects are considered to be *matter*. Discuss the idea that *color* and *shape* are two *observable properties* of matter; in other words, they can be seen and can be used to describe the objects.
2. Give each table the materials. With their table partners, students will first sort these solids into groups on the basis of color.
3. After students have sorted the objects by color, ask different groups to share the different color groups they created. Ask, "Were any of the objects difficult to sort by color?"
4. Next have students return the objects to the trays and sort the solids by shape. After students have sorted the objects by shape, ask different groups to share the different shape groups they created. Ask, "Were any of the objects difficult to sort by shape?"
5. Review vocabulary learned today (*matter, observable properties*). Have students record the definitions in their science journal. Under the definition of *matter*, students should list a few examples from the classroom or from the investigation. Under the definition of *observable properties*, students should start a list of properties by adding *color* and *shape*.

Day 2

Students will need the same materials they used Day 1.

1. Review the definitions of *matter* and *observable properties*. Review that color and shape are two observable properties.
2. Tell students that today they will be determining other types of observable properties.
3. Give each table the materials. With their table partners, students should determine two other ways to sort the objects (size, texture, weight, etc.).
4. After students have sorted their objects, ask them to share the different property groups they created. Create a list of observable properties on the board as students share.
5. In their journal, ask students to add the class's list to their personal list of observable properties.
6. Tell students that they will pick an object to examine more closely. Model for students how to journal their observations (all of the object's observable properties) for one of the objects. Next pick an object that the class will collaboratively write a description for. Both the teacher and the students will record this in their journals. Finally, have students individually choose one other object from the investigation, name it and describe all of its properties in their journal.
7. Ask students to share if there were additional properties they noticed that were unique to the object they described. If so, add these to the class list and in the journals.

Summarizing Strategy:

At the end of each class period, return to the focus questions for the lesson. Ask students to tell a partner the answers to as many as they can. Call on a few students to share aloud.

Formative Assessment:	**Summative Assessment:**
Science Journal – individual description of observable properties (Day 2; Step 6)	See lesson 3

Teaching Strategies/Tips: • Have materials prepared prior to class. • Science journals can be customized to the lessons, printed and pre-assembled. This might be good for second graders who are just starting to use science journals. Another option is for students to use a composition book. If using a composition book, be sure to point out how to label different pages and sections each day. • The teacher may want to keep his/her own science journal as a model.
Differentiation (content/process/product): Predetermined table groups and discussion partners, additional time (if necessary), designated work spaces (within proximity of the teacher)
Attachments (assessments, rubrics, graphic organizers, projects, etc.): N/A

Lesson 2: Testing the Hardness of Materials

Lesson Focus Question:
How can a material's hardness be tested and described?

Standards:

Science:

- **2.PS1.1-** Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

ELA:

- **W.2.7-** Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- **W.2.8-** Recall information from experiences or gather information from provided sources to answer a question.

Learning Targets:
I can test a material's hardness.
I can describe a material based on its hardness.

Key Concepts/Vocabulary:
Hardness
Flexibility

Activating Strategy:
Introduce the focus question. Have students brainstorm a list of objects they consider to be hard (rocks, metal, marbles, etc.). Based on the list students generate, the teacher will ask, "Do all objects have the same amount of hardness? What is the opposite of hard? What are different words to describe different levels of hardness? " As a class, brainstorm a list of words (hard, firm, flexible, soft, etc.). Ask students to work with a partner to put the words in order from least hard to hardest. Record this range of hardness on the board so that students can refer to it later.

Learner Activities:
Students will need the following materials for this lesson: science journal and a tray of 5 solid objects with varying degrees of harness (rock, aluminum can, stick, rubber ball, sponge, etc.)

1. Let students know that in this lesson, they will examine a set of objects to describe and compare their hardness. Remind students that *hardness* is an *observable property* of *matter*.
2. Ask students to discuss with their partner, "How can we test how hard an object is?" Have different students share their ideas with the whole class. Record their ideas on the board.
3. With their discussion partners, ask students to collaboratively decide on a plan to test the hardness of their objects. Students will fill out a graphic organizer and questions to document their materials and plan.
4. Direct students (with their partner) to conduct their investigations. They will use the same

graphic organizer to document their observations and results. This will become part of their science journal.

5. In their table groups (groups of 4) have them compare their methods and ranking of the levels of harness.
6. As a class, share aloud the ranking of each object's level of hardness. Make sure students tell the reason behind their ranking.

Summarizing Strategy:
Do a whip share – ask each students to name one observable property of matter.

Formative Assessment:	**Summative Assessment:**
Science Journal – investigation plan and results Class discussion after the investigation	See lesson 3

Teaching Strategies/Tips:

- Have materials prepared prior to class.

Differentiation (content/process/product):
Predetermined partners, additional time (if necessary), designated work spaces (within proximity of the teacher)

Attachments (assessments, rubrics, graphic organizers, projects, etc.):
Testing the Hardness of Materials – Investigation Plan and Results

2nd Grade Science
Testing the Hardness of Materials
Investigation Plan and Results

1. Explain how you will test the hardness of the materials.

2. In the chart below, record your materials and observations. The first one is done for you.

Material	Observations
Aluminum Can	*Could not break it. Was hard when we touched it and squeezed it. Could crush it when we stepped on it.*

3. List the materials in order of hardest to least hard.

4. Evaluate your plan. Did it work? How easy was it for you to decide how hard each material was?

Lesson 3: Investigating Liquids

Lesson Focus Questions:
Is all matter solid? How are liquids and solids similar and different? How can we describe a liquid?

Standards:

Science:

- **2.PS1.1-** Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

ELA:

- **W.2.7-** Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- **W.2.8-** Recall information from experiences or gather information from provided sources to answer a question.

Learning Targets:
I can tell the difference between a liquid and a solid.
I can describe a liquid using its observable properties.

Key Concepts/Vocabulary:
Solid
Liquid

Activating Strategy:
Review the definition of *matter* with students. Ask students, "Is all matter solid?" Make sure students recognize that some matter is liquid. Define *solid* and *liquid*. Students should add these to their journals. As a class, brainstorm some examples of solids and liquids. Students should add these examples under the definitions in the journals. Tell students that today they will be investigating observable properties of liquids.

Learner Activities:
Students will need the following materials for this lesson: science journal, a set of 4 liquids (oil, water, salt water, paint, etc.), wax paper, and spoons.

1. Explain to students that they will be recording observations about several liquids.
2. Using glue as your liquid, model how you would investigate and record the observable properties of glue (thick, white, sticky, strong smell, etc.). Ask students to identify the methods (smell, stir, look, drip) you used to investigate the glue. Explain to students that because they do not know what the liquids are, we will not be tasting them because that could be dangerous. Ask students if there are additional safe ways to investigate the observable properties of a liquid.
3. Have each pair collect four cups of different liquids (labeled *liquid1, 2, 3, 4*), spoons, and one piece of wax paper.
4. Ask students to investigate the liquids in the cups using the different methods previously

discussed. Prompt students to record their methods and observations in their science journals.

5. Ask some of the following questions to guide their investigations:
    - What color are the liquids? Which can you see through? Are some thicker than others? How are the liquids different from one another? What things do they have in common? What do they smell like?
6. After students clean up, ask different students to describe their observations of the liquids. Record their observations on a class chart. Ask students to explain how the liquids are similar/different.

Summarizing Strategy:
Return to the class list of observable properties of matter. Ask the class what properties should be added to the list based on their observations. Have students add these to the list in their journals. Point out that liquids and solids often have similar types of observable properties.

Formative Assessment:	**Summative Assessment:**
Science Journal – descriptions of methods and observable properties for the 4 liquids	Matter and Observable Properties Venn Diagram

Teaching Strategies/Tips:

- Have materials prepared prior to class.
- Cover desks with newspaper ahead of time.
- Make sure students have already used a Venn diagram prior to this lesson.

Differentiation (content/process/product):

- Predetermined partners, additional time (if necessary), designated work spaces (within proximity of the teacher), scribe (if necessary)
- On the summative assessment, some students may benefit from having to compare only 2 materials. Teacher should make this decision on a case by case basis.

Attachments (assessments, rubrics, graphic organizers, projects, etc.):
Class Chart-"Liquid observations"
Assessment– Matter and Observable Properties Venn Diagram

Class Chart-"Liquid Observations"

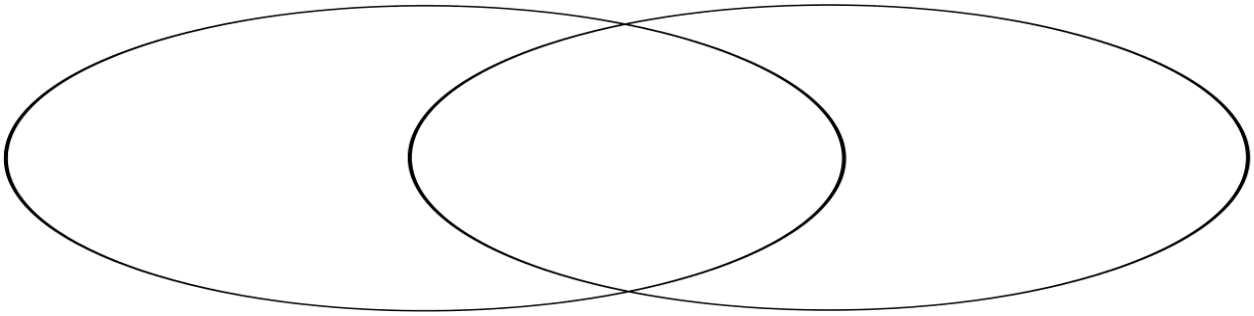
Liquid	Observable Properties
Glue	*white, thicker than water, sticky, has a strong scent, starts to get thicker as it dries, dries quickly in small drops, no shape until you "drip it"*
Liquid #1	
Liquid #2	
Liquid #3	
Liquid #4	

Matter and Observable Properties Assessment

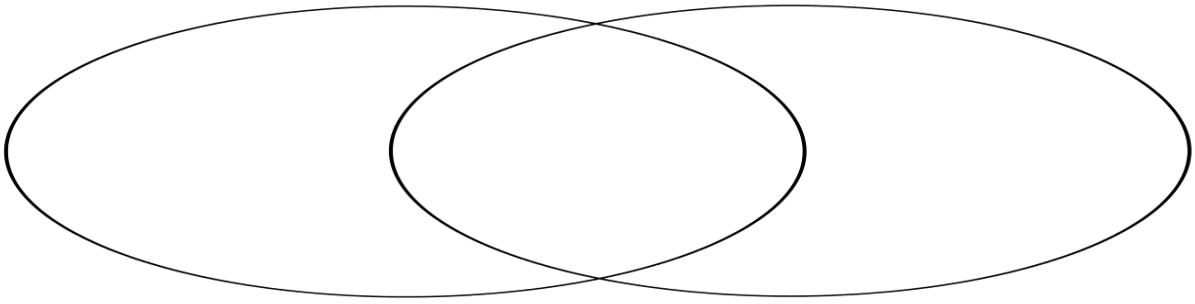
Identify each material as a liquid or a solid.

1. Glue
2. Water
3. Computer Paper

Use the Venn Diagram to show how glue and water's observable properties are similar and different.



Use the Venn Diagram to show how glue and computer paper's observable properties are similar and different.



Lesson 4: Choosing the Best Material

Lesson Focus Questions:
How do we decide what the best material is for an intended purpose?
How and why do scientists test their ideas?
How do scientists use data and evidence to answer questions?

Standards:

Science:

- **2.PS1.1-** Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- **2. PS1.2-** Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

ELA:

- **W.2.8-** Recall information from experiences or gather information from provided sources to answer a question.

Learning Target:
I can choose the best material for an intended purpose and explain what observable properties make it the best.
I can conduct a test, collect data, and use evidence to answer a question.

Key Concepts/Vocabulary:
Properties
Purpose
Hypothesis
Data
Evidence
Absorbency

Activating Strategy:
Watch a short video called, "How it's Made?" about crayons. Have a class discussion about a crayon's purpose and why crayons are made out of wax instead of a different material. Explain that today the class will be investigating which materials are best for certain purposes and why.

Learner Activities:

Day 1

1. Define the word *purpose*. Students should add this to their journals. Show students different objects (can be pictures or the actual objects) and ask them to think of their purpose. Make a list so that students get a better understanding of the term.
2. Tell students that today they will be investigating which material (a paper towel, a piece of paper, or a tissue) is the best for cleaning up spills. Ask the class, "How can we find out which material is best for each of the purposes?" Students should recognize that they need to "test" each of the materials. Reinforce that scientists test things to find answers to

their questions. This helps them collect evidence. Define the word *evidence*. Students should add this to their journals

3. The teacher will demonstrate the first experiment by showing three different materials: a paper towel, a piece of paper, and a tissue. The teacher will ask the class to write down a guess (*hypothesis*) and reason about which material will do the best job of cleaning up a spill. She will then explain that they will test each material and write down their observations after each one. The teacher will proceed by "spilling" a cup of colored liquid on a cookie tray three different times, and using each of the materials (a paper towel, a piece of paper, and a tissue) to clean it up. Between each new test, she will ask the class to describe what they observed. The class and teacher will record their observations in their journals.
4. After all 3 materials have been tested, the teacher will ask students to revisit their hypothesis. As a class, record the results of the best material and discuss/record the reasons for this (absorbency, strength, thickness).

Day 2

1. Review the definitions of *purpose, absorbency, hypothesis*, and *evidence*. Review that absorbency is another observable property.
2. Tell students that today they will be testing other materials for different purposes (the ability to hold a stack of papers together and the ability to spread a substance).
3. Review the procedures (hypothesis, test, observe and record results, conclusion, evidence, and reasons) used yesterday. Ask students to summarize what happened at each step yesterday.
4. Review today's materials (giant paper clips and string) for experiment 1 – *Which material is best for holding together a stack of papers?* Provide students with a stack of papers for the experiment and a graphic organizer to record their hypothesis, observations, conclusion, evidence and reasons. Students will have approximately 10 minutes to conduct the first experiment's tests and record their findings.
5. Review today's materials (plastic spatula, fork) for experiment 2 – *Which materials is best for spreading icing?* Provide students with a small container of icing, 2 cookies and a graphic organizer to record their hypothesis, observations, conclusion, evidence and reasons. Students will have approximately 10 minutes to conduct the second experiment's tests and record their findings.

Summarizing Strategy:
Day 1 - Ask students to tell their partners why scientists test their ideas and why scientists need evidence. Ask a few students to summarize what they tested today and what their evidence was.
Day 2 - Ask a few students to summarize what they tested today and what their results and evidence were.

Formative Assessment:	**Summative Assessment:**
Journal and discussion from Day 1	Graphic Organizers for Choosing the Best Materials Experiments – Day 2

Teaching Strategies/Tips: • Have materials prepared ahead of time.
Differentiation (content/process/product): • Predetermined partners, additional time (if necessary), designated work spaces (within proximity of the teacher), scribe (if necessary)
Attachments (assessments, rubrics, graphic organizers, projects, etc.): Assessment– graphic organizers for Choosing the Best Materials Experiments

2nd Grade Science
Choosing the Best Material
Experiment #1
Which material is best for holding together a stack of papers?

1. Hypothesis - Which material (*string* or a *paper clip*) do you think will be best for holding together a stack of papers?

2. What happened when you tested each material? In the chart below, record your observations.

Material	Observations
String	When we tried to use the string to hold together the papers…
Paper Clip	When we tried to use the paper clip to hold together the papers…

3. Which material worked BEST to hold together the papers?

4. What observable properties made the material BEST for this purpose?

2nd Grade Science
Choosing the Best Material
Experiment #2
Which material is best for spreading icing?

1. Hypothesis - Which material (*plastic spatula* or *fork*) do you think will be best for spreading icing?

2. What happened when you tested each material? In the chart below, record your observations.

Material	Observations
Plastic Spatula	When we tried to use the plastic spatula to spread the icing…
Fork	When we tried to use the fork to spread the icing…

3. Which material worked BEST to spread the icing?

4. What observable properties made the material BEST for this purpose?

Lesson 5: Same Pieces, Different Objects

Lesson Focus Questions:
How are different objects created from the same set of pieces?
How are objects from the same set of pieces alike and different?

Standards:

Science:

- **2.PS1.1-** Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- **2.PS1.3-** Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.

Learning Targets:
I can explain how an object can be disassembled and reassembled into a new object.
I can compare and contrast two objects made from the same set of pieces.

Key Concepts/Vocabulary:
Assemble
Disassemble
Reassemble
Data
Evidence

Activating Strategy:
Introduce the terms *assemble, disassemble* and *reassemble*. Define them and model them using a simple structure made out of a few Lego pieces. Students should add these terms to their journals. Tell students that they will be investigating ways to make different structures out of the same set of pieces. Tell students that part of this work will be assembling, disassembling and reassembling.

Learner Activities:

1. Provide each pair of students with the same number, shape and size of wooden blocks.
2. Model for students how to construct a building (a simple straight tower) out of the blocks, using all the pieces. Keep this model constructed throughout the lesson.
3. Ask students to *assemble* this same model.
4. Next prompt students to *disassemble* the building and use all of their blocks to *reassemble* a different building.
5. Prompt students to draw a sketch and describe in their science journals the characteristics of their building compared to the model. Students should recognize changes in characteristics such as size and shape. Ask students to verbalize why they think the same set of pieces can create different objects.
6. Provide each student with a different set of Lego pieces. Give students 5 minutes to build

anything they would like. Ask partners to trade objects, draw a simple sketch and record observations of their friend's object. After making observations, the partner will disassemble the original object and reassemble it into something new. Ask students to record observations of the new object. Students should be able to explain similarities and differences between the original and the new.

Summarizing Strategy:
Remind students that scientists use data and evidence to prove their thinking. Explain that evidence comes from the things we see during our observations. Ask students, "What evidence do we have that different objects can be assembled, disassembled and reassembled all from the same set of pieces?"

Formative Assessment:	**Summative Assessment:**
• Observations during investigation • Journal entries • Summarizing strategy discussion about evidence	See lesson 6

Teaching Strategies/Tips:
- Have materials prepared ahead of time.

Differentiation (content/process/product):
Be aware of students who have trouble with fine motor skills. They may need assistance assembling, disassembling and reassembling.

Attachments (assessments, rubrics, graphic organizers, projects, etc.): N/A

Lesson 6: Changing Matter - Cooling and Heating

Lesson Focus Question:
How can cooling and heating change materials?

Standards:

Science:

- **2.PS1.1-** Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- **2.PS1.4-** Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

ELA:

- **W.2.7-** Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- **W.2.8-** Recall information from experiences or gather information from provided sources to answer a question.

Learning Target:
I can give examples of reversible and irreversible changes caused by cooling and heating.

Key Concepts/Vocabulary:
Solid
Liquid
Heating
Cooling
Reversible
Irreversible
Date
Evidence

Activating Strategy:
Introduce the words *cooling* and *heating* to students. Ask students to brainstorm ways we can cool something (refrigerate it, freeze it, let it sit out in cool air) and heat something (put it in the microwave, put it on the stove or in the oven, let it sit out in warm air). Explain that today the class will investigate what happens to different materials (*matter*) when they are heated or cooled.

Learner Activities:

Day 1

1. Show students a cup of water. Ask students to identify whether water is a liquid or solid. Ask students to brainstorm and share ways to turn the water into a solid.
2. Show students a piece of ice. Ask students if it is possible to turn ice back into water. Let

students share their ideas.

3. Explain to students that when water is frozen (cooled), it turns into ice. When it is heated, it turns back into water. Demonstrate by heating the piece of ice. Call this change *reversible*. Have students define *reversible* in their science journal and write down "ice to water" and "water to ice" as an example. .
4. Tell students that they will now investigate whether or not changes are reversible for all liquids and solids when they are heated or cooled. Provide students with a chart to collect data on several materials (chocolate, cola, paper).
5. Students will watch as an adult conducts experiments for the class based on the above materials. **Prior to each experiment,** have the class examine the material in its current state and record its observable properties.
    - **Experiment 1 (chocolate) -** Ask students to predict what will happen when the chocolate bar is heated and what will happen when it is cooled again. Using an electric burner, heat the chocolate. Prompt students to observe and describe the heated chocolate. Spoon the melted chocolate into a plastic cup. Tell students that you will chill this until the end of class. After the remaining experiments, show students the cooled chocolate. Ask students to record their observations of the cooled chocolate.
    - **Experiment 2 (cola) –** Show students a cup of cola. Ask them to predict what will happen to cola when you put it in the freezer. Will it freeze and turn into a solid like water even though it has bubbles? After a few minutes, show students a previously frozen cube of cola. Ask them to record their observations and predict what will happen when you heat the frozen cola. Using an electric burner, heat the frozen cola. Ask them to record their observations of the heated cola.
    - **Experiment 3 (paper) –** Show students a piece of paper. Ask them to predict what will happen when you heat it (with a lighter) and whether or not the change will be reversible. Using a lighter, burn the paper. Ask students to record their observations. Discuss with students how the ashes cannot be turned back into paper.
6. Review with students which materials had reversible changes when cooled and heated and which materials had irreversible changes. Create a T chart to document the results.

Day 2

1. Review the T-chart created at the end of the previous class period.
2. Ask students to tell their discussion partner what the words *reversible* and *irreversible* mean.
3. Ask students to brainstorm other materials that might fit under the different sides of the chart. Discuss answers and reasons as a class and add to the correct side of the chart. If students have trouble generating ideas on their own, provide them with materials to consider (an egg, pancake batter, butter, Jello, caramel, etc.)
4. Remind students that scientists use evidence to prove their thinking. Tell them that it is time for them prove their thinking. Students will work individually and independently to provide evidence for statements based on what they learned in this unit. (see summative assessment for specifics)

Summarizing Strategy:
Day 1; Step 6 – Review with students which materials had reversible changes when cooled and heated and which materials had irreversible changes. Create a T chart to document the results.

Formative Assessment: observations from day 1 recorded in science journal; group discussion on day 2 about reversible and irreversible changes	**Summative Assessment:** Arguments with evidence (Day 2; Step 4)

Teaching Strategies/Tips:

- Have materials prepared ahead of time.
- Make sure all students can easily see the experiments from where they are seated.
- Before using the lighter, explain safety procedures with the students, also explaining that only adults should use lighters.

Differentiation (content/process/product):
Additional time (if necessary), designated work spaces (within proximity of the teacher), scribe (if necessary)

Attachments (assessments, rubrics, graphic organizers, projects, etc.):
Cooling and Heating Data Chart
Structure and Properties of Matter Assessment

2nd Grade Science
Cooling and Heating Data Chart

Material	**Observable Properties BEFORE experiment**	**Observable Properties AFTER…**	**Observable properties AFTER…**	**Reversible?**
Water	*liquid, clear, fluid, thin, takes shape of container*	**AFTER freezing…** *Solid, ice, takes shape of container, cold, hard*	**AFTER heating again…** *turns back to water*	*YES*
Chocolate		**AFTER heating…**	**AFTER cooling again…**	
Cola		**AFTER freezing…**	**AFTER heating again**	
Paper		**AFTER heating…**	**AFTER cooling again…**	

2nd Grade
Structure and Properties of Matter Assessment
Arguments and Evidence

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Complete the sentences by filling in the blank with the correct word from the word bank. Then give examples to prove it's a true statement.

reversed	solid
observable	liquid
irreversible	disassembled

1. Sometimes matter is a _____.
   Here are TWO examples:

2. Sometimes matter is a _____.
   Here are TWO examples:

3. Matter has _____ properties.
   For example, a *marble* has these properties: (list at least TWO properties)

4. An object made of a small set of pieces can be _____and then turned into a new object.

5. Some changes caused by heating or cooling are _____.
   Here is ONE example:

6. Some changes caused by heating or cooling are _____, meaning they <u>cannot</u> be reversed.
   Here is ONE example:

7. Why would someone choose glass as the material to make a window?

2nd Grade
Structure and Properties of Matter Assessment
Arguments and Evidence
ANSWER KEY

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Complete the sentences by filling in the blank with the correct word from the word bank. Then give examples to prove it's a true statement.

reversible	solid
observable	liquid
irreversible	disassembled

1. (3 points) Sometimes matter is a **(student can put SOLID or LIQUID)**
   Here are TWO examples:
   For solids, student can list things like: rock, pencil, door, book, person, apple, etc.
   For liquids, student can list things like: lemonade, water, oil, milk, cough medicine, etc.

2. (3 points) Sometimes matter is a **(student can put SOLID or LIQUID, whichever they didn't use for #1)**
   Here are TWO examples:
   For solids, student can list things like: rock, pencil, door, book, person, apple, etc.
   For liquids, student can list things like: lemonade, water, oil, milk, cough medicine, etc.

3. (3 points) Matter has **OBSERVABLE** properties.
   For example, a *marble* has these properties: (list at least TWO properties)
   Student can list properties like: glass, round, small, hard

4. (1 point) An object made of a small set of pieces can be **DISASSEMBLED** and then turned into a new object.

5. (3 points) Some changes caused by heating or cooling are **REVERSIBLE**.
   Here is ONE example:
   Student can list examples such as: water can change to ice and then back to water; chocolate can be melted and then hardened again; butter can melt into a liquid and then return to a solid. It is important that they list both parts of the change to show how it's reversible.

6. (2 points) Some changes caused by heating or cooling are **IRREVERSIBLE**, meaning they cannot be reversed.
   Here is ONE example:
   Student can list examples such as: after an egg is cooked, it cannot be reversed; after paper is burned, it cannot be reversed; after cake batter is baked, it cannot be reversed.

7. (1 point)Why would someone choose glass to make a window?
   Student should provide at least one reason based on the purpose, such as because it is easy to see through or because it allows sunlight in, etc.