The Evolution of the T2L Science Curriculum

Over the last four years, the Teach to Learn program created 20 NGSS-aligned science units in grades K-5 during our summer sessions. True to our plan, we piloted the units in North Adams Public Schools, and asked and received feedback from our science fellows and our participating teachers. This feedback served as a starting point for our revisions of the units. During year 2 (Summer of 2015), we revised units from year 1 (Summer/Fall 2014) and created new units to pilot. In year 3, we revised units from years 1 and 2 and created new units of curricula, using the same model for year 4. Our understanding of how to create rich and robust science curriculum grew, so by the summer of 2018, our final summer of curriculum development, we had created five exemplar units and established an exemplar unit template which is available in the T2L Toolkit.

We made a concerted effort to upgrade all the existing units with exemplar components. We were able to do much, but not all. So, as you explore different units, you will notice that some contain all elements of our exemplar units, while others contain only some. The fully realized exemplar units are noted on the cover page. We did revise all 20 units and brought them to a baseline of "exemplar" by including the Lessons-At-A-Glance and Science Talk elements.

Grade 2

Materials Matter

MCLA NAPS Williams

Teach To Learn

A collaboration between MCLA, Williams College, and North Adams Public Schools

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T2L Curriculum Unit

Materials Matter

Physical Science/Grade 2

This unit explores the idea that different materials have different properties that make them suitable for different purposes. It also introduces students to the idea that matter can be changed into different forms or configurations, some of which are reversible and some of which are not.

This unit was developed with National Science Foundation funding (Grant #1432591). It is a DRAFT document that will be revised as the unit is piloted and feedback received.

Unit Creation and Revision History

Authors, Summer 2014
Jean Bacon, Administrator for Teaching and Learning, North Adams Public Schools
Claire Grogan, Grade 2 Teacher, North Adams Public Schools
Josh Colon, Physics major, Massachusetts College of Liberal Arts
Lindsay Osterhoudt, Science Coordinator, North Adams Public Schools

Revisions, Summer 2015
Dylan Caples, Chemistry major, Massachusetts College of Liberal Arts
Darla M. Torres, Undeclared major, Williams College

Revisions, Summer 2016
Connor Mulhall, Statistics major, Williams College
Meaghan Boucher, Physics major, Massachusetts College of Liberal Arts

Revision Summer 2018
Lauren Mangiardi, Education and English Literature major, Massachusetts College of Liberal Arts
Stephanie Nguyen, Elementary Education, Interdisciplinary Studies, Massachusetts College of Liberal Arts

Project Manager: Leslie Rule, Teach to Learn, Massachusetts College of Liberal Arts

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Unit Plan

Stage 1 Desired Results

2-PS1-1. Describe and classify different kinds of materials by observable properties of color, flexibility, hardness, texture, and absorbency.

2-PS1-2. Test different materials and analyze the data obtained to determine which materials have the properties that are best suited for an intended purpose.*
Clarification Statements:
Examples of properties could include, color, flexibility, hardness, texture, and absorbency.
Data should focus on qualitative and relative observations.

2-PS1-3. Analyze a variety of evidence to conclude that when a chunk of material is cut or broken into pieces, each piece is still the same material and, however small each piece is, has weight. Show that the material properties of a small set of pieces do not change when the pieces are used to build larger objects.
Clarification Statements:
Materials should be pure substances or microscopic mixtures that appear contiguous at observable scales.
Examples of pieces could include blocks, building bricks, and other assorted small

Meaning

UNDERSTANDINGS
Students will understand that…

- **Matter can be described and classified by its observable properties.**
- **Different properties are suited to different purposes.**
- **A great variety of objects can be built up from a small set of pieces.**
- **Objects or samples of a substance can be weighed, and their size can be described and measured.**
- **Heating and cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.**

ESSENTIAL QUESTION

Why do materials matter?

Student Learning Targets

Students will be able to …

1. Differentiate between materials and the properties of materials
2. Identify the materials that compose a common object and explain what makes that material suitable for that object.
3. Define matter as anything that takes up space
4. Identify objects and materials as solid, liquid, or gas.
5. Recount or describe key ideas or details from a text read aloud.

objects. **2-PS1-4.** Construct an argument with evidence that some changes to materials caused by heating or cooling can be reversed and some cannot. Clarification Statements: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and burning paper. **2-PS3-1(MA).** Design and conduct an experiment to show the effects of friction on the relative temperature and speed of objects that rub against each other. Clarification Statements: Examples could include an object sliding on rough vs. smooth surfaces. Observations of temperature and speed should be qualitative. **2.K-2-ETS1-3**. Analyze data from tests of two objects designed to solve the same design problem to compare the strengths and weaknesses of how each object performs. * Clarification Statements:	6. Read with sufficient accuracy and fluency to support comprehension. (This will be addressed in the small reading groups and during partner reading.) 7. Identify the main purpose of this text, including what the author wants to explain or describe. 8. Explain citing evidence why a material is hard or less hard. 9. Explain citing evidence why a material is strong or not strong. 10. Write an informational/explanatory text. 11. Introduce a topic, use facts and definitions to develop points. 12. Provide a concluding statement or section. 13. Classify objects by texture, using observation and touch. 14. Describe and classify objects by their absorbency through testing. 15. Describe and classify objects by their absorbency through testing, 16. Show and explain that when a large piece of material is cut into smaller pieces, it is still the same material. 17. Show and explain that materials' properties do not change when small pieces are used to build larger pieces. 18. Construct an argument with evidence that some changes are REVERSIBLE, such as when water is heated or cooled. 19. Construct an argument with evidence that some changes are IRREVERSIBLE. 20. Design and conduct an experiment to show the effects of friction on the relative temperature and speed of objects that rub against each other. 21. Describe the motion of objects. 22. Collect evidence to describe motion. 23. Demonstrate that motion is affected by a push or a pull, and different amounts can cause different changes. 24. Observe how speed and friction are related through rubbing of objects.

Data can include observations and be either qualitative or quantitative. Examples can include how different objects insulate cold water or how different types of grocery bags perform	25. State the relationship between friction and speed 26. Design a demonstration to show the relationship between friction and speed. 27. Demonstrate that speed is different when a toy car is rolled down a smooth ramp vs. a rough ramp. 28. Design and conduct an experiment to show the effects of friction on the relative temperature and speed of objects that rub against each other. 29. Analyze data from tests of two objects designed to solve the same design problem to compare the strengths and weaknesses of how each object performs.
Stage 2 – Evidence	
Evaluative Criteria	**Assessment Evidence**
	CEPA: Based on what students have learned through their investigations of the properties of various materials, students will experiment with a piece of overhead transparency, a square of felt, a piece of plexiglass and a coffee filter to determine which would make the best materials for an umbrella. **Students will be presented with this scenario:** You work at an umbrella factory and have been asked to select a new material to use to make your umbrellas. From the different choices you can select three materials to test out to decide which is best. You must design a demonstration and prepare an explanation to convince your employer that your final recommendation is the best material with which to manufacture your umbrellas.
Stage 3 – Learning Plan	
Lesson 1: Through observation and manipulation of various materials, students will describe the properties that vary across different materials. They will see that the world is composed of a wide variety of materials with different properties which are suited for different purposes.	

Lesson 2: On the first day of this lesson, the teacher will read aloud to the class the book, *What Is Matter?,* to help students understand what matter is, the three states of matter, and the properties required to be a solid, a liquid, or a gas. On the second day, the teacher will work with small groups of students using the differentiated student books to read aloud and discuss the text. On the same day, the teacher may choose to pair up the students to reread the books for fluency and comprehension.

Lesson 3: The lesson's purpose is to teach about the scientific classification of properties of matter, and to expose students to informational text. This lesson will begin with a review of classification by color. Students should already understand that objects of similar colors are grouped and all remaining objects not grouped are placed into a separate, new group. The lesson will then cover observable physical properties and their importance. Refer to the learning objectives for specific literacy goals. The *Properties* book written by Delta Science Readers is an introduction to the vocabulary and classification activities that students will encounter in the following science lessons.

Lesson 4: In this lesson, students will test a variety of materials to determine the level of "hardness" associated with each material. The students will then test those same materials for "strength". The teacher will give suggestions as to how to test the materials, and students may find other ways to test the materials. The students will record their data and give evidence to support why they categorized the materials the way they did.

Lesson 5: This will be a writing lesson for English Language Arts, and it will show the students' understanding of the properties of strength and hardness. The main point of the lesson is to construct a scientific argument using evidence.

Lesson 6: Students will work with a partner, moving around the room to various materials as listed on their data papers. By observation and touch, they will write the texture properties for the materials.

Lesson 7: Students will work together in groups using an eyedropper dipped into thinned watercolor paint to put drops of water on different materials. They will record whether the material is absorbent or not. They will also pour water onto each material without using the eyedropper to test for absorbency. Note: Make sure to coordinate the setup of the lesson with the classroom teacher. This lesson requires the use of stations which will take some time to create.

Lesson 8: Students will cut and/or rip a variety of materials to determine that the properties of the materials do not change when taken

apart. There should be a lot of discussion among the students to provide evidence. Each group will record their data and present to the class. Note to teachers: Students may struggle with the concept of "weight." Students often believe that objects only have weight if they can feel the weight. For example, eraser shavings, no matter how small they may be, have weight. Very light objects, like cotton balls or feathers, have weight even though the students may not be able to feel the weight. This is something to be prepared for, and ready to have students confront through discussion or experiment.

Lesson 9: Students will combine a variety of materials to determine that the properties of the individual materials do not change when put together. There should be a lot of discussion among the students to provide evidence.

Lesson 10: This will be a four-day whole class lesson. Students will do an experiment to see what happens when two bottles of water are put into the freezer, then put on the school vent/heater with the cover on the bottles the next day, and, finally, on the last day, put on the heater without covers on the bottles. Students will fill the bottles with water on the first day and take measurements every day to document what is happening to the water. Students will see that water can be changed to ice and then be reversed back to water. They will also see that water can change into a gas.

Lesson 11: Students will learn from this lesson that some changes are irreversible. They will weigh bubble gum which contains sugar before they chew it. The thought provoking question "Can you 'unchew' gum?" will be elaborated upon by asking the students if they think the gum will weigh the same, weigh more, or weigh less after it is chewed. Then the students will chew the gum, and we will weigh the chewed gum to find that the gum will weigh less because the sugar comes out of the gum when chewed. Therefore, this change is irreversible.

Lesson 12: Through observation and experimentation of various surfaces on a material students will be able to use previous knowledge gained on material properties to examine the relationship between friction and temperature, through the rubbing of an object on multiple surfaces. Students will also be able to see how different surfaces and materials can be used if the temperature or friction needs to be controlled.

Lesson 13: This lesson will serve as a review of directional motion and force. The students will engage in different activities that represent the different directions motion can take. Through this lesson, students will better understand how and why things move the way they do. They will then apply this information to future lessons and experiments. This lesson has been adapted from the Minnesota Science Teachers Education Project.

Lesson 14: Through observation and experimentation, and drawing on their previous learning, students will understand how different surfaces and angles of materials can control speed or friction. To explore this relationship between friction and speed, the students will roll a toy car on a range of flat and inclined surfaces.

Lesson 15: This lesson is built on the students' previous knowledge of friction, materials, and physical properties. Through designing and experimenting with various surfaces on spheres, students will be able to design a bowling alley lane using the relationship between friction and speed and friction and temperature. Students will also be able to see how design choices can impact the results.

Lesson Feature Key

Lessons in this unit include a number of features to help instructors. This key is a quick guide to help identify and understand the most important features.

Icons

 **Talk science icon:** Look for this icon to let you know when to use some of the talk science strategies (found in the unit resources of this unit)

 **Anchor phenomenon icon:** Indicates a time when an anchoring scientific phenomenon is introduced or when an activity connects back to this important idea.

Text Formatting:

[SP#: ....] Any time you see a set of brackets like this, it indicates that students should be engaged in a specific science or engineering practice.

Underlined text in the lesson: This formatting indicates important connections back to the central scientific concepts and is useful to note these connections as an instructor, as well as for students.

Callouts

Teaching Tip

In these call-out boxes, you'll find tips for teaching strategies or background information on the topic.

Student Thinking Alert

Look out for common student answers, ways in which students may think about a phenomenon, or typical misconceptions.

Tiered Vocabulary List

Tier 1	Tier 2	Tier 3
Water	Material	Property
Air	Investigate	Matter
Wood	Classify	Solid
Flow	Balance	Liquid
Scientist	Informational text	Gas
Sense	Explanatory text	Force
Hard	Texture	State
Soft	Evidence	Magnet
Shape	Arguments	Mass
Smooth	Describe	Strength
Rough	Direction	Hardness
Cool	Analyze	Absorbency
Heat	Data	Weight
Weigh	Design	Configuration
Scale	Examples	Reverse
Temperature	Observe	Irreversible
Surface	Compare	Friction
Push	contrast	Resistance
Pull		Force
Speed		Motion
Flat		Incline

Lesson 1: Introduction to Concepts of Materials and Exploration of Properties

BACKGROUND

Overview of the Lesson

Through observation and manipulation of various materials, students will describe the properties that vary across different materials. In addition, they will begin to see how their world is composed of a wide variety of materials with different properties which are suited for different purposes.

Focus Standard

2-PS1-1. Describe and classify different kinds of materials by observable properties of color, flexibility, hardness, texture, and absorbency.

Learning Targets

I can differentiate between materials and the properties of materials.

I can identify the materials that compose a common object and explain what makes that material suitable for that object. **[SP-6 Constructing explanations]**

Assessment

Have students respond to the following question in their science journals or on a piece of paper: Which would be best for making a door and why? Wood, air, water, or starch?

Targeted Academic Language

Tier 1: water, air, wood

Tier 2: material

Tier 3: property, matter

RESOURCES AND MATERIALS

Quantity	Item	Source
4	**Popsicle sticks**	**Bin**
4	Bags of starch putty (recipe is below) http://www.wikihow.com/Make-Silly-Putty	Bin
4	**Cups (to be filled with water)**	**Bin**
4	**Balloons (balloons need to be inflated)**	**Bin**
Classroom Set	Science Journals	Classroom Teacher

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

1. Write or project the unit's essential question "Why do materials matter?", and read it aloud. Explain that this is the BIG QUESTION we will be trying to answer in our science lessons for the next few weeks. But what does it mean? There are two special words in this question that we need to understand – "materials" and "matter." How do students define "material"? Acknowledge their responses and then explain that in science class when we use the word "material," we are talking about the stuff that is used to build or make an object. Give some examples from around the room. e.g. "What

materials is this pencil made of?" Choose items to discuss that will highlight that some objects are made of a single material and some are made of multiple materials.

2. Once the concept of materials is explained, introduce the idea the materials have "properties." Define "properties" as characteristics of materials (this can be demonstrated during the explanation). For example, walk over to one of the students' desks and ask what "material" the desk is made up of (wood or metal). Now pose the question, "what kinds of properties does the desk have?" Allow the students to guess at first, then ask them specific questions. "Is the desk hard or soft? (Knock on the desk for added understanding). What color is the desk?" Explain to the students that these are the "properties" of the desk, and that every "material" has its own properties. On the whiteboard, draw a word web to illustrate how the properties relate to the material. For instance, write the word "wood" or whatever material the teacher chooses in the center of the word web. The spokes coming off the word web will be for the material's properties such as hard, brown, etc.

3. Now that we understand what the word "material" means when we use it as a science word, let's discuss the word "matter" from our BIG QUESTION. Can anyone use the word "matter" in a sentence? Explore ways they know and understand that word. If they cannot produce an example, then provide one and ask them what your example means; e.g. "Since I have my umbrella, it does not matter whether it rains today or not." "It does matter whether or not you come to school regularly." "Everything we have in our world is made up of matter." Make sure students understand the word, "matter", in the context of science.

4. Revisit the essential question, "Why do materials matter?" and discuss what it means. Have students write down their ideas of what the question means in their science journal.

5. Today, we are going to begin our study of materials and what makes them special. Over the next few weeks we will learn about lots of different properties of different materials. This will help us answer our BIG QUESTION about why it matters that we have all sorts of different materials in the world.

During the Lesson

1. **Exploring Starch Putty**
   a. Hand each child a baggie of starch putty. "I want you to investigate what's in your baggie and write in your science journal (or on a piece of paper) every word you can think of to describe the material that is in your bag." Give students 2-3 minutes to explore the material and record their observations **[SP-3 Planning and carrying out investigations]**.

   b. Circulate and observe the children, asking prompting questions if they seem stuck. What does it look like? What does it feel like? Is it hard? Is it soft? What shape is it? What does it smell like? Can you break it apart? Can you put it back together?

   c. Ask students to put the putty back in the baggies and collect it.

   d.  (**Science Talk: Small Group and then Whole Class):** Students should be split up into small groups, and then discuss among themselves their observations. Then, each group will share their observations with the whole class. When the students share their words, you should categorize them as you write them on the board or on chart paper i.e. grouping together words that describe color, texture, hardness, etc. Do not explain your groupings as you write.

e.  **(Science Talk: Small Group and then Whole Class):** When complete, assign each small group of students one group of words. Then, ask "What do all these words have in common?" and use that discussion to make the point that there are some common categories or properties we can use to help us describe different materials, e.g. color, texture (or how something feels), hardness, strength (easy or hard to break apart), etc. It is not necessary to discuss these properties at length now; the purpose is just to give them an introduction to the idea. Afterwards, the groups will share with the whole class why the words were grouped together.

2. Comparing Materials

a. Now that we understand the different characteristics, we can think about how to describe a material. We're going to use what we just learned to look at a bunch of different materials and compare their characteristics. Sometimes there will be objects for you to look at, and you will have to identify the material it's made of. At other stations there will be a container with a material inside it; you have to figure out what that material is and describe its characteristics.

b. Set up at four stations with the following objects:

Station 1: popsicle sticks
Station 2: a bag of starch putty
Station 3: 1 cup of water
Station 4: an inflated balloon

NOTE: Instead of having students rotate to four stations, you can provide the four objects to each group of 4-5 students.

c. Explain "When scientists are studying the world around us, they need an organized way to keep track of the information they are gathering." Explain the data table handout as a way to keep all the information organized.

d. Then, hand out the data table to each student to record what they are observing. You will need to explain how to use the data sheet, and students may include this in their science journals. [Optional: Add a word bank at the top of the data table containing examples of descriptive words like wet, dry, smooth, rough, clear, brown, heavy, light, soft, hard, etc.]

e. The classroom teacher will assign students to each center. The teacher will have each group of students move to the next center every 3-5 minutes. For the main part of this activity, students will go to each station, identify the materials, and record what they observe for the materials.

f. At the same time, the Science Fellows and classroom teacher can walk around and ask what the students are seeing and doing. The adults can assist students in making their observations if necessary.

g. **(Science Talk: Class Discussion):** The final part of the lesson will be the class coming back together to discuss the findings on their data tables.
Guiding questions for the discussion:
- In what ways are the four materials the same?
- In what ways are they different?
- What words did you use to describe each object?
- What were the four materials? [Optional

3. What's it made of?

(Science Talk: Partners): We started our lesson today by discussing our BIG QUESTION – Why do materials matter? Now that we understand what materials are, and that different characteristics, I want you to start

thinking about why we might need all these different materials. If you look around the room, I bet you can see that the objects in the room are made of lots of different materials. In this activity I'm going to ask each of you, with a partner, to find an object in the room and identify the material or materials that compose the object. Then, discuss with your partner why you think that object is made of those materials (and not other materials). Why did the people who made this object choose this material instead of starch putty?

Probing Questions: Think about the object's purpose.
Does it need to be strong, flexible, soft, hard, etc?
What do you think would happen if the object didn't have these characteristics?
Would the object still be the same if it was made out of a different material?

Lesson Closing

- Review with class the main points of the lesson. You might ask for oral responses to "what did you learn today?" **[SP-8 Obtaining, evaluating, and communicating information]**
- Check with thumbs up, thumbs down, mastery of the student learning objectives.

Assessment

Have students respond to the following question in their science journals or on a piece of paper: Which would be best for making a door and why? Wood, air, water, or starch putty?

Lesson 2: What is Matter?

(To be taught by the Classroom Teacher)

BACKGROUND

Overview of the Lesson

The first day of this lesson, the teacher will read aloud to the whole class the big book, *What Is Matter?* This book will help students understand what matter is, the three states of matter, and the properties required to be a solid, a liquid, or a gas. On the second day, the teacher will work with small groups of students, using the small student books to read aloud and discuss the text. On the same day, the teacher may choose to split the students into pairs to reread the books for fluency and comprehension.

Focus Standard

2-PS1-1. Describe and classify different kinds of materials by observable properties of color, flexibility, hardness, texture, and absorbency.

Literacy Standards

2-RFS-4 Read with sufficient accuracy and fluency to support comprehension.
2-SL-2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.
2-LS-2 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on *grade 2 reading and content*, choosing flexibly from an array of strategies.
2-RI-5 Know and use various text features (e.g., captions, bold print, subheadings, glossaries, indexes, electronic menus, icons) to locate key facts or information in a text efficiently

Learning Targets

I can define matter as anything that takes up space.
I can identify objects and materials as solid, liquid, or gas.
I can recount or describe key ideas or details from a text read aloud with sufficient accuracy and fluency to support comprehension. (This will be addressed in the small reading groups and during partner reading.)
I can identify the main purpose of this text, including what the author wants to explain or describe.

Assessment

Ask students to respond to the two questions below in their science journals.

- What is matter?
- Give one example of a material for each state of matter.

Targeted Academic Language

Tier 1**:** flow, scientist
Tier 2: investigate
Tier 3: matter, solid, liquid, gas, force, state

RESOURCES AND MATERIALS

Quantity	Item	Source
1	**Big book, *What Is Matter?* by Lisa Trumbauer**	**Bin**
1	Lyrics to "Matter song" https://www.youtube.com/watch?v=kjjIS6ZaEvM	CMC Website/ Binder
Class set	Science Journals	Classroom Teacher

6	**Foss Science Reader *Solids and Liquids***	**Bin**
1	Chart paper	Classroom Teacher
Set	Markers	Classroom Teacher

****Items in bold should be returned for use next year****

DAY 1 LESSON DETAILS

Lesson Opening/ Activator

"We are going to learn about matter! In our last lesson we talked about our BIG QUESTION: Why do materials matter? We discussed that the word "material" was one meaning in common speech and a different, special meaning in science. We also discussed what the word "matter" means. Does anyone remember? Review the definitions for "materials" and "matter" from last time. "Today we are going to learn about "matter" in the context of science. To begin, I want you to tell me what you think the word "matter" would mean when we use it to describe something in science.

Pretest - Type I –

What is matter? Students will write one or two sentences stating what they think matter is in their science journals. If they do not know, tell them that they can write "I don't know what matter is".

During the Lesson

1. This lesson will introduce the unit "Materials Matter".
2. Pass out the students' science journals.
3. Tell students to write "My Science Journal" by _____ on the cover.
4. For each entry, have students write the date.
5. Give the Type I pretest as mentioned above.
6. Read aloud the big book, *What Is Matter?,* to the class.

7. Discuss academic vocabulary and write the words on chart paper as you read aloud the book. Have students write down the vocabulary words and their definitions in their science journals.
8. Ask verbal comprehension questions regarding the text as you read. **[SP-7 Engaging in argument from evidence]**

** Refer to the Teacher's Guide for the book, *What Is Matter?* for questions to ask as the teacher reads aloud the book.

Lesson Closing

After reading the book, discuss what was learned. Teacher will record what was learned on the class chart. NOTE: Assessment of content learned will take place at the end of day 2.

DAY 2 LESSON DETAILS

During the Lesson (Sequence of Activities): CLASSROOM TEACHER ONLY

1. This lesson reinforces science vocabulary concepts and oral reading fluency.

2. The teacher will divide students into small groups based on the students' needs. The teacher will use differentiated student books within these small groups.
3. The teacher will take one group at a time and guide students as needed while they take turns reading the text aloud. The teacher will ask comprehension questions as they go along similar to those used when reading the big book.
4. After reading, students will be split up into small groups and each group will be assigned a vocabulary word. As a group, students will use context clues to define the vocabulary.
5. Then, as a whole class, the teacher will review the science vocabulary to make sure students really understand the words.
6. During the lesson, teacher will lead students in the "Matter Song" to the tune of "The Wheels on the Bus". Lyrics are included in the unit and a video is available on YouTube if the teacher wishes to watch and learn the song beforehand.

The teacher should distribute copies to the students as a guide or put the lyrics on chart paper for students to follow along.

7. At the end of the lesson, the teacher could either ask for verbal answers to the "Think About It" questions, which are at the end of the book, or the teacher could have students write the answers to these questions in their science journals.
8. The teacher can pair up students to reread aloud the books for fluency. Rereading will provide an opportunity for them to also review vocabulary and science concepts. If the students do not answer the "Think About It" questions during the small group lesson, the teacher could have the partners answer the questions in their science journals during this time.

Assessment

Ask students to respond to the two questions below in their science journals.

- What is matter?
- Give one example of a material for each state of matter.

Lesson 3: Introduction to Properties

(To be taught by the Classroom Teacher)

BACKGROUND

Overview of the Lesson

The lesson's purpose is to teach students about the scientific classification of properties of matter and to expose students to informational text. This lesson will begin with a review of classification by color. Students should already understand that objects of similar colors are grouped and all remaining objects not in grouped are placed into a separate, new group. The lesson will then cover observable physical properties and their importance. Refer to the learning objectives for specific literacy goals. The *Properties* book written by Delta Science Readers is an introduction to the vocabulary and classification activities that students will encounter in the following science lessons.

Focus Standard(s)

2-PS1-1. Describe and classify different kinds of materials by observable properties of color, flexibility, hardness, texture, and absorbency.
2-SL-2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.
2-RI-5 Know and use various text features (e.g., captions, bold print, subheadings, glossaries, indexes, electronic menus, icons) to locate key facts or information in a text efficiently.
2-RI-6 Identify the main purpose of a text, including what the author wants to answer, explain, or describe

Learning Targets

I can describe and classify materials by observing color.
I can recount or describe key ideas or details from a text read aloud.
I can use various text features including bold print, subheadings, and glossaries to locate key facts or information in a text efficiently.
I can identify the main purpose of a text, including what the author wants to explain or describe.

Assessment

Post Test - Type II

- What are properties?
- Write two different materials (that you haven't talked about during the group discussion) and write one property for each of them.

Targeted Academic Language

Tier 1: senses
Tier 2: classify, balance
Tier 3: gas, liquid, solid, magnet, mass, matter, properties

RESOURCES AND MATERIALS

Quantity	Item	Source
	Science Journals	Classroom Teacher
As needed	Chart paper	Classroom Teacher
As needed	Markers	Classroom Teacher

1	***Properties, Delta Science Readers***	**Bin**

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

1. Review the discussion from Lesson 1. Remind students that in lesson 1 they learned about materials and properties. Discuss what they remember about each word and see if they can provide some examples.

2. After they finish answering, tell the students they will get into groups according to the color of their shirt. Tell the class that you want a group of people with white shirts, green shirts, red shirts, blue shirts, and a group for anyone without any of those colors.

3. Ask students "Who can tell us about what we learned when we classified everyone by the color of their shirt?" **[SP- Analyzing and interpreting data]**

4. Reinforce the fact that their shirts' colors is a property.
   Probing Questions: What material did we focus on for this activity?
   Specifically, what type of clothing did we based our groups off of?
   What characteristic or property of the shirts did we use for categorization?
5. Explain that "The more properties you can describe a material with, the more we can understand about that material. For example, if I asked you to find [student's name] and you didn't already know who s/he was, then you wouldn't be able to find her/him. If I told you to find [student's name] and also told you s/he was wearing a [whatever color shirt the student is wearing] shirt, that would make it much easier to find the student. If I asked you to bring me a banana,

would you look for an object that is yellow or blue? Yellow! Exactly! This shows that the properties of a material help us know what it is."

During the Lesson

1. The teacher reads aloud the big book, *Properties.*
2. Discuss vocabulary as you read the book.

Lesson Closing

1. After reading the book, ask students what they learned and record on the class chart.
2. Answer any student questions about what solids, liquids, and gases are. Write examples of solids, liquids, and gases found in the real world on the whiteboard.
3. Ask the class to describe the various properties of different materials found in objects around the room. If weather permits, the teacher should bring the students outside to explore the properties of materials in nature. Make sure to write on the whiteboard examples of properties such as strength, color, texture, softness, etc. if the students are struggling. **[SP- Engaging in argument from evidence]**

Assessment

Post Test - Type II

- What are properties?
- Write two different materials (that you haven't talked about during the group discussion) and write one property for each of them.

Lesson 4: Classify According to Strength and Hardness

BACKGROUND

Overview of the Lesson

In this lesson, students will test a variety of materials to determine the level of "hardness" associated with each material. The students will then test those same materials for "strength". The teacher will give suggestions as to how to test the materials, and students may find other ways to test the materials. The students will record their data and give evidence to support why they categorized the materials the way they did.

Focus Standard

2-PS1-1. Describe and classify different kinds of materials by observable properties of color, flexibility, hardness, texture, and absorbency.

Learning Targets

I can explain citing evidence why a material is hard or less hard.
I can explain citing evidence why a material is strong or not strong.

Assessment

Post Test - Type II

- Part A - Name one material that is hard and tell how you know it is hard.
- Part B - Name one material that is strong and explain (with evidence) how you know you know it is strong.
- Part C - Name a material that is either strong or hard, but not both, and explain why that material has only one characteristic and not the other.

Targeted Academic Language

Tier 1: Hard, Soft, Shape
Tier 2: Material
Tier 3: Strength, Hardness

RESOURCES AND MATERIALS

Quantity	Item	Source
Class set	Science Journals	Classroom Teacher
1	"Hardness and Strength," video https://www.youtube.com/watch?v=mUkJKIaz5WQ	CMC Website
16	3" x 5" index cards for categories	Bin
1 per student	Hardness Recording Sheet	Binder (Classroom Teacher to copy)
1 per student	Strength Recording Sheet	Binder (Classroom Teacher to copy)
4	Pairs of scissors	Classroom Teacher
1	Large chart paper	Classroom Teacher
As needed	Markers	Classroom Teacher
	Various readily available materials for classifying: soft/hard, and strong/not strong such as: and not limited to: *paper, felt, plastic wrap, coffee filters, tissues, feathers, wood, cardboard, stones, metal, Lincoln Logs, Cuisenaire Rods, marbles, ceramic tiles, paper towels, overhead transparency plastic papers, wax paper, metal keys, cloth, cotton balls*	**Bin/Classroom Teacher**

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

1. Pretest - Type I - in science journals
    - What makes an object “hard”? What makes an object “strong?” Is there a difference?
    - Have students watch “Hardness and Strength”(video on the YouTube channel).
2. Re-explain to students that hardness is resistance to indentation or deformation (a material’s ability to maintain its initial shape), while strength is the ability to withstand a load or stress without breaking (shape can change or bend, but can’t fracture or split). Provide examples of objects that are hard or strong and encourage students to come up with a few examples. Students should write the definitions of hardness and strength in their science journals along with a couple of examples.
3. Ask why is might be important to know whether a material is hard or soft? Strong or weak? (You can reference examples from the Solids and Liquids reading in the last lesson. If you were going to make a sweater would it be better to make it from…)
4. As scientists, we’re going to investigate materials to see which ones are more “hard” than others and which materials are more “strong” than others.

During the Lesson

1. Set up four learning centers with a variety of testable materials. Two centers will test hardness and the other two will test strength. (Ensure that some of the materials at both stations are the same, so that students can see that things which are strong can also be soft. They can also see that materials which are hard can also be weak. **[SP-2 Developing and using models]**

2. Students take the pretest - Type I as mentioned above in their journals.

3. Discuss the academic vocabulary.

4. Explain to the students that they may test hard or soft, strong or not strong in a variety of ways. Brainstorm some ways to test hardness such as:
    a. Can you bend the material?
    b. If you press on it does it change shape?

    And some ways to test strength:
    a. Can you cut the material?
    b. Can you rip the material?
    c. Does it fall apart or break if you put too much weight on it?

Students should make a checklist of ways to test hardness and strength as a guide for the activity.

5. We will classify each material and give evidence to justify their classifications in the tables.

Lesson Closing

Each group will present their findings. The teacher will record on the large class chart (Save chart for next lesson).
[SP-8 Obtaining, evaluating, and communicating information]

Assessment

Post Test - Type II

- Part A - Name one material that is hard and tell how you know it is hard.
- Part B - Name one material that is strong and explain how you know you know it is strong.
- Part C - Name a material that is either strong or hard, but not both, and explain why that material has only one characteristic and not the other.

Lesson 5: Informational Report about the Properties of Hardness or Strength

(To be taught by the Classroom Teacher)

BACKGROUND

Overview of the Lesson

This will be a writing lesson for English Language Arts, and it will show the students' understanding of the properties of strength and hardness. The main point of the lesson is to construct a scientific argument using evidence. **[SP-7 Engaging in argument from evidence]**

Focus Standard

W.2.2. Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section. (2-PS1-4)

Learning Targets

I can write an informational/explanatory text.
I can introduce a topic, using facts and definitions to develop points.
I can provide a concluding statement or section.

Assessment

The assignment is the assessment.

WIDA Language Objectives

Level 1-2: Construct an informative text using sentence frames and a word bank

Level 3-4: Write an informative text using sentence starters

Targeted Academic Language

Tier 2: informational, explanatory, text

RESOURCES AND MATERIALS

Quantity	Item	Source
Class Set	Science Journals	Classroom Teacher
	The class chart for hardness	Classroom Teacher
	The class chart for strength	Classroom Teacher
	A list of report requirements on chart paper or on the board	Classroom Teacher

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

This assignment is the assessment.

Prompt: Yesterday, we experimented with materials to determine if they were hard or soft and strong or not strong. Today you will write an informational report to tell others what you learned from our experiment.

During the Lesson

1. The teacher states and writes on the board or chart paper the lessons expectations:
   a. You may choose one material to write about in your report.

b. You need to make a web to organize your report. The teacher should draw an example of a web on the whiteboard if students are unsure how to create one.
c. You may look at the class charts for ideas about strength or hardness for your webs.
d. Students will be allowed to research facts about their material's strength and hardness for the report. The teacher will provide students with a worksheet as a guide of what kind of facts they should include.
e. After you have completed your web, you will write your rough draft for your report.
f. You need a topic sentence that tells the name of the material you are writing about and whether it is hard or soft and strong or not strong. A sentence frame the teacher could provide is "My report is about 'insert material' which is hard/soft and strong/not strong".
g. You need to write three or more sentences proving why the material is hard/soft and strong/not strong.
h. You need a concluding sentence about this report.

2. The teacher may decide to take another day for proofreading and editing with individual students. The teacher should provide a checklist for students.

Checklist for proofreading:

Uses the word hard or soft and strong or not strong.
Writes in complete sentences.

Checklist for editing:

Capitalizes the first letter in each sentence.
Uses punctuation.

3. If desired, the teacher may have the students "publish" (write the final draft of the report) on the next day to be displayed.

Lesson Closing

Students will illustrate and label the material. Then, they will describe its properties of strength and hardness. This can be done in the science journal. There is also the option to "publish" the report by typing it up or to write it on white construction paper, so it can be displayed. **[SP-8 Obtaining, evaluating, and communicating information]**

Assessment

The assignment is the assessment.

Lesson 6: Classify by Texture

BACKGROUND

Overview of the Lesson

Students will work with a partner, moving around the room to explore various materials as listed on their data papers. By observation and touch, they will write down the texture properties for materials.

Focus Standard

2-PS1-1. Describe and classify different kinds of materials by observable properties of color, flexibility, hardness, texture, and absorbency.

Learning Target

I can classify objects by texture, using observation and touch. **[SP-4 Analyzing and interpreting data]**

Assessment

Post Test - Type II

- Part A - What is texture?
- Part B - Write one material and describe its texture.

Targeted Academic Language

Tier 1: smooth, rough, and other texture words as desired
Tier 2: classify
Tier 3: texture

RESOURCES AND MATERIALS

Quantity	Item	Source
	Science Journals	Classroom Teacher
	Pencils	Classroom Teacher
1 per student	Clipboards	Classroom Teacher
1 per group	Xeroxed numbered list of materials around the classroom to be examined	Classroom Teacher
1	A list of texture words on a large chart at the board	Classroom Teacher
	Blank large chart paper	Classroom Teacher
As needed	Markers	Classroom Teacher
1	Paper bag	Bin
1 per student	Classify by Texture Worksheet	Binder (Classroom Teacher to copy)
	Small materials for students to feel, describe, and show the material to the class such as: Bin: buttons, cardboard, plastic wrap, cotton balls, sandpaper, sponges, scissors, rubber toys.	**Classroom Teacher and Bin**

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

Place one item from the materials collection in the paper bag. Invite a student to touch the material inside the bag and describe it. [Optional: the class may guess what the material is based on the description]. Then, the student shows the material to the class. Repeat several times with different student volunteers.

During the Lesson

Split up the students in groups of 2-3. Give each student a clipboard with the classify by texture worksheet and a pencil. Set up stations around the classroom with different textured objects, making sure the objects are labeled. Tell the students they will be going around the room to find each object. They should look at and touch each object. Next, they should record one or more texture properties for each object. Students may refer to the list of texture words displayed on the board. Assign each group a different number on the list, so they are all at different objects. Remind students to take turns recording their data. When all groups have finished, have each group present their findings to the class. **[SP-8 Obtaining, evaluating, and communicating information]**.

(Science Talk: Class Discussion): Then, the teacher should bring the class outside and have students identify the textures of objects they find in nature. Afterwards, the teacher will record the data on a large class chart. The teacher should then guide a discussion which focuses on comparing and contrasting the textures of objects found in the classroom and outside.

Lesson Closing

Post Test - Type II

- Part A - What is texture?
- Part B - Write one object and describe its texture.

Assessment

Post Test - Type II

- Part A - What is texture?
- Part B - Write one object and describe its texture

Lesson 7: What Materials Absorb Liquid?

BACKGROUND

Overview of the Lesson

Students will work together in groups using an eyedropper to put drops of thinned watercolor paint on different materials. Then, they will record whether the material is absorbent or not. They will also pour water onto each material without using the eyedropper to test for absorbency. **Note:** Make sure to coordinate the setup of the lesson with the classroom teacher. This lesson requires the use of stations which will take some time to create.

Focus Standard

2-PS1-1. Describe and classify different kinds of materials by observable properties of color, strength, flexibility, hardness, texture, and absorbency.

Learning Target

I can describe and classify objects by their absorbency through testing.

Assessment

Post Test - Type II

- Part A - What does absorbency mean?
- Part B - Name one material that is very absorbent. How do you know this? **[SP-7 Engaging in argument from evidence]**

Targeted Academic Language

Tier 3: absorbency, absorb, absorbent, nonabsorbent

RESOURCES AND MATERIALS

Quantity	Item	Source
Class Set	Science Journals	Classroom Teacher
4	**Containers to catch the liquids**	**Bin**
1 per student	Table worksheets or blank paper for students to make tables and record their observations	Classroom Teacher
1	Large chart paper with markers	Classroom Teacher
4	**Cups (to be filled with water)**	**Bin**
4	**Cups of paint thinned with water**	**Bin**
4	**Plastic eye droppers**	**Bin**
1 per student	What Materials Absorb Liquid Worksheet	Binder

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

Pretest - Type I - What do you think absorbency means? Students will write their answers in their science journals. Ask for a student volunteer to come to the front of the class. Ask the student to put his/her hand over the plastic container. The teacher pours a little water over the student's hand. Ask the student what happened? Ask: Did you get wet? Why? Did the water run off your hand? Why? Did the water go into your skin? Why or why not?

During the Lesson

1. Ask students to explain the rules for group work. Students need to work cooperatively, take turns, discuss what they are doing, record their data, and use inside voices. They need to be prepared to present their data to the class at the end of the lesson. **[SP-8 Obtaining, evaluating, and communicating information]**.

2. Tell students that we are going to do an investigation with water and paint to find out which materials are absorbent, and which are not.
    a. Discuss the vocabulary:
        i. absorbency, absorb, absorbent, and nonabsorbent.
    b. Have students write down the definitions and examples of the vocabulary words.

3. **Absorbency centers:** Set up four centers with assorted materials to test absorbency (this will take about 5 to 10 minutes). Make sure the cups have water, the paint has been thinned with water, and the materials are properly distributed amongst the stations. Students will use eye droppers, water, and thinned watercolor paint to test materials. Tell the students that they will take turns putting the eyedropper in the thinned paint. Then, they will squeeze the eyedropper onto the material. The teacher should demonstrate how to use the eyedropper with the thinned watercolor paint. They should do all of the experiments over a container to catch the liquid. Students should also try to pour a little of the plain water onto each material. Give each student the *Do Materials Absorb Liquid worksheet* to record the materials and if they are absorbent/nonabsorbent. Any other observations such as "very absorbent" or "just a little absorbent" should also be recorded.

Lesson Closing

At the end, each group will present their findings to the class, and the teacher will record the data on a large class chart.

Assessment

Post Test - Type II

- Part A -What does absorbency mean?
- Part B - Name one material that is very absorbent. How do you know this?

Teach To Learn
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Lesson 8: Breaking Materials Apart (Large to Small)

BACKGROUND

Overview of the Lesson

Students will cut and/or rip a variety of materials to determine that the properties of the materials do not change when taken apart. There should be a lot of discussion among the students to provide evidence. Each group will record their data and present it to the class.

Focus Standard

2-PS1-3. Analyze a variety of evidence to conclude that when a chunk of material is cut or broken into pieces, each piece is still the same material and, however small each piece is, it has weight. Show that the material properties of a small set of pieces do not change when the pieces are used to build larger objects. **Clarification Statement:** Materials should be pure substances or microscopic mixtures that appear contiguous at observable scales. Examples of pieces could include blocks, building bricks, and other assorted small objects.

Learning Target

I can show and explain that when a large piece of material is cut into smaller pieces, it is still the same material.

Assessment

Post Test - Type II

- Part A - If you cut any material into smaller pieces, will it still be the same material?

Student Thinking Alert

Students may struggle with the concept of "weight." Students often believe that objects only have weight if they can feel the weight. For example, eraser shavings, no matter how small they may be, have weight. Very light objects, like cotton balls or feathers, have weight even though the students may not be able to feel the weight. This is something to be prepared for, and

- Part B - Explain why or why not. **[SP-7 Engaging in argument from evidence]**

WIDA Language Objectives

(Dependent on the needs of your ELL students)

Targeted Academic Language

Tier 2: evidence
Tier 3: weight, properties

RESOURCES AND MATERIALS

Quantity	Item	Source
4	Pieces of 9" x 12" colored construction paper	Classroom Teacher
1 box	Plastic straws	Bin
4	**Containers of Play-Doh**	**Bin**
4	**Masking tape**	**Bin**
1 bag	Twizzlers	Bin
1 box	**Plastic knives**	**Bin**
As needed	Pairs of scissors	Classroom Teacher
	Large chart paper and markers	Classroom Teacher
	Science Journals	Classroom Teacher
1 per student	Breaking Materials Apart Worksheet	Binder

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

1. Pretest - Type I - If you cut a piece of paper into little pieces, will it still be the same material? Why or why not? Students write their answers in their science journals.
2. Today you will be able to eat one of our science materials at the end of this lesson. Our lesson is about starting with something large or whole and cutting it into smaller pieces.

During the Lesson

1. **Breaking centers:** Set up four centers, each with the materials mentioned above, except the Twizzlers.
2. Give each student a *Breaking Materials Apart Worksheet*
3. Show students the Twizzlers and tell them the one at each center is not to eat, but everyone will get a Twizzler at the end of the lesson. Then put one Twizzler at each center.
4. Give pretest as mentioned above.
5. The teacher will assign or let students choose which center to go to.
6. Each student cuts one of the materials.
7. The group discusses and records observations about each material and writes evidence as to whether the material is still the same or not. **[SP-3 Planning and carrying out investigations]**
8.  Guiding questions could be: Does the object look different or the same compared to when we started? Why or why not? Do the properties of he object stay the same? Students should be sure to use vocabulary terms learned from this unit, such as properties.
   Discussion points include (but are not limited to) smell, color, touch, weight [see teacher note above], etc.

Lesson Closing

Each group presents their findings, and the teacher records the data on large chart paper. You can give the students a Twizzler to enjoy. **[SP-8 Obtaining, evaluating, and communicating information]**.

Assessment

Post test - Type II

- Part A - If you cut any material into smaller pieces, will it still be the same material?
- Part B - Explain why or why not.

Lesson 9: Joining Bits Together (Small to Large)

BACKGROUND

Overview of the Lesson

Students will combine a variety of materials to determine that the properties of the individual materials do not change when put together. There should be a lot of discussion among the students to provide evidence. Each group will record their data and present to the class.

Focus Standard

2-PS1-3. Analyze a variety of evidence to conclude that when a chunk of material is cut or broken into pieces, each piece is still the same material and, however small each piece is, has weight. Show that the material properties of a small set of pieces do not change when the pieces are used to build larger objects.

Clarification Statements:

- Materials should be pure substances or microscopic mixtures that appear contiguous at observable scales.
- Examples of pieces could include blocks, building bricks, and other assorted small objects.

Learning Target

I can show and explain that materials' properties do not change when small pieces are used to build larger pieces.

Assessment

Post Test - in science journals - Type II

- If you create a big object with a bunch of small objects, do the materials keep their properties? Why or why not? Students write their answers in their science journals.

WIDA Language Objectives

(Dependent on the needs of your ELL students)

Targeted Academic Language

Tier 3: properties, configuration

RESOURCES AND MATERIALS

Quantity	Item	Source
	Materials that can be joined together (**puzzle pieces**, cut pieces of paper, **magnets**, tape, **Legos**)	Classroom Teacher/**Bin**
1 per student	Joining Bits Together Worksheet	Binder
	Science Journals	Classroom Teacher
As needed	Pencils	Classroom Teacher
	Large chart paper and marker	Classroom Teacher

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

Pretest - Type I

-  If you create a big object with a bunch of small objects, does the material keep its properties? Why or why not? Students write their answers in their science journals. Turn and talk to a classmate about what your hypothesis/prediction is, being sure to use vocabulary terms such as properties.
- Today you will get to build something with our materials. You may create whatever you want!

During the Lesson

1. Set up four centers, each with the materials mentioned above. **[SP-2 Developing and using models]** Give each student at *Joining Bits Together Worksheet*. Give pretest as mentioned above. Tell the students they will need to think about all the ways we have classified materials by their properties to do this lesson. (We classified by states of matter, color, strength, hardness, texture, and absorbency.)
    a. Each group will have enough Legos for the students to build something. Let the students take five minutes to build anything they want with the Legos, and emphasize that they need to use all of the cubes.
    Note: It is important to make sure the students understand how to work in groups, and emphasize that this is a collaborative effort that requires everyone to do their part.
    b. At the end, tell the groups the stop and bring them together for a discussion.
    c. Have the students walk around and see what the other groups have created.
    d. Ask the students “what did you notice about the creations around the room?"
    e. Introduce the idea that everyone created something different with the same materials, and bring the students to the conclusion that small things can be combined to create bigger things that retain the same properties.

Lesson Closing

Post Test - in science journals - Type II

- If you create a big object with a bunch of small objects, does the material keep its properties? Why or why not? Students write their answers in their science journals.

Assessment

Post Test - in science journals - Type II

- If you create a big object with a bunch of small objects, does the material keep its properties? Why or why not? Students write their answers in their science journals.

Lesson 10: Changing States of Matter by Heating and Cooling

BACKGROUND

Overview of the Lesson

This will be a four-day whole class lesson. Students will do an experiment to see what happens when two bottles of water are put into the freezer, then put on the school vent/heater with the cover on the bottles the next day, and, finally, on the last day, put on the heater without covers on the bottles. Students will fill the bottles with water on the first day and take measurements every day to document what is happening to the water. Students will see that water can be changed to ice and then be reversed back to water. They will also see that water can change into a gas.

Focus Standard

2-PS1-4. Construct an argument with evidence that some changes to materials caused by heating or cooling can be reversed and some cannot.

Clarification Statements:

- Examples of reversible changes could include materials such as water and butter at different temperatures.
- Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and burning paper.

Learning Target

I can construct an argument with evidence that some changes are REVERSIBLE, such as when water is heated or cooled. **[SP-Engaging in argument from evidence.**

Assessment

Post Test - Type II

- Part A - What can we change water into?
- Part B - Can we reverse that change? Explain why or why not.

WIDA Language Objectives

(Dependent on the needs of your ELL students)

Targeted Academic Language

Tier 1: cool(ing), heat(ing)

Tier 2: evidence, argument

Tier 3: reverse, reversible

RESOURCES AND MATERIALS

Quantity	Item	Source
	Science Journals	Classroom Teacher
As needed	Pencils	Classroom Teacher
2	**Transparent plastic water bottles**	**Bin**
1	**Measuring cup**	**Bin**
1	**Black Sharpie**	**Bin**
1	**Red Sharpie**	**Bin**
1	**Green Sharpie**	**Bin**
1	**Blue Sharpie**	**Bin**
1 roll	**Masking tape**	**Bin**

	School freezer	Classroom Teacher
	School heater/air vent	Classroom Teacher
1 per student	*What Can We Change Water Into Worksheet*	Binder

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

Pretest - Type I - What can we change water into? Students write their answers in their science journals.
Discuss what students think water can change into. Tell students this experiment will take four days to complete!

During the Lesson

The teacher should explain what an irreversible and reversible change is and encourage students to try to share out examples of what they think could be a good representation of either. This conversation should be segued into properties of water, and whether or not they think changing water into different states of matter is an irreversible or reversible change. This will be a whole class lesson for each of the four days. Give each student a copy of the *What Can We Change Water Into Worksheet* to complete over the course of the lesson.

Sentence starters/ frames for students during discussion:

- I believe that _____ is a reversible/irreversible change because _____.
- An example of a reversible/irreversible change is _____.

Day 1 - Have student volunteers come to the front of the room. Choose a different student for each task.

a. Have one student get 8oz of water from the sink in a measuring cup.
b. Have one student hold one of the plastic bottles on a table while another student pours the water into the bottle.
c. A student puts the cover on the bottle.
d. A student marks the bottle with a black Sharpie at the top of the water level.
e. A student writes the teacher's name on the masking tape and tapes it to the bottle.
f. A student measures the water level from the bottom of the bottle to the black line in inches and records on the class
g. recording sheet or the teacher could record the measurements.
h. Another student does the same, but measures in centimeters.
i. Repeat steps 1-7 using the other water bottle.
j. The whole class takes a "field trip" to the cafeteria to put the two bottles of water in the freezer until the next day.
k. Ask students to predict in their science journals what they think the water level will look like the next day.

Day 2 - No pretest because this is a continuation of Day 1's lesson

a. The whole class takes a "field trip" to the cafeteria to get the two water bottles and bring them back to the classroom. Choose different students to assist today.
b. Ask the class what they see about the two bottles, and the teacher records observations on the class chart.
c. Have a student use the red Sharpie and make a line at the top of the ice level.
d. Have a student measure in inches from the bottom of the bottle to the red line and record the measurement on the recording sheet.
e. Have a student do the same, but measure in centimeters.
f. Repeat steps 1-6 with the other bottle.
g. Discuss the results and ask why questions while the teacher records on the class chart.
h. Put both bottles on the class heater until tomorrow. Keep the covers on the bottles.

i. Ask students to record in their science journals what they think the water levels in the bottles the next day will look like.

Post Test - Type II

- Part A - What happened to the water in the two bottles?
- Part B- Tell me one fact we learned today.

Day 3 - Again choose different students to assist.

a. Take the two bottles off the heater and bring them to the front of the room.
b. Discuss what they see, ask them if anyone guessed write in their hypothesis from the day before while the teacher records on the class chart.
c. Repeat the measurement and recording as done on Days 1 and 2. Use a green Sharpie.
d. Remove the two bottle covers and place the two bottles on the classroom heater.
e. Ask students to make a prediction in their science journals of what the water level will look like the next day.

Day 4 - Different students assist.

a. Take the two bottles off the heater and bring them to the front of the room.
b. Discuss what they see, and the teacher records on the class chart.
c. Ask: Where did the water go? Gather student ideas and see what evidence they may have to support those ideas. Can discuss evaporation.
d. The water _____ because of _____.
e. I predict that the water _____.
f. Repeat the measurement and recording as done on Days 1, 2, and 3. Use a blue Sharpie.

g. Discuss what was done and what was learned during the four- day experiment, and record on the class chart. Discuss the predictions that the students made in their journals throughout the week and see if they changed at all from day 1 to day 4.

Extension

The students could do a possible research project on days that they are just measuring by looking up different properties and videos concerning ice. Teacher should suggest websites and videos for the students to use so that there is structure to what they can look up online.

Please note

a. The next day will be a writing lesson to write an informational report **[SP-Obtaining, evaluating, and communicating info]** about what we did for this four-day lesson and what we learned from it.
b. Students will make a web about each day of the experiment, referring to the class charts.
c. Next students will write their rough draft of this informational report, using transition words to clearly express the order of how we did the experiments.
d. Students need a topic sentence, enough sentences to state in sequence the steps in our experiments, and a concluding sentence or paragraph about what we learned by doing this four-day lesson.
e. On the following day, students will edit and proofread their rough drafts with teacher support.
f. Then, either on the same day or the following day, students will "publish" their reports.

Assessment

Post Test - Type II

- Part A -What can we change water into?
- Part B- Can we reverse that change? Explain why or why not.

Lesson 11: Can We "Unchew" Gum?

***Note: This lesson may be short, so it can be combined with the next lesson if necessary.**

BACKGROUND

Overview of the Lesson

Students will learn from this lesson that some changes are irreversible. They will weigh bubble gum which contains sugar before they chew it. The thought provoking question "Can you 'un-chew' gum?" will be elaborated upon by asking the students if they think the gum will weigh the same, weigh more, or weigh less after it is chewed. Then the students will chew the gum, and we will weigh the chewed gum to find that the gum will weigh less because the sugar comes out of the gum when chewed. Therefore, this change is irreversible.

Focus Standard

2-PS1-4. Construct an argument with evidence that some changes to materials caused by heating or cooling can be reversed and some cannot.

Clarification Statements:

- Examples of reversible changes could include materials such as water and butter at different temperatures.
- Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and burning paper.

Learning Target

I can construct an argument with evidence that some changes are IRREVERSIBLE.

Assessment

Post Test - Type II

- Can we “un-chew” gum? Why or why not?
- Are all changes reversible? Why or why not?

WIDA Language Objectives

(Dependent on the needs of your ELL students)

Targeted Academic Language

Tier 1: weigh, scale

Tier 3: irreversible

RESOURCES AND MATERIALS

Quantity	Item	Source
1	**Gram scale**	**Bin**
30	Piece of unwrapped Bazooka bubble gum (not sugar free) for every student	Bin
	Science Journals	Classroom Teacher
As needed	Pencils	Classroom Teacher
1 package	**Coffee filter**	**Bin**
	Large chart paper	Classroom Teacher
As needed	Markers	Classroom Teacher
1	**Timer**	**Bin**

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

Pretest - Type I –

- Can we "un-chew" gum? Don't tell me out loud. Write what you think in your journal.
- Do you think the gum will weigh more, less, or the same after we chew it? We are going to do an experiment to find the answers to these questions!

Student Thinking Alert

Students will most likely think that the gum will weigh more, thinking that their saliva will add a significant amount of weight to the gum, when in fact it will weigh less because of the sugar that is extracted from the gum when chewed and dissolved in the mouths of the students.

During the Lesson

This is a whole class lesson. (Gum chewing weight experiment)

1. Choose students to assist at the front of the room.
2. Put one coffee filter on the gram scale.
3. Put the total number of pieces of unwrapped gum in the coffee filter.
4. Using a gram scale, weigh the gum. Ask students to predict what they think the weight of the gum is going to be. Record actual weight on the class chart.
5. Give each student a piece of gum.
6. Set the timer for five minutes.
7. Students chew the gum until the timer goes off.
8. Discuss what they think might be the results while they are chewing the gum. Have them talk in a group at their table or with a partner they are sitting next to as to what they think the results will be for the weight of the gum.
   a. I predict the gum will weigh _____ because _____.
   b. The weight of the gum is going to change/ stay the same because _____.

9. After five minutes, have each student come to the scale and carefully spit the gum into the coffee filter.
10. Weigh the gum using whichever method you originally used.
11. Record the results on the chart.
12. Discuss what happened and why it happened (the gum should weigh less because the sugar in the gum comes out when chewed.) Make sure to emphasize the point that the sugar in the gum has been dissolved and digested by the students, and so the gum cannot be "un-chewed." It is an irreversible change.
13. Record conclusions on the class chart.

Lesson Closing

Post Test - Type II –

- Can we "un-chew" gum? Why or why not?
- Are all changes reversible? Why or why not?

Assessment

Post Test - Type II

- Can we "un-chew" gum? Why or why not?
- Are all changes reversible? Why or why not?

Lesson 12: Friction & Temperature

BACKGROUND

Overview of the Lesson

Through observation and experimentation of various surfaces and materials, students will be able to use previous knowledge gained on material properties to examine the relationship between friction and temperature, through the rubbing of an object on multiple surfaces. Students will also be able to see how different surfaces and materials can be used if the temperature or friction needs to be controlled.

Focus Standard

2-PS3-1(MA). Design and conduct an experiment to show the effects of friction on the relative temperature and speed of objects that rub against each other.

Clarification Statements:

- Examples could include an object sliding on rough vs. smooth surfaces.
- Observations of temperature and speed should be qualitative.

Learning Target

I can design and conduct an experiment to show the effects of friction on the relative temperature and speed of objects that rub against each other.

Assessment

Post Test-Type II

The first question will be a simple choice of warmer or cooler. When friction increases does the temperature get warmer or cooler? Write one way you can increase friction when you rub an object against a surface.

WIDA Language Objectives

(Dependent on the needs of your ELL students)

Targeted Academic Language

Tier 1: temperature, surface

Tier 3: friction, resistance, force

RESOURCES AND MATERIALS

Quantity	Item	Source
	Science Journals	Classroom Teacher
	Pencils	Classroom Teacher
4	Data tables	Classroom Teacher
4	**Felt squares**	**Bin**
4	**Pieces of sandpaper**	**Bin**
4	**Carpet samples**	**Bin**
4	Blocks	Classroom Teacher

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

Science Fellows or Classroom Teacher asks students to hold up their hands and tells them they are going to rub the palms of their hands together. Science Fellows or Classroom Teacher demonstrates by putting up their hands and rubbing the palms together. "What is happening?" "Now push the palms of your hands together and rub harder?" What has changed?" "You will find out during the science lesson today about friction."

During the Lesson

Friction demonstration:

1. Teacher writes friction on the board and explains that friction is a force that holds back the movement of a sliding object. When the palms of your hands are rubbed together they create heat. This is caused by the resistance of your hands when moving. If more pressure is applied, then the temperature will increase. The students' observations should be that of warmth and more pressure will create more heat.

2. Ask the students to reflect on the activator and what they think will happen the more they rub their hands together. The expected response should be the harder they press their hands together or the faster the rub their hands together, the temperature will change accordingly.

Friction investigation:

1. Students will then be broken up into groups to investigate their findings more. **[SP-3 Planning and carrying out investigations]** Once broken up into groups assigned by the teacher, the students will then explore the temperature change as a result of friction by using a block and various materials to rub it against. Each group will get a station with the felt squares, sandpaper pieces, carpet tiles, and blocks. There will also be enough data tables at each station for all the students.

2. Each of these groups will then take 10-20 minutes and experiment with the surfaces and the block. They should be taking time to rub the block against each surface multiple times slow, fast, softly, harder. The students will also record their finding in the data table. The goal is for the students to work together, help each other and maybe even think of ways to use their surfaces later on.

Friction presentation:
After the 15-20 minutes is up have the groups come back together as a whole class. Have a student from each group present their findings to the class. Ask the students which material they thought caused the most friction and which setup caused the most heat (if not already stated in presentations to the class).

Teaching Tip
Write on the board the topics you want the students to hit during their presentation to keep them on target.

Extension
The students could access the internet in this lesson either as a whole group with the teacher or independently to find videos and examples of friction being used to generate heat. Examples of these would be videos of car tires spinning out or fire being made by the rubbing of sticks.

Assessment

Post Test-Type II
The first question will be a simple choice of warmer or cooler. When friction increases does the temperature get warmer or cooler?
Write one way you can increase friction when you rub an object against a surface.

Lesson 13: Friction and Speed

BACKGROUND

Overview of the Lesson

Through observation and experimentation, and drawing on their previous learning, students will understand how different surfaces and angles of materials can control speed or friction. To explore this relationship between friction and speed, the students will roll a toy car on a range of flat and inclined surfaces.

Focus Standard(s)

2-PS3-1(MA). Design and conduct an experiment to show the effects of friction on the relative temperature and speed of objects that rub against each other.

Clarification Statements:

- Examples could include an object sliding on rough vs. smooth surfaces.
- Observations of temperature and speed should be qualitative.

2.K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same design problem to compare the strengths and weaknesses of how each object performs. *

Clarification Statements:

- Data can include observations and be either qualitative or quantitative.
- Examples can include how different objects insulate cold water or how different types of grocery bags perform.

(Old Standard) PS-4. Demonstrate that the way to change the motion of an object is to apply a force (give it a push or a pull). The greater the force, the greater the change in the motion of the object**.**

Learning Targets

I can observe how speed and friction are related through rubbing of objects.
I can state the relationship between friction and speed.
I can design a demonstration to show the relationship between friction and speed.
I can demonstrate that speed is different when a toy car is rolled down a smooth ramp vs. a rough ramp.

Assessment

Post Test - Type II

- Write which material made the toy car go faster.
- Explain why that material made the toy car go faster.

WIDA Language Objectives

(Dependent on the needs of your ELL students)

Targeted Academic Language

Tier 1: speed, flat
Tier 2: analyze, data,
Tier 3: friction, resistance, incline

RESOURCES AND MATERIALS

Quantity	Item	Source
	Science Journals	Classroom Teacher
4	Templates for data	Classroom Teacher
4	Sheets of construction paper	Classroom Teacher
4	**12" long pieces of felt**	**Bin**
4	**12" long pieces of sandpaper**	**Bin**
4	**Measuring tape**	**Bin**
4	**3" three ring binders**	**Bin**
4	**Toy cars**	**Bin**

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

The activator will start off this lesson with a discussion question on what happens when a ball is rolled. Then ask: what if it is rolled down a hill? As these questions are being asked, the Science Fellows or Classroom Teacher will demonstrate a ball rolled on the desk, and after discussion it will then be rolled down an inclined surface (to simulate a hill). Then the discussion includes observations such as change of speed. "Today Boys and Girls we will be looking at friction and speed using race cars!"

During the Lesson

Note: All these parts can and should be performed outside if weather permits.

Part A

After the initial discussion, which is like a brainstorming session, the students will then participate and observe what happens when a toy car is pushed on various materials **[SP-2 Developing and using models].** The teacher will then break the students into groups for them to experiment with the concepts shown in the activator. Each group will have construction paper, felt, sandpaper, a toy car, a large three ring binder, and a measuring inch scale. Students will also be given a data template to use.

Part B

Flat Movement investigation: The groups will then experiment with the materials to determine the better one for the toy car to roll on. They should start by placing the materials on the flat surface of a tabletop or pavement. The students should gently push the car on the surfaces. The students will also be able to measure how far the toy car rolls on each surface in a flat setting and record their data. They should notice the felt has the most resistance and is the hardest for the toy car to move on. On the other hand, the construction paper should be the smoothest and easiest for the toy car to move on.

Teaching Tip

Make sure to demonstrate how to measure the distance traveled for the students before they start this process. Measuring can be a difficult skill!

Part C

Inclined movement investigation: Next the groups will try to relate the ball rolling down a hill to the toy car. They will use the binder as an incline to place the sandpaper, felt, and construction paper on; if outside and there is an incline such as a hill then the test can be performed on this as well. The students should now repeat the tests from the flat surface on this new inclined surface. The toy car will be placed on the top of the incline, observing whether the car is stuck or moved without a push. If it doesn't move, the students can give it a gentle push. There will be a data table for this set of tests as well and the

students should record their data for the three materials on the incline before ending this experiment. Measuring the distance will only come into play if the toy car does not go all the way down the incline.

Part D:

The class now comes back together as a whole and is asked what they observed, providing evidence for which material caused the most friction. **[SP-7 Engaging in argument from evidence]** Students should answer using the vocabulary they have learned in the unit.

a. I have found that (name of material) caused the most friction because____.
b. (Material) caused the least amount of friction because _____.

Lesson Closing

Post Test - Type II -

Part A - Write which material made the toy car go faster.

Part B - Explain why that material made the toy car go faster.

The exit ticket is that the students should be able to see the less friction there is the higher the speed. So if friction goes down, speed goes up.

Assessment

Post Test - Type II -

Part A - Write which material made the toy car go faster.

Part B - Explain why that material made the toy car go faster.

Lesson 14: The Way Things Move

BACKGROUND

Overview of the Lesson

This lesson will serve as a review of directional motion and force. The students will engage in different activities that represent the different directions motion can take. Through this lesson, students will better understand how and why things move the way they do. They will then apply this information to future lessons and experiments. This lesson has been adapted from the Minnesota Science Teachers Education Project.

Focus Standard

(Old Standard) PS-4 Demonstrate that the way to change the motion of an object is to apply a force (give it a push or a pull). The greater the force, the greater the change in the motion of the object.

Learning Targets

I can describe the motion of objects.
I can collect evidence to describe motion.
I can demonstrate that motion is affected by a push or a pull, and different amounts of fource can cause different changes.

Assessment

Post Test - Type II -
Students will list in their journal two forces that move the truck and write at least one sentence telling about what they learned from the activity. **[SP-Constructing explanations]**

WIDA Language Objectives

(Dependent on the needs of your ELL students)

Targeted Academic Language

Tier 1: push, pull

Tier 2: describe, direction

Tier 3: motion, force

RESOURCES AND MATERIALS

Quantity	Item	Source
	Science Journals	Classroom Teacher
1	***"And Everyone Shouted, "Pull!": A first Look at Forces and Motion"* by Claire Llewellyn**	**Bin**
4	**Toy Truck**	**Bin**
4	**Rubber band**	**Bin**
4	Rulers	Classroom Teacher
4	Blocks	Classroom Teacher
4	**Cardboard tube**	**Bin**
4	A few thick books	Classroom Teacher
4	**Small ball**	**Bin**

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

Introduce lesson by reading "And Everyone Shouted, 'Pull!'": A First Look at Forces and Motion by Claire Llewellyn, Picture Window Books, 2005. Ask why the cart is not floating in the air. Use the students' answers to help explain that a force is pulling the cart down. Ask what forces were used in the book when the cart moved (push and pull). Remind students that a force was needed in order for the cart to move. Discuss that it also took a force to change the cart's direction.

During the Lesson

This lesson should begin with a demonstration of the experiment, so the students have an idea of what to do when it is their turn.

1. Begin the activity by demonstrating the concept of a “pull” (pull activity)
   a. Have the students break up into four stations and make sure each station has a toy truck, a rubber band, a ruler, toy blocks, a cardboard tube, a few thick books, and a small ball.
   b. Have the students attach a rubber band to the front bumper of the toy truck. Place a ruler on the floor beside and in front of the truck.
   c. Pull the rubber band until the truck starts to move. Note how far the rubber band has stretched.
   d. Repeat the activity this time adding blocks (weight) to the truck. Compare the length the rubber band stretches and help the students conclude that heavier objects need more force to start them moving.
2. Continue the activity by exploring the concept of a “push” (push activity)
   a. Place one end of a cardboard tube (inside of a paper towel roll, preferably) on a stack of thick books, creating a ramp **[SP-2 Developing and using Models]**. Place the back of the toy truck at the lower end of the tube.
   b. Put a ruler on the floor beside and in front of the truck. Roll a small ball down the tube so it hits the truck. Note how far the truck moves.

c. Repeat the activity, this time adding blocks (weight) to the truck. Compare the distances and help the students conclude that if the pushing force is the same, the weight of the truck is what is changing the distance it will travel.

3. Conclude the activity with the assessment that follows.

Lesson Closing

Post Test - Type II -

Students will list in their journal two forces that move the truck and write at least one sentence telling about what they learned from the activity.

Assessment

Post Test - Type II

Students will list in their journal two forces that move the truck and write at least one sentence telling about what they learned from the activity.

Lesson 15: The Great Friction Strike Out

BACKGROUND

Overview of the Lesson

This lesson is built on the students' previous knowledge of friction, materials, and physical properties. Through designing and experimenting with various surfaces on spheres, students will be able to design a bowling alley lane using the relationship between friction and speed, and friction and temperature. Students will also be able to see how design choices can impact the results.

Focus Standard(s)

2-PS3-1(MA). Design and conduct an experiment to show the effects of friction on the relative temperature and speed of objects that rub against each other.

Clarification Statements:

- Examples could include an object sliding on rough vs. smooth surfaces.
- Observations of temperature and speed should be qualitative.

2.K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same design problem to compare the strengths and weaknesses of how each object performs. *

Clarification Statements:

- Data can include observations and be either qualitative or quantitative.
- Examples can include how different objects insulate cold water or how different types of grocery bags perform.

(Old standard) PS-4. Demonstrate that the way to change the motion of an object is to apply a force (give it a push or a pull). The greater the force, the greater the change in the motion of the object

Learning Targets

I can design and conduct an experiment to show the effects of friction on the relative temperature and speed of objects that rub against each other.

I can analyze data from tests of two objects designed to solve the same design problem to compare the strengths and weaknesses of how each object performs.

Assessment

Have each student complete the *Great Friction Strike Out Conclusions Worksheet.*

WIDA Language Objectives

(Dependent on the needs of your ELL students)

Targeted Academic Language

Tier 2: design, examine, observe, compare, and contrast

RESOURCES AND MATERIALS

Quantity	Item	Source
	Science Journals	Classroom Teacher
As needed	Pencils	Classroom Teacher
	Blocks	Classroom Teacher
1 per student	Bowling Score Sheet	Binder (Classroom Teacher to copy)
1 per student	Bowling Challenge Recording Sheet for Lane and Ball Materials (3 sheets)	Binder (Classroom

		Teacher to copy)
1 per student	Great Friction Strike Out Conclusions Worksheet	Binder (Classroom Teacher to copy)
1	**Marble**	**Bin**
4	**12" long felt pieces**	**Bin**
4	**12" long sandpaper**	**Bin**
4	**12" long cardboard**	**Bin**
4	**Carpet tiles**	**Bin**
1	1 "bowling lane": this will be a long cardboard box with the top and one short side cut off to simulate a bowling lane with bumpers	Classroom Teacher to make prior to the lesson

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

Pose the design challenge to students that they will get the use their knowledge of friction and material properties to design a game of bowling.

During the Lesson

Before the lesson begins, have a quick review of the previous lessons on friction with both temperature and speed. See what the students may reflect on either one. The goal is that they the less friction the greater the speed, and that greater friction results in higher temperature. Given these already known concepts the students should be able to understand and perform the task at hand. The task is to choose the best material for the lane and the best ball to suit the challenge of a game of bowling.

Part A Choosing materials

Start by breaking the students into four groups. Each group will work together to choose the material and ball that they want to use for their bowling game. Each group will then be given a set of materials, consisting of the flat and round materials, to examine. Give each student a bowling score sheet to record their data. This may include looking at texture, thickness, hardness, and/or strength, as well as any other properties from previous lessons. The goal is for the groups to pick the materials, surface and ball that have the least amount of friction between each other such that the ball makes it to the end of our mock bowling alley lane. **[SP-2 Developing and using models]**

Part B Using materials

After the students have had time to examine the materials, the class will come back together as a group and turn their attention to a center table. At the center table there the teacher will have set up the mock bowling lane made of cardboard for the groups to test the materials they chose. The teacher will place a set of small blocks at end of mock lane to simulate pins. Then each group, one at a time, will then go up and test their selected lane surface material and ball by bowling. Each group can tell the class why they chose that material combination as they do their test. They should use vocabulary words that they have learned in their unit so far in their explanation of why they chose the materials to the class. Students then will record their data followed by the next group going until all groups have gone.

Sentence Starters for Activity Description:

1. We chose _____ for our material because_____.
2. We believe that (name of material)causes (less/more) friction because _____.

Lesson Closing

Type II –

Write one way you could have improved the choices you made for the surface and ball materials.

Assessment

Have each student complete the *Great Friction Strike Out Conclusions Worksheet.*

Curriculum Embedded Performance Assessment (CEPA)

The Umbrella Design Challenge You work at an umbrella factory and have been asked to select a new material to use to make your umbrellas. From the different choices you can select three materials to test out to decide which is best.

You must design a demonstration and prepare an explanation to convince your employer that your final recommendation is the best material with which to manufacture your umbrellas.

Task Description: Based on what students have learned through their investigations of the properties of various materials, students will experiment with a piece of overhead transparency, a square of felt, a piece of plexiglass and a coffee filter to determine which would make the best materials for an umbrella.

Materials

- Felt square
- Piece of overhead transparency
- Plexiglass squares
- Coffee filter
- Cocktail umbrella
- Eye Dropper (can be shared)
- Cups (for water)
- Recording Sheet
- Catch basin for water
- Paper towels

Instructions

The investigation can be done by individual students or in pairs.

Read "The Umbrella Design Challenge" to the students.

Distribute the cocktail umbrellas for students to examine and have the students or student pairs consider the properties of the material needed to cover the umbrella – Should it be hard or flexible, should it be rough or smooth, should it be absorbent or not? Have them complete Part 1 on their response sheets.

Then ask students to decide which three of the four available materials they will select to investigate for their suitability as an umbrella covering, and come and take pieces of each of the materials they would like to consider, as well as any "tools" (e.g. the eyedroppers or cups or catch basis or paper towels) they feel they will need to conduct their investigations.

Provide support as needed for students to utilize the reporting sheets or complete their reports. For advanced students, you could provide instructions on what their report should include rather than the scaffolded reporting template (e.g. "Your report should have an opening sentence, three detail sentences and a closing sentence").

Science Talk and Oracy in T2L Units

Science talk is much more than talking about science. In line with the science and engineering practices, students are expected to make a claim that can be supported by scientific evidence. The MA STE Standards (and the NGSS) value the importance of engaging in an argument from evidence. NGSS defines how this practice takes form in the real world: *"In science, reasoning and argument are essential for identifying the strengths and weaknesses of a line of reasoning and for finding the best explanation for a natural phenomenon. Scientists must defend their explanations, formulate evidence based on a solid foundation of data, examine their own understanding in light of the evidence and comments offered by others, and collaborate with peers in searching for the best explanation for the phenomenon being investigated."*

Students are asked to participate in articulate and sensible conversations in which they can communicate their ideas effectively, listen to others to understand, clarify and elaborate ideas, and reflect upon their understanding. These forms of talk can be developed using scaffolds such as the A/B Talk protocol (below) and strategies for class discussions (from the Talk Science Primer, link below). Oracy is developed in the physical, linguistic, cognitive, and social-emotional realms; each of these realms can be expanded upon over time in order to develop a thoughtful speaker. Being able to display appropriate body language, use proper tone and grammar, be thoughtful and considerate thinkers, and allow space for other thoughts and opinions are all important facets of oracy to work on and through with students. Incorporating the appropriate scaffolding is an important aspect of fostering these skills. Techniques for teaching effective science talk often include modeling, discussion guidelines, sentence-starters, and generating roles, while gradually putting more responsibility on students to own their thinking and learning.

Part of creating a safe school environment for students is allowing them a space that is comfortable enough for them to express ideas and ask questions, while being validated for their thoughts and questions; students should be feel comfortable and confident when speaking and listening for understanding. Effective talk is an important part of being an active, intelligent member of a community and society. Successful development in oracy is important for future employability and general well-being of adults.

The following resources should be helpful examples of how to employ effective use of progressive oracy and science talk in your classrooms.

- Oracy in the Classroom: https://www.edutopia.org/practice/oracy-classroom-strategies-effective-talk
- Science Talk Primer: https://inquiryproject.terc.edu/shared/pd/TalkScience_Primer.pdf

A/B Talk Protocol

Adapted from https://ambitiousscienceteaching.org/ab-partner-talk-protocol/

<table>
<tr>
<td>1. Share your ideas
 
Partner A
● I think _____ happened because…
● Evidence that supports my idea is…
● The activity we did with _____ helps me know more about _____ because…
● One thing I'm wondering about is…</td>
<td>2. Listen to Understand
Partner B
 
● I heard you say _____. What makes you think that?
● I heard you say _____. What if _____?
● Can you explain the part about _____ again?
● What do you mean when you say _____?</td>
</tr>
<tr>
<td>3. Clarify and elaborate
Partner A
 
Answer partner's questions or ask for clarification in order to understand a question.</td>
<td>4. Repeat steps 2 & 3 until all questions are answered
 
  </td>
</tr>
</table>

5. Switch roles and repeat steps 1-4  	6. Reflect on your understanding in writing ● My idea about _____ changed when my partner said _____. ● I will add _____ to my idea about _____ because… ● I still have questions about… ● I may be able to answer my question(s) if I could investigate _____.

List of Unit Resources

Lesson 1

Quantity	Item	Source
4	**Popsicle sticks**	**Bin**
4	Bags of starch putty (recipe is below) http://www.wikihow.com/Make-Silly-Putty	Bin
4	**Cups (to be filled with water)**	**Bin**
4	**Balloons (balloons need to be inflated)**	**Bin**
Classroom Set	Science journals	Classroom Teacher

Lesson 2

Quantity	Item	Source
1	**Big book, *What Is Matter?* by Lisa Trumbauer**	**Bin**
1	Lyrics to "Matter song" https://www.youtube.com/watch?v=kjjIS6ZaEvM	CMC Website/ Binder
Class set	Science Journals	Classroom Teacher
6	**Foss Science Reader *Solids and Liquids***	**Bin**
1	Chart paper	Classroom Teacher

Set	Markers	Classroom Teacher

Lesson 3

Quantity	Item	Source
	Science Journals	Classroom Teacher
As needed	Chart paper	Classroom Teacher
As needed	Markers	Classroom Teacher
1	***Properties, Delta Science Readers***	**Bin**

Lesson 4

Quantity	Item	Source
Class set	Science Journals	Classroom Teacher
1	"Hardness and Strength," video https://www.youtube.com/watch?v=mUkJKIaz5WQ	CMC Website
16	3" x 5" index cards for categories	Bin
1 per student	Hardness Recording Sheet	Binder (Classroom Teacher to copy)
1 per student	Strength Recording Sheet	Binder (Classroom Teacher to copy)

4	Pairs of scissors	Classroom Teacher
1	Large chart paper	Classroom Teacher
As needed	Markers	Classroom Teacher
	Various readily available materials for classifying: soft/hard, and strong/not strong such as: and not limited to: paper, felt, plastic wrap, coffee filters, tissues, feathers, wood, cardboard, stones, metal, Lincoln Logs, Cuisenaire Rods, marbles, ceramic tiles, paper towels, overhead transparency plastic papers, wax paper, metal keys, cloth, cotton balls	**Bin/Classroom Teacher**

Lesson 5

Quantity	Item	Source
Class Set	Science Journals	Classroom Teacher
	The class chart for hardness	Classroom Teacher
	The class chart for strength	Classroom Teacher
	A list of report requirements on chart paper or on the board	Classroom Teacher

Lesson 6

Quantity	Item	Source
	Science Journals	Classroom Teacher
	Pencils	Classroom Teacher
1 per student	Clipboards	Classroom Teacher
1 per group	Xeroxed numbered list of materials around the classroom to be examined	Classroom Teacher

1	A list of texture words on a large chart at the board	Classroom Teacher
	Blank large chart paper	Classroom Teacher
As needed	Markers	Classroom Teacher
1	Paper bag	Bin
1 per student	Classify by Texture Worksheet	Binder (Classroom Teacher to copy)
	Small materials for students to feel, describe, and show the material to the class such as: **Bin: buttons, cardboard, plastic wrap, cotton balls, sandpaper, sponges, scissors, rubber toys.**	**Classroom Teacher and Bin**

Lesson 7

Quantity	Item	Source
Class Set	Science Journals	Classroom Teacher
4	**Containers to catch the liquids**	**Bin**
1 per student	Table worksheets or blank paper for students to make tables and record their observations	Classroom Teacher
1	Large chart paper with markers	Classroom Teacher
4	**Cups (to be filled with water)**	**Bin**
4	**Cups of paint thinned with water**	**Bin**

4	**Plastic eye droppers**	**Bin**
1 per student	What Materials Absorb Liquid Worksheet	Binder

Lesson 8

Quantity	Item	Source
4	Pieces of 9” x 12” colored construction paper	Classroom Teacher
1 box	Plastic straws	Bin
4	**Containers of Play-Doh**	**Bin**
4	**Masking tape**	**Bin**
1 bag	Twizzlers	Bin
1 box	**Plastic knives**	**Bin**
As needed	Pairs of scissors	Classroom Teacher
	Large chart paper and markers	Classroom Teacher
	Science Journals	Classroom Teacher
1 per student	Breaking Materials Apart Worksheet	Binder

Lesson 9

Quantity	Item	Source
	Materials that can be joined together (puzzle pieces, cut pieces of paper, magnets, tape, Legos)	Classroom Teacher/Bin
1 per student	Joining Bits Together Worksheet	Binder
	Science Journals	Classroom Teacher
As needed	Pencils	Classroom Teacher

	Large chart paper and marker	Classroom Teacher

Lesson 10

Quantity	Item	Source
	Science Journals	Classroom Teacher
As needed	Pencils	Classroom Teacher
2	**Transparent plastic water bottles**	**Bin**
1	**Measuring cup**	**Bin**
1	**Black Sharpie**	**Bin**
1	**Red Sharpie**	**Bin**
1	**Green Sharpie**	**Bin**
1	**Blue Sharpie**	**Bin**
1 roll	**Masking tape**	**Bin**
	School freezer	Classroom Teacher
	School heater/air vent	Classroom Teacher
1 per student	*What Can We Change Water Into Worksheet*	Binder

Lesson 11

Quantity	Item	Source
1	**Gram scale**	**Bin**
30	Piece of unwrapped Bazooka bubble gum (not sugar free) for every student	Bin
	Science Journals	Classroom Teacher
As needed	Pencils	Classroom Teacher

1 package	**Coffee filter**	**Bin**
	Large chart paper	Classroom Teacher
As needed	Markers	Classroom Teacher
1	**Timer**	**Bin**

Lesson 12

	Science Journals	Classroom Teacher
	Pencils	Classroom Teacher
4	Data tables	Classroom Teacher
4	**Felt squares**	**Bin**
4	**Pieces of sandpaper**	**Bin**
4	**Carpet samples**	**Bin**
4	Blocks	Classroom Teacher

Lesson 13

Quantity	Item	Source
	Science Journals	Classroom Teacher
1	***"And Everyone Shouted, "Pull!": A first Look at Forces and Motion"* by Claire Llewellyn**	**Bin**
4	**Toy Truck**	**Bin**
4	**Rubber band**	**Bin**
4	Rulers	Classroom Teacher
4	Blocks	Classroom Teacher

4	**Cardboard tube**	**Bin**
4	A few thick books	Classroom Teacher
4	**Small ball**	**Bin**

Lesson 14

Quantity	Item	Source
	Science Journals	Classroom Teacher
4	Templates for data	Classroom Teacher
4	Sheets of construction paper	Classroom Teacher
4	**12" long pieces of felt**	**Bin**
4	**12" long pieces of sandpaper**	**Bin**
4	**Measuring tape**	**Bin**
4	**3" three ring binders**	**Bin**
4	**Toy cars**	**Bin**

Lesson 15

Quantity	Item	Source
	Science Journals	Classroom Teacher
As needed	Pencils	Classroom Teacher
	Blocks	Classroom Teacher
1 per student	Bowling Score Sheet	Binder (Classroom Teacher to

		copy)
1 per student	Bowling Challenge Recording Sheet for Lane and Ball Materials (3 sheets)	Binder (Classroom Teacher to copy)
1 per student	Great Friction Strike Out Conclusions Worksheet	Binder (Classroom Teacher to copy)
1	**Marble**	**Bin**
4	**12" long felt pieces**	**Bin**
4	**12" long sandpaper**	**Bin**
4	**12" long cardboard**	**Bin**
4	**Carpet tiles**	**Bin**
1	1 "bowling lane": this will be a long cardboard box with the top and one short side cut off to simulate a bowling lane with bumpers	Classroom Teacher to make prior to the lesson