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.
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CEPA
**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. |

<table>
<thead>
<tr>
<th>UNDERSTANDINGS</th>
<th>Meaning</th>
<th>ESSENTIAL QUESTIONS</th>
<th>Q</th>
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</thead>
<tbody>
<tr>
<td>Students will understand that…</td>
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<tr>
<td>● Matter can be described and classified by its observable properties.</td>
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<tr>
<td>● Different properties are suited to different purposes.</td>
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<tr>
<td>● A great variety of objects can be built up from a small set of pieces.</td>
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<tr>
<td>● Objects or samples of a substance can be weighed, and their size can be described and measured.</td>
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<tr>
<td>● Heating and cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.</td>
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</table>

<table>
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<tr>
<th>Student Learning Targets</th>
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</table>
| 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. |
Examples of pieces could include blocks, building bricks, and other assorted small 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

5. Recount or describe key ideas or details from a text read aloud.
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.
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.

<table>
<thead>
<tr>
<th>Stage 2 – Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluative Criteria</td>
</tr>
<tr>
<td><strong>CEPA:</strong> 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.</td>
</tr>
<tr>
<td><strong>Students will be presented with this scenario:</strong> 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.</td>
</tr>
</tbody>
</table>

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.
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.
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 begin to describe the properties that can vary across different materials, and begin to see their world as composed of a wide variety of materials with different properties that make them suited to different purposes.

**Lesson 2:** The first day of this lesson, the teacher will read aloud to the whole class the big 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 small student books to read aloud and discuss the text. On the same day, the teacher may choose to partner the students to reread the student books for fluency and comprehension.

**Lesson 3:** The purpose of this lesson is to give students scientific information regarding classification by properties of matter, and to expose students to informational text in a class lesson. 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 a group are placed into a group of their own. 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 recording data papers which will be clipped to their clipboards. 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, and 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: This lesson takes a while to prepare. 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.

Adapted from Massachusetts Department of Elementary and Secondary Education’s Model Curriculum Unit Template. Originally based on Understanding by Design 2.0 © 2011 Grant Wiggins and Jay McTighe. Used with Permission July 2012
## Tiered Vocabulary List

<table>
<thead>
<tr>
<th>Tier 1</th>
<th>Tier 2</th>
<th>Tier 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Material</td>
<td>Property</td>
</tr>
<tr>
<td>Air</td>
<td>Investigate</td>
<td>Matter</td>
</tr>
<tr>
<td>Wood</td>
<td>Classify</td>
<td>Solid</td>
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<tr>
<td>Flow</td>
<td>Balance</td>
<td>Liquid</td>
</tr>
<tr>
<td>Scientist</td>
<td>Informational text</td>
<td>Gas</td>
</tr>
<tr>
<td>Sense</td>
<td>Explanatory text</td>
<td>Force</td>
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<tr>
<td>Hard</td>
<td>Texture</td>
<td>State</td>
</tr>
<tr>
<td>Soft</td>
<td>Evidence</td>
<td>Magnet</td>
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<tr>
<td>Shape</td>
<td>Arguments</td>
<td>Mass</td>
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<tr>
<td>Smooth</td>
<td>Describe</td>
<td>Strength</td>
</tr>
<tr>
<td>Rough</td>
<td>Direction</td>
<td>Hardness</td>
</tr>
<tr>
<td>Cool</td>
<td>Analyze</td>
<td>Absorbency</td>
</tr>
<tr>
<td>Heat</td>
<td>Data</td>
<td>Weight</td>
</tr>
<tr>
<td>Weigh</td>
<td>Design</td>
<td>Configuration</td>
</tr>
<tr>
<td>Scale</td>
<td>Examples</td>
<td>Reverse</td>
</tr>
<tr>
<td>Temperature</td>
<td>Observe</td>
<td>Irreversible</td>
</tr>
<tr>
<td>Surface</td>
<td>Compare</td>
<td>Friction</td>
</tr>
<tr>
<td>Push</td>
<td>contrast</td>
<td>Resistance</td>
</tr>
<tr>
<td>Pull</td>
<td></td>
<td>Force</td>
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<tr>
<td>Speed</td>
<td></td>
<td>Motion</td>
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<tr>
<td>Flat</td>
<td></td>
<td>incline</td>
</tr>
</tbody>
</table>
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 begin to describe the properties that can vary across different materials, and begin to see their world as composed of a wide variety of materials with different properties that make them suited to 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 putty?
Targeted Academic Language
Tier 1: water, air, wood
Tier 2: material
Tier 3: property, matter

RESOURCES AND MATERIALS

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Popsicle sticks</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Bags of starch putty (recipe is below)</td>
<td>Bin</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.wikihow.com/Make-Silly-Putty">http://www.wikihow.com/Make-Silly-Putty</a></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Cups (to be filled with water)</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Balloons (balloons need to be inflated)</td>
<td>Bin</td>
</tr>
<tr>
<td>Classroom Set</td>
<td>Science Journals</td>
<td>Classroom Teacher</td>
</tr>
</tbody>
</table>

**Items in bold must be returned to the bin at the end of the lesson**

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 many materials combined together.

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.

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 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.”

4. Revisit the essential question and discuss what it means.

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].


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

   d. Ask random students to share their words, categorizing 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. When complete, ask students to look at one group of words, 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.
2. Comparing Materials

a. Now that we understand the different characteristics we can think about when we 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 and 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 they will be collecting organized as they make their observations.

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. The main part of this activity will now begin with the students going to each station,
identifying the materials and recording 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. The final part of the lesson will be the class coming back together as a group 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?
We started our lesson today by discussing our BIG QUESTION – Why do materials matter? Now that we understand what materials are, and that different materials have 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 object is made of, and then finally to 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 thing choose to make it from what they made it from and not from starch putty?
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? 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 small student books to read aloud and discuss the text. On the same day, the teacher may choose to partner the students to reread the student 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

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lyrics to “Matter song” <a href="https://www.youtube.com/watch?v=kjJrS6ZaEvM">https://www.youtube.com/watch?v=kjJrS6ZaEvM</a></td>
<td>Thumb drive/ Binder</td>
</tr>
</tbody>
</table>
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 as a science word. We also discussed what the word “matter” means. Does anyone remember? “Review meaning of materials and matter from last time. “Today we are going to learn about a special science meaning of the word “matter”, so 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 write one or two sentences stating what they think matter is in their science journals. If they do not know, they 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.
7. Discuss academic vocabulary and write the words on chart paper as you read aloud the book.
8. Ask verbal comprehension questions regarding the text as you read. [SP-7 Engaging in argument from evidence]

**Lesson Closing**
After completing the reading of the book, discuss what was learned. Teacher records 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. Teacher divides students into small groups based on the students’ needs. Teacher uses the differentiated small student books with the small groups.

3. Teacher takes one group at a time and guides students as needed while they take turns reading the text aloud. The teacher asks comprehension questions as they go along similar to those used when reading the big book.

4. Teacher reviews the science vocabulary to make sure students really understand the words.

5. 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.

6. At the end of the lesson, 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.

7. Teacher can partner students to reread aloud for fluency and for review of vocabulary and science concepts. If not done at the end of the small group lesson, the teacher could have the partners answer questions in their science journals.

**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 purpose of this lesson is to give students scientific information regarding classification by properties of matter, and to expose students to informational text in a class lesson. 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 a group are placed into a group of their own. 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.

This unit was developed with Race to the Top and National Science Foundation funding (Grant #1432591). It is a DRAFT document that will be revised annually as the unit is piloted through the 2017-18 school year.
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**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Science Journals</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>As needed</td>
<td>Chart paper</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>As needed</td>
<td>Markers</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1</td>
<td><strong>Properties, Delta Science Readers</strong></td>
<td>Bin</td>
</tr>
</tbody>
</table>

**Items in bold must be returned to the bin at the end of the lesson**
LESSON DETAILS

Lesson Opening/ Activator

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

2. After they finish answering, tell the students they are to get into groups according to the color of their shirt. Tell the class that you want a group for 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 that the color of the shirt they are wearing is a property which describes their shirt. “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

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.
3. Ask students as a group through hand raising to describe various properties about different materials found in objects around to room. Make sure to give examples of properties 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**

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<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class set</td>
<td>Science Journals</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1</td>
<td>“Hardness and Strength,” video</td>
<td>Thumb drive</td>
</tr>
<tr>
<td></td>
<td><a href="https://www.youtube.com/watch?v=mUkJIaz5WQ">https://www.youtube.com/watch?v=mUkJIaz5WQ</a></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>3” x 5” index cards for categories</td>
<td>Bin</td>
</tr>
<tr>
<td>1 per student</td>
<td>Hardness Recording Sheet</td>
<td>Binder (Classroom Teacher to copy)</td>
</tr>
<tr>
<td>1 per student</td>
<td>Strength Recording Sheet</td>
<td>Binder (Classroom Teacher to copy)</td>
</tr>
<tr>
<td>4</td>
<td>Pairs of scissors</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1</td>
<td>Large chart paper</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>As needed</td>
<td>Markers</td>
<td>Classroom Teacher</td>
</tr>
</tbody>
</table>
**Items in bold must be returned to the bin at the end of the lesson**

**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 materials 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).

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 are 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, and 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?

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]

This unit was developed with Race to the Top and National Science Foundation funding (Grant #1432591). It is a DRAFT document that will be revised annually as the unit is piloted through the 2017-18 school year.
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(s)
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, use 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

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Set</td>
<td>Science Journals</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td></td>
<td>The class chart for hardness</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td></td>
<td>The class chart for strength</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td></td>
<td>A list of report requirements on chart paper or on the board</td>
<td>Classroom Teacher</td>
</tr>
</tbody>
</table>

**Items in bold must be returned to the bin at the end of the lesson**

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 experiments.

During the Lesson

1. The teacher states and writes on the board or chart paper the lesson's expectations:
a. You may choose one material to write about in your report.
b. You need to make a web to organize your report.
c. You may look at the class charts for ideas about strength or hardness for your webs.
d. After you have completed your web, you will write your rough draft for your report.
e. 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.
f. You need to write three or more sentences proving why the material is hard/soft and strong/not strong.
g. You need a concluding sentence about this report.

2. The teacher may decide to take another day for proofreading and editing with individual students.
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 by name and the properties of strength and hardness. This can be done in the science journal if not “publishing” the report or it can be done on white construction paper if it is to 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 various materials as listed on their recording data papers which will be clipped to their clipboards. By observation and touch they will write the texture properties for the 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

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Science Journals</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td></td>
<td>Pencils</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1 per student</td>
<td>Clipboards</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1 per group</td>
<td>Xeroxed numbered list of materials around the classroom to be examined</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1</td>
<td>A list of texture words on a large chart at the board</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td></td>
<td>Blank large chart paper</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>As needed</td>
<td>Markers</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1</td>
<td>Paper bag</td>
<td>Bin</td>
</tr>
<tr>
<td>1 per student</td>
<td>Classify by Texture Worksheet</td>
<td>Binder (Classroom Teacher to copy)</td>
</tr>
<tr>
<td>1 set</td>
<td>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.</td>
<td>Classroom Teacher and Bin</td>
</tr>
</tbody>
</table>

**Items in bold must be returned to the bin at the end of the lesson**

# LESSON DETAILS

## Lesson Opening/ Activator

Place one item from the materials collection in the paper bag. Invite a student up to feel the material inside the bag and describe what it feels like. [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
Partner 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 along with the object name. Tell the students they will be going around the room to find each object. They should look at and touch each object. Next they write one or more texture properties next to the object’s name. Students may refer to the list of texture words displayed at the board. Assign each group a different number on the list to start 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]. The teacher records the data on the large class chart.

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 dipped into thinned watercolor paint to put drops of water on different materials, and 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:** This lesson takes a while to prepare. 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**

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

**Items in bold must be returned to the bin at the end of the lesson**
LESSON DETAILS

Lesson Opening/ Activator

Pretest - Type I - What do you think absorbency means? Students 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 tell about what we need to do when we work in groups. Students need to work cooperatively, taking turns, discussing what they are doing, recording their data, and using 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 experiments with water and paint to find out which materials are absorbent and which are not. Discuss the vocabulary: absorbency, absorb, absorbent, and nonabsorbent.

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 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 and then 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, and any other observations, such as “very absorbent” or “just a little absorbent”.

**Lesson Closing**

At the end, each group presents their findings to the class, and the teacher records 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?
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 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.

**Focus Standard(s)**

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

**WIDA Language Objectives**
(Independent on the needs of your ELL students)

**Targeted Academic Language**
Tier 2: evidence
Tier 3: weight, properties

**RESOURCES AND MATERIALS**

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<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>Pieces of 9” x 12” colored construction paper</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1 box</td>
<td>Plastic straws</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Containers of Play-Doh</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Masking tape</td>
<td>Bin</td>
</tr>
<tr>
<td>1 box</td>
<td>Plastic knives</td>
<td>Bin</td>
</tr>
<tr>
<td>As needed</td>
<td>Pairs of scissors</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td></td>
<td>Large chart paper and markers</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td></td>
<td>Science Journals</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1 per student</td>
<td>Breaking Materials Apart Worksheet</td>
<td>Binder</td>
</tr>
</tbody>
</table>

**Items in bold must be returned to the bin at the end of the lesson**
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.
2. Give each student a *Breaking Materials Apart Worksheet*
3. Give pretest as mentioned above.
4. The teacher will assign or let students choose which center to go to.
5. Each student cuts one of the materials.
6. The group discusses and records each material and writes evidence that the material is still the same or not. [*SP-3 Planning and carrying out investigations*]
7. Guiding questions could be: Does it look different? Why or why not? Do the properties stay the same? 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. [*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(s)
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

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 per student</td>
<td>Materials that can be joined together (puzzle pieces, cut pieces of paper, magnets, tape, Legos)</td>
<td>Classroom Teacher/Bin</td>
</tr>
<tr>
<td>As needed</td>
<td>Joining Bits Together Worksheet</td>
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<tr>
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<td>Classroom Teacher</td>
</tr>
<tr>
<td>As needed</td>
<td>Large chart paper and marker</td>
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</tr>
</tbody>
</table>

**Items in bold must be returned to the bin at the end of the lesson**
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.
- 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

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<th>Item</th>
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</thead>
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<tr>
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</tr>
<tr>
<td>2</td>
<td>Transparent plastic water bottles</td>
<td>Bin</td>
</tr>
<tr>
<td>1</td>
<td>Measuring cup</td>
<td>Bin</td>
</tr>
</tbody>
</table>

This unit was developed with Race to the Top and National Science Foundation funding (Grant #1432591). It is a DRAFT document that will be revised annually as the unit is piloted through the 2017-18 school year.
**Items in bold must be returned to the bin at the end of the lesson**

**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**

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.

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.

---

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

This unit was developed with Race to the Top and National Science Foundation funding (Grant #1432591). It is a DRAFT document that will be revised annually as the unit is piloted through the 2017-18 school year.
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 recording sheet or the teacher could record the measurements.

g. Another student does the same, but measures in centimeters.

h. Repeat steps 1-7 using the other water bottle.

i. The whole class takes a “field trip” to the cafeteria to put the two bottles of water in the freezer until 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.

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, and 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.

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. Repeat the measurement and recording as done on Days 1, 2, and 3. Use a blue Sharpie.

Discuss what was done and what was learned during the four-day experiment, and record on the class chart.

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?

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 ‘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.

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**

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<thead>
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<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gram scale</td>
<td>Bin</td>
</tr>
<tr>
<td>30</td>
<td>Piece of unwrapped Bazooka bubble gum (not sugar free) for every student</td>
<td>Bin</td>
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<tr>
<td>As needed</td>
<td>Pencils</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1</td>
<td>Coffee filter</td>
<td>Bin</td>
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<tr>
<td>As needed</td>
<td>Markers</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1</td>
<td>Timer</td>
<td>Bin</td>
</tr>
</tbody>
</table>

**Items in bold must be returned to the bin at the end of the lesson**
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!

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 and record 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.
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.)
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 up or down. When friction increases does the temperature go up or down?
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

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<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
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</tr>
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<td>4</td>
<td>Data tables</td>
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<tr>
<td>4</td>
<td>Felt squares</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Pieces of sandpaper</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Carpet samples</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Blocks</td>
<td>Classroom Teacher</td>
</tr>
</tbody>
</table>

**Items in bold must be returned to the bin at the end of the lesson**
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. They 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).

**Assessment**

Post test-Type II

The first question will be a simple choice of up or down. When friction increases does the temperature go up or down? Write one way you can increase friction when you rub an object against a surface.
Lesson 13: 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 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

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<th>Item</th>
<th>Source</th>
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<tr>
<td>1</td>
<td>“And Everyone Shouted, “Pull!”: A first Look at Forces and Motion” by Claire Llewellyn</td>
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<tr>
<td>4</td>
<td>Toy Truck</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Rubber band</td>
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<td>Rulers</td>
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<tr>
<td>4</td>
<td>Cardboard tube</td>
<td>Bin</td>
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<tr>
<td>4</td>
<td>A few thick books</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>4</td>
<td>Small ball</td>
<td>Bin</td>
</tr>
</tbody>
</table>

**Items in bold must be returned to the bin at the end of the lesson**
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 changes 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 14: 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

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<tr>
<td>4</td>
<td>12” long pieces of felt</td>
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</tr>
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<td>12” long pieces of sandpaper</td>
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<td>Measuring tape</td>
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</tr>
<tr>
<td>4</td>
<td>3” three ring binders</td>
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</tr>
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<td>Toy cars</td>
<td>Bin</td>
</tr>
</tbody>
</table>

**Items in bold must be returned to the bin at the end of the lesson**

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

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 the tabletop. 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.

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. The students should now repeat the tests on 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]

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 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

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>As needed</td>
<td>Pencils</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>Blocks</td>
<td>Classroom Teacher</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1 per student</td>
<td>Bowling Score Sheet</td>
<td>Binder (Classroom Teacher to copy)</td>
</tr>
<tr>
<td>1 per student</td>
<td>Bowling Challenge Recording Sheet for Lane and Ball Materials (3 sheets)</td>
<td>Binder (Classroom Teacher to copy)</td>
</tr>
<tr>
<td>1 per student</td>
<td>Great Friction Strike Out Conclusions Worksheet</td>
<td>Binder (Classroom Teacher to copy)</td>
</tr>
<tr>
<td>1</td>
<td>Marble</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>12” long felt pieces</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>12” long sandpaper</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>12” long cardboard</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Carpet tiles</td>
<td>Bin</td>
</tr>
<tr>
<td>1</td>
<td>1 “bowling lane” (instructions below). This will be a long cardboard box with the top and one short side cut off to simulate a bowling lane with bumpers</td>
<td>Classroom Teacher to make prior to the lesson</td>
</tr>
</tbody>
</table>

**Items in bold must be returned to the bin at the end of the lesson**
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 control 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. Students then will record their data followed by the next group going until all groups have gone.

**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”).
## List of Unit Resources

### Lesson 1

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Popsicle sticks</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Bags of starch putty (recipe is below)</td>
<td>Bin</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.wikihow.com/Make-Silly-Putty">http://www.wikihow.com/Make-Silly-Putty</a></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Cups (to be filled with water)</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Balloons (balloons need to be inflated)</td>
<td>Bin</td>
</tr>
<tr>
<td>Classroom Set</td>
<td>Science journals</td>
<td>Classroom Teacher</td>
</tr>
</tbody>
</table>

### Lesson 2

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<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Lyrics to “Matter song” <a href="https://www.youtube.com/watch?v=kjjIS6ZaEvM">https://www.youtube.com/watch?v=kjjIS6ZaEvM</a></td>
<td>Thumb drive/ Binder</td>
</tr>
<tr>
<td>Class set</td>
<td>Science Journals</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>6</td>
<td><em>Foss Science Reader</em> <em>Solids and Liquids</em></td>
<td>Bin</td>
</tr>
<tr>
<td>1</td>
<td>Chart paper</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>Set</td>
<td>Markers</td>
<td>Classroom Teacher</td>
</tr>
</tbody>
</table>
Lesson 3

<table>
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<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Science Journals</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>As needed</td>
<td>Chart paper</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>As needed</td>
<td>Markers</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1</td>
<td>Properties, Delta Science Readers</td>
<td>Bin</td>
</tr>
</tbody>
</table>

Lesson 4

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Science Journals</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1</td>
<td>“Hardness and Strength,” video</td>
<td>Thumb drive</td>
</tr>
<tr>
<td></td>
<td><a href="https://www.youtube.com/watch?v=mUkJKlaz5WQ">https://www.youtube.com/watch?v=mUkJKlaz5WQ</a></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>3” x 5” index cards for categories</td>
<td>Bin</td>
</tr>
<tr>
<td>1 per student</td>
<td>Hardness Recording Sheet</td>
<td>Binder (Classroom Teacher to copy)</td>
</tr>
<tr>
<td>1 per student</td>
<td>Strength Recording Sheet</td>
<td>Binder (Classroom Teacher to copy)</td>
</tr>
</tbody>
</table>

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### Lesson 5

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>Pairs of scissors</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1</td>
<td>Large chart paper</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>As needed</td>
<td>Markers</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>4 bags</td>
<td>Various readily available materials for classifying: soft/hard, and strong/not strong such as: 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</td>
<td>Bin/Classroom Teacher</td>
</tr>
</tbody>
</table>

### Lesson 6

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The class chart for hardness</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td></td>
<td>The class chart for strength</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td></td>
<td>A list of report requirements on chart paper or on the board</td>
<td>Classroom Teacher</td>
</tr>
</tbody>
</table>

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Lesson 7

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
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<tbody>
<tr>
<td>Class Set</td>
<td>Science Journals</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>4</td>
<td>Containers to catch the liquids</td>
<td>Bin</td>
</tr>
<tr>
<td>1 per student</td>
<td>Table worksheets or blank paper for students to make tables and record their observations</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1</td>
<td>Large chart paper with markers</td>
<td>Classroom Teacher</td>
</tr>
</tbody>
</table>

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Lesson 8

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Pieces of 9” x 12” colored construction paper</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1 box</td>
<td>Plastic straws</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Containers of Play-Doh</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Masking tape</td>
<td>Bin</td>
</tr>
<tr>
<td>1 box</td>
<td>Plastic knives</td>
<td>Bin</td>
</tr>
<tr>
<td>As needed</td>
<td>Pairs of scissors</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td></td>
<td>Large chart paper and markers</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td></td>
<td>Science Journals</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1 per student</td>
<td>Breaking Materials Apart Worksheet</td>
<td>Binder</td>
</tr>
</tbody>
</table>
Lesson 9

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

Lesson 10

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Science Journals</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>As needed</td>
<td>Pencils</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>2</td>
<td><strong>Transparent plastic water bottles</strong></td>
<td>Bin</td>
</tr>
<tr>
<td>1</td>
<td>Measuring cup</td>
<td>Bin</td>
</tr>
<tr>
<td>1</td>
<td>Black Sharpie</td>
<td>Bin</td>
</tr>
<tr>
<td>1</td>
<td>Red Sharpie</td>
<td>Bin</td>
</tr>
<tr>
<td>1</td>
<td>Green Sharpie</td>
<td>Bin</td>
</tr>
<tr>
<td>1</td>
<td>Blue Sharpie</td>
<td>Bin</td>
</tr>
<tr>
<td>1 roll</td>
<td>Masking tape</td>
<td>Bin</td>
</tr>
<tr>
<td></td>
<td>School freezer</td>
<td>Classroom Teacher</td>
</tr>
</tbody>
</table>

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Lesson 11

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gram scale</td>
<td>Bin</td>
</tr>
<tr>
<td>30</td>
<td>Piece of unwrapped Bazooka bubble gum (not sugar free) for every student</td>
<td>Bin</td>
</tr>
<tr>
<td>As needed</td>
<td>Pencils</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1</td>
<td>Coffee filter</td>
<td>Bin</td>
</tr>
<tr>
<td>As needed</td>
<td>Markers</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1</td>
<td>Timer</td>
<td>Bin</td>
</tr>
</tbody>
</table>

Lesson 12

<table>
<thead>
<tr>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Journals</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>Pencils</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>4</td>
<td>Data tables</td>
</tr>
<tr>
<td>4</td>
<td>Felt squares</td>
</tr>
<tr>
<td>4</td>
<td>Pieces of sandpaper</td>
</tr>
<tr>
<td>4</td>
<td>Carpet samples</td>
</tr>
</tbody>
</table>
Lesson 13

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Science Journals</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1</td>
<td>“And Everyone Shouted, “Pull!”: A first Look at Forces and Motion” by Claire Llewellyn</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Toy Truck</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Rubber band</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Rulers</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>4</td>
<td>Blocks</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>4</td>
<td>Cardboard tube</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>A few thick books</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>4</td>
<td>Small ball</td>
<td>Bin</td>
</tr>
</tbody>
</table>

Lesson 14

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Science Journals</td>
<td>Classroom Teacher</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Templates for data</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>4</td>
<td>Sheets of construction paper</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>4</td>
<td>12” long pieces of felt</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>12” long pieces of sandpaper</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Measuring tape</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>3” three ring binders</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Toy cars</td>
<td>Bin</td>
</tr>
</tbody>
</table>

Lesson 15

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>As needed</td>
<td>Pencils</td>
<td>Classroom Teacher</td>
</tr>
<tr>
<td>1 per student</td>
<td>Bowling Score Sheet</td>
<td>Binder (Classroom Teacher to copy)</td>
</tr>
<tr>
<td>1 per student</td>
<td>Bowling Challenge Recording Sheet for Lane and Ball Materials (3 sheets)</td>
<td>Binder (Classroom Teacher to copy)</td>
</tr>
<tr>
<td>1 per student</td>
<td>Great Friction Strike Out Conclusions Worksheet</td>
<td>Binder (Classroom Teacher to copy)</td>
</tr>
<tr>
<td>1</td>
<td>Marble</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>12” long felt pieces</td>
<td>Bin</td>
</tr>
<tr>
<td></td>
<td>Item Description</td>
<td>Location</td>
</tr>
<tr>
<td>---</td>
<td>---------------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>4</td>
<td>12” long sandpaper</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>12” long cardboard</td>
<td>Bin</td>
</tr>
<tr>
<td>4</td>
<td>Carpet tiles</td>
<td>Bin</td>
</tr>
<tr>
<td>1</td>
<td>1 &quot;bowling lane&quot; (instructions below). This will be a long cardboard box with the top and one short side cut off to simulate a bowling lane with bumpers</td>
<td>Classroom Teacher to make prior to the lesson</td>
</tr>
</tbody>
</table>