

This or That: What Should I Use?

Structure And Properties of Matter

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Grade Level	2nd Grade	**Time Frame**	3-4 class period(s)
Course	Physical Science	**Duration**	200 minutes

Essential Question

What materials have the properties that are best suited for an intended purpose?

Summary

In this lesson, students will learn to determine which materials are best used in various situations based on their properties. After categorizing a few common materials like cotton balls and cooking oil, students contribute their rationales to an Anchor Chart, which is then expanded to include the scientific properties of those materials. Students then choose what they think would be the best materials for a variety of situations, including protecting an egg during a fall, before participating in an egg drop experiment.

Snapshot

Engage

Students examine a number of common materials, such as cotton balls and cooking oil, and sort the materials. Then, as a class, students discuss their sorting methods and properties using an Anchor Chart.

Explore

Students sort their materials again and discuss the properties of their materials with the class.

Explain

Using the Sticky Bars strategy, students consider eight statements and choose the correct material for each given situation.

Extend

Students choose from a list of materials the one(s) they believe would best protect an egg from breaking during a drop. These choices are tested with two rounds of egg drop experiments.

Evaluate

Using the Four Corners strategy, students form opinions on five statements and explain their reasoning.

Standards

Next Generation Science Standards (Grade 2)

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

Oklahoma Academic Standards (1st Grade)

ESS1: Earth's Place in the Universe
1.ESS1.2.2.1: Seasonal patterns of sunrise and sunset can be observed, described, and predicted.

Attachments

- Egg-Drop-Challenge-This-or-That.docx
- Egg-Drop-Challenge-This-or-That.pdf
- Sticky-Bar-Cards-This-or-That.docx
- Sticky-Bar-Cards-This-or-That.pdf
- Venn-Diagram-This-or-That.docx
- Venn-Diagram-This-or-That.pdf

Materials

- Items for Engage activity examination (suggested: cotton balls, sand, paper towels, small rocks, cooking oil, chenille sticks or Wikki Sticks, tongue depressors, water, and plastic wrap)
- Venn Diagram handout (optional; attached; one per student)
- Chart paper (optional)
- Sticky notes (optional)
- Sticky Bar Cards handout (optional; attached; one per student)
- Tape (optional)
- Egg Drop Challenge handout (attached; one per student)
- Approx. three dozen eggs (can be altered to suit classroom needs)
- Step ladder or other raised platform

Engage

Teacher's Note: Lesson Prep

In preparation for this lesson, have a few common and inexpensive items available for students to handle and examine. Include items of varying strength, flexibility, hardness, texture, and absorbency. Suggested materials are cotton balls, sand, paper towels, small rocks, cooking oil, chenille stems, tongue depressors or wooden craft sticks, water, and plastic wrap. Have enough of each item on hand so that, once your students are divided into small groups, each group can examine one of each material. Depending on your classroom needs, these materials can be altered or substituted.

To begin the lesson, divide your materials so that each group has at least one of each item. Begin class with the materials on display. Sort students into small groups, with one group per collection of materials. Invite students to sort the various materials into categories. Have the students come up with their own categories and rationales for sorting the materials. Do not give any direction on how the objects might be sorted.

Possible Student Responses: Sorting Methods

Students may choose to sort by color, shape, state of matter (liquid or solid), texture, size, or other properties. As the class works, keep an eye out for any group that sorts according to strength, flexibility, hardness, texture, or absorbency.

Once students have finished discussing and sorting with their groups, ask students to think about the following question: How do we describe materials? Invite volunteers from each group to share with the class how they sorted their items. As the class shares out, begin making a list on a whiteboard area with students' methods. After groups have finished sharing, introduce the word "properties" to identify all of these descriptions.

Next, turn the class's list of sorting methods and properties into an Anchor Chart on the whiteboard space. Write the word "Properties" at the top of the chart. Ask students to share the words they used to describe the materials. As they share, add these words to the chart. Listen for words that are synonymous with scientific properties, such as strength, absorbency, flexibility, hardness, or texture. For example, if a student gives the word "bendable," use the opportunity to tell students that scientists use the word "flexible" instead. Then, put the scientific property word (for example, flexible) on your chart. The same applies to the property words "strength" (tough, rugged, strong), "hardness," "texture," "absorbency," and others as they come up. Ask the class to help define these property words and add definitions to the Anchor Chart.

PROPERTIES

Strength	Absorbency	Flexibility	Hardness	Texture
How strong or weak is it?	*Can it soak up a liquid?*	*Can it bend or not?*	*How hard is it? Can I break it or scratch it?*	*Is it rough, smooth, bumpy?*

Example of an Anchor Chart with properties

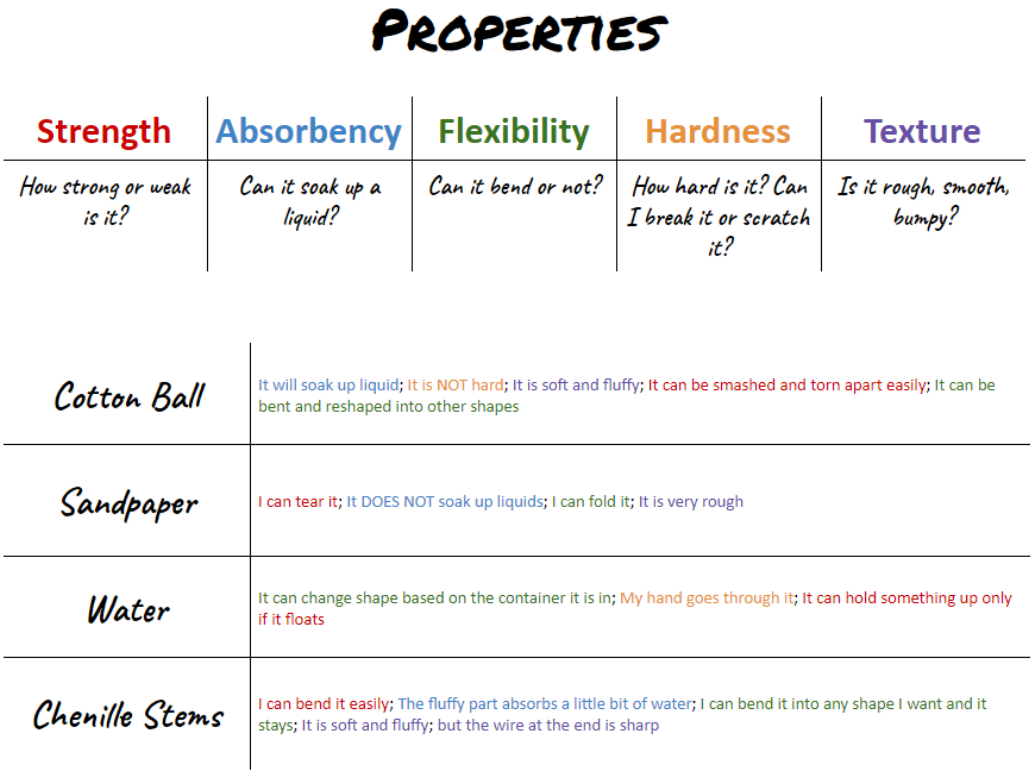
Resist adding any properties to the chart that students do not contribute first. Continue the discussion until you feel the chart reflects an appropriate depth of understanding. If students struggle with this discussion, consider using these guiding questions and statements:

1. What can you tell me about {property}?
2. What can you tell me about {material's} {property}, such as its strength, absorbency, flexibility, hardness, or texture? How would you describe {material's} {property}?
3. Why would {property} matter?
4. Do you agree with including {this property}? Why or why not? I love that you have a different opinion! It gives us something to discuss.

Explore

Next, ask the class to use the information on the Anchor Chart and, with their group, explore and identify the materials that fit each property. Have students sort the materials a second time. Ask groups to focus on identifying the properties that each material possesses, not the material's use. Allow 7–10 minutes for group discussion.

Invite groups to discuss as a class how they sorted their materials and how they matched each property to each material. As the class discusses each group's results, add these ideas to the Anchor Chart.



PROPERTIES

Strength	Absorbency	Flexibility	Hardness	Texture
How strong or weak is it?	Can it soak up a liquid?	Can it bend or not?	How hard is it? Can I break it or scratch it?	Is it rough, smooth, bumpy?
Cotton Ball	It will soak up liquid; It is NOT hard; It is soft and fluffy; It can be smashed and torn apart easily; It can be bent and reshaped into other shapes			
Sandpaper	I can tear it; It DOES NOT soak up liquids; I can fold it; It is very rough			
Water	It can change shape based on the container it is in; My hand goes through it; It can hold something up only if it floats			
Chenille Stems	I can bend it easily; The fluffy part absorbs a little bit of water; I can bend it into any shape I want and it stays; It is soft and fluffy; but the wire at the end is sharp			

Example of an expanded Anchor Chart with properties and materials

Optional Activity: Venn Diagrams

This phase of the lesson also presents an opportunity to introduce your students to using Venn diagrams to compare the properties of the different materials. To do so, pass out copies of the attached **Venn Diagram** handout.

If students struggle with this discussion, consider using these guiding questions:

1. Do any of these materials have more than one property?
2. Why wouldn't we put cotton balls (or another weak material) with the property "strength"?
3. What are some similarities and differences you notice between the materials?
4. Do you see a pattern? What causes the pattern?
5. Is it helpful to know the properties of materials before using them, or determining what they could be used for?

Explain

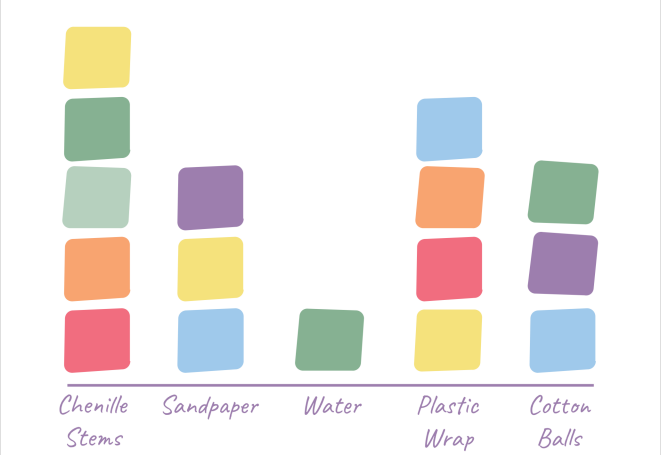
Teacher's Note: Prep

To prepare for this phase of the lesson, identify eight wall areas or whiteboard spaces around the room. On large pieces of chart paper or poster board, write one of each of the eight tasks listed below in the eight spaces around the room. Include the materials you have used in your classroom so far as with the x-axis on a bar graph). Additionally, have sticky notes available, or print out a copy of the attached **Sticky Bar Cards** for each student.

Ask students this phase's essential question: Can you identify which properties make a material best suited for the intended purpose? With the Anchor Chart displayed as a reference, use a modified version of the Sticky Bars and Gallery Walk strategies for the next activity. The statements are:

1. Washing your face
2. Cleaning up spilled water
3. Building a model house
4. Making a necklace
5. Cracking open a nut
6. Smoothing splintered wood
7. Painting
8. Keeping something dry

Ask each group to begin at a different Sticky Bar graph and use the information they collected about materials and their properties to decide which material they examined is best for the given task (see below for an example). Ask students to determine what materials have the appropriate properties to accomplish the task and justify their answers with an explanation of the property the material possesses that makes it the appropriate choice. Students should either cut out their set of Sticky Bar Cards, write their answers in the provided spaces, and attach each card to a Sticky Bar graph with tape, or write their answers on sticky notes (including a reason why the material they chose would be the best choice) and place their answers on the Sticky Bar graph. Have groups rotate statements every few minutes, allowing enough time for students to evaluate and complete each question. Allow about 10–15 minutes total for this activity.



Example of Sticky Bars with sticky notes

Possible Student Responses

Students may give a variety of evidence and reasoning, and for each statement, you may find there can be more than one correct answer. Use the reasoning provided on students' notes to correct misunderstandings and foster a brief discussion of the class findings.

Extend

Hand out a copy of the attached **Egg Drop Challenge** sheet to each student. Using the Anchor Chart, Sticky Bar findings, and class discussions thus far, have students choose 1–3 different materials they think would best protect an egg from cracking when dropped from a height of eight feet or more. Ask students to record their choices in the top row of the Egg Drop handout.

Teacher's Note: Suggested Egg Drop Materials

Suggested materials for this phase are empty tissue boxes, clean milk cartons, small cups, scrap paper, newspaper, tissues, rubber bands, cotton balls, sand, and coffee filters. If other materials are necessary, the Egg Drop handout can be altered to suit your classroom needs.

Invite students to participate in an egg drop demonstration. Either have students work in small groups to construct their egg drop devices, or construct one of each device ahead of time.

For the demonstration, use an outdoor or protected setting. Using a step ladder or other elevated platform (such as bleachers, a stage, etc.) drop each device from eight feet or more. Have students observe the drop, and complete the first attempt box on the Egg Drop Challenge sheet. After the results of the egg drop demonstration are recorded and discussed as necessary, have students repeat the process, modifying their devices and recording their ideas on the Egg Drop Challenge sheet, and recording the results after a second demonstration.

Optional: Additional Egg Drop Demonstration

If you find it helpful, consider having the class do one more round of modifications, and one more demonstration. The Egg Drop Challenge sheet has one additional field for notes from this bonus demonstration.

Allow time for students to record and reflect on their final results. Discuss with the class what properties of the materials made them work better than others for their intended purpose—to protect an egg during landing. Encourage students to use the information found on their recording sheets as evidence to support their thinking. If students struggle with this discussion, consider using these guiding questions:

1. Can you explain your results using evidence derived or taken from the task?
2. Based on the data collected would you make any modifications or changes to your design?
3. Comparing your design to others, can you discuss materials that were consistently successful, materials that were consistently unsuccessful, and why?

Evaluate

Teacher's Note: Prep

Place one sign on each of the four walls or corners of your classroom. These signs should say "Agree," "Disagree," "Strongly Agree," or "Strongly Disagree."

Using the Four Corners strategy, give students a series of statements regarding the concepts learned. Ask students to decide if they strongly agree, agree, disagree or strongly disagree based on the evidence they know about the statement and the material. Students should be able to explain their thinking. Read the statements one at a time and allow students to shift around the room for each:

1. The best way to clean up spilled juice is with a dish towel.
2. Using sand is the best way to fill the hole in our yard.
3. Scrubbing your face with sandpaper is a great way to get rid of unwanted dead skin!
4. Using olive oil on your dry skin is not only effective but also very nourishing.
5. Using a clean cloth is the best way to cover an open cut on your leg.

Teacher's Note: Alternate Statements

To suit your classroom needs, alter the vocabulary used in the above statements as necessary to be understood by your students.

At any time, students can change their stance, but should still be able to explain why their opinion changed. Based on a given student's choice, they will move to one of the four signs posted in the room to express their opinion in regards to their agreement level with the statement. Consider asking for volunteers from each agreement group to explain their thinking, discuss points of view, and reason through different scenarios. Observe and evaluate each student's understanding of the key concepts. Try to continually question and ask why students agree, disagree, or even strongly agree or strongly disagree.

Optional: Alternative To Four Square

If the Four Square strategy will not work for your classroom, consider having your students record their thoughts on a small whiteboard or piece of paper and discussing them as a class.

Resources

- K20 Center. (n.d.). Anchor charts. Strategies. Retrieved fromhttps://learn.k20center.ou.edu/strategy/64f2b35101a470dda36d44421900af08
- K20 Center. (n.d.). Four corners. Strategies. Retrieved from https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5064550
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- K20 Center. (n.d.). Sticky bars. Strategies. Retrieved from https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f505ee0f
- Penuel, W. R., & Van Horne, K. (2016, November). STEM Teaching Tool #41: Prompts for Integrating Crosscutting Concepts Into Assessment and Instruction. Retrieved from http://oksciencframework.pbworks.com/w/file/fetch/133759011/STT CCC Prompts-patterns.pdf.
- Penuel, W. R., Van Horne, K., & Bell, P. (2016, March). STEM Teaching Tool #30: Integrating Science Practices Into Assessment Tasks. Retrieved from http://oksciencframework.pbworks.com/w/file/fetch/133758684/STT%20SEP%20Prompts%20-%20Data.pdf.