

# Teacher Guide and Student Journal

Sample Activity and Planning Pages

# Solving Problems with Properties

## 2PNG



S E C O N D   E D I T I O N

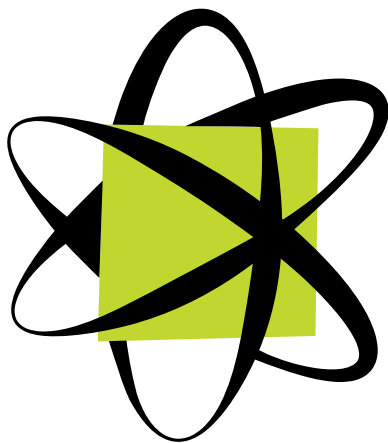
A second grade unit supporting Next Generation Science Standards  
and Michigan Science Standards



S E C O N D E D I T I O N

# Solving Problems with Properties 2PNG

A second-grade unit supporting **Next Generation Science Standards** and the **Michigan Science Standards** developed and written by the Battle Creek Area Mathematics and Science Center for



**CEREAL CITY  
SCIENCE™**

by BCAMSC



# Solving Problems with Properties

## Pre-activity Informational Pages

Unit Introduction	1
Teacher Background Information	2
Multiple Literacies	7
Curriculum Alignment Color Coding	9
Prior Knowledge	13
Identifying Desired Results	17
Next Generation Science Standards	19
Guiding Questions	23
Common Core State Standards	27
Unit At A Glance	34
Parent Letter	39
Activities To Do At Home	40

## Activities

1. What Are Objects Made Of?	41
2. Exploring Properties	55
3. Solving Problems with Properties	65
4. Liquids	71
5. Melting and Freezing	97
6. Taking Our Property Observations Outdoors	105
7. Rearranging the Pieces	117

## Appendix

Key Terms	123
A Model for Guided Reading	124
The Learning Cycle	126
Engineering Design Process	128
Science Talk	130
Field Trips and Classroom Visitors	132
Science Process Skills	133
Cooperative Learning	134
Inclusive Education	137
Encouraging Underrepresented Groups	140

# PLANNING

## NEXT GENERATION SCIENCE STANDARDS

Disciplinary Core Ideas	Activities
<p><b>PS1.A: Structure and Properties of Matter</b></p> <ul style="list-style-type: none"> <li>• Different kinds of matter exist, and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.</li> <li>• Different properties are suited to different purposes.</li> <li>• A great variety of objects can be built up from a small set of pieces.</li> </ul>	1,2,3,4,5,6,7
<p><b>2-PS1-1:</b> Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.</p>	1,4,6
<p><b>2-PS1-2:</b> Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.</p>	1,2,3,6,7
<p><b>2-PS1-3:</b> Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.</p>	3,7
<p><b>2-PS1-4:</b> Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.</p>	4,5
<p><b>PS1.B: Chemical Reactions</b></p> <ul style="list-style-type: none"> <li>• Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.</li> </ul>	5
<p><b>2-PS1-4:</b> Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.</p>	4,5

## NEXT GENERATION SCIENCE STANDARDS

Science and Engineering Practices	Activities
<p><b>Planning and Carrying Out Investigations</b>            Planning and carrying out investigations to answer questions or test solutions to problems in K-2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.</p> <ul style="list-style-type: none"> <li>Plan and conduct investigations collaboratively to produce data to serve as the basis for evidence to answer a question.</li> </ul>	1,4,5
<p><b>2-PS1-1:</b> Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.</p>	1,4,6
<p><b>Analyzing and Interpreting Data</b>            Analyzing data in k-2 builds on prior experiences and progresses to collecting, recording, and sharing observations.</p> <ul style="list-style-type: none"> <li>Analyze data from tests of an object or tool to determine if it works as intended.</li> </ul>	2,3,4,5,6
<p><b>2-PS1-2:</b> Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.</p>	1,2,3,6,7
<p><b>Constructing Explanations and Designing Solutions</b>            Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence- based accounts of natural phenomena and designing solutions.</p> <ul style="list-style-type: none"> <li>Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.</li> </ul>	1,2,3,4,5,6,7
<p><b>2-PS1-3:</b> Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.</p>	3,6,7
<p><b>Engaging in Argument from Evidence</b>            Engaging in argument from evidence in K-2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).</p> <ul style="list-style-type: none"> <li>Construct an argument with evidence to support a claim.</li> </ul>	3,6,7
<p><b>2-PS1-2:</b> Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.</p>	2,3,6,7



## NEXT GENERATION SCIENCE STANDARDS

Crosscutting Concepts	Activities
<b>Cause and Effect</b> <ul style="list-style-type: none"> <li>• Events have causes that generate observable patterns.</li> <li>• Simple tests can be designed to gather evidence to support or refute student ideas about causes.</li> </ul>	2,3,4,5,6,7
<b>2-PS1-2:</b> Analyze data obtained for testing different materials to determine which materials have the properties that are best suited for an intended purpose.	2,3,6,7
<b>2-PS1-4:</b> Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.	4,5
<b>Patterns</b> <ul style="list-style-type: none"> <li>• Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.</li> </ul>	1,2,4,6,7
<b>2-PS1-1:</b> Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.	1,2,3,4,6
<b>Energy and Matter</b> <ul style="list-style-type: none"> <li>• Objects may break into smaller pieces and be put together into larger pieces, or change shapes.</li> </ul>	7
<b>2-PS1-3:</b> Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.	3,6,7
<b>Connections to Engineering, Technology, and Applications of Science</b>	
<b>Influence of Engineering, Technology, and Science, on Society and the Natural World</b> <ul style="list-style-type: none"> <li>• Every human-made product is designed by applying some knowledge of the natural world and is built by using natural materials.</li> </ul>	6
<b>2-PS1-2:</b> Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.	3,6,7

# PLANNING

**COMMON CORE STATE STANDARDS - READING**

Reading Standards for Informational Text—Grade 2	Activities
<b>Key Ideas and Details</b>	
<b>RI.2.1</b> - Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.	1,4,6
<b>RI.2.2</b> - Identify the main topic of a multi-paragraph text as well as the focus of specific paragraphs within the text.	1,4
<b>RI.2.3</b> - Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.	1,4,6
<b>Craft and Structure</b>	
<b>RI.2.4</b> - Determine the meaning of words and phrases in a text relevant to a grade 2 topic or subject area.	1,4,6
<b>RI.2.5</b> - 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.	4,6
<b>RI.2.6</b> - Identify the main purpose of a text, including what the author wants to answer, explain, or describe.	1,4,6
<b>Integration of Knowledge and Ideas</b>	
<b>RI.2.7</b> - Explain how specific images (e.g., a diagram showing a machine works) contribute to and clarify a text.	1
<b>RI.2.8</b> - Describe how reasons support specific points the author makes in a text.	1,4,6
<b>RI.2.9</b> - Compare and contrast the most important points presented by two texts on the same topic.	4
<b>Range of Reading and Level of Text Complexity</b>	
<b>RI.2.10</b> - By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 2-3 text complexity band proficiently, with scaffolding as needed at the high end of the range.	1,2,4,6

# PLANNING

## COMMON CORE STATE STANDARDS - WRITING

Writing Standards–Grade 2	Activities
<b>Text Types and Purposes</b>	
<b>W.2.1</b> - Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, using linking words (e.g., because, and, also) to connect opinion and reasons, and provide a concluding statement or section.	3
<b>W.2.2</b> - Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.	1,2,4,5,6,7
<b>W.2.3</b> - Write narratives in which they recount a well-elaborated event or short sequence of events, include details to describe actions, thoughts, and feelings, use temporal words to signal event order, and provide a sense of closure.	2
<b>Production and Distribution of Writing</b>	
<b>W.2.4</b> - (Begins in grade 3)	
<b>W.2.5</b> - With guidance and support from adults and peers, focus on a topic and strengthen writing as needed by revising and editing.	2,4,5,7
<b>W.2.6</b> - With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.	
<b>Research to Build and Present Knowledge</b>	
<b>W.2.7</b> - Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).	2,3,4,5,6,7
<b>W.2.8</b> - Recall information from experiences or gather information from provided sources to answer a question.	1,2,3,4,5,6,7

**COMMON CORE STATE STANDARDS - LANGUAGE**

Language Standards—Grade 2	Activities
<b>Conventions of Standard English</b>	
<p><b>L.2.1</b> - Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.</p> <ul style="list-style-type: none"> <li>a. Use collective nouns (e.g., group).</li> <li>b. Form and use frequently occurring irregular plural nouns (e.g., feet, children, teeth, mice, fish).</li> <li>c. Use reflexive pronouns (e.g., myself, ourselves).</li> <li>d. Form and use the past tense of frequently occurring irregular verbs (e.g., sat, hid, told).</li> <li>e. Use adjectives and adverbs, and choose between them depending on what is to be modified.</li> <li>f. Produce, expand, and rearrange complete simple and compound sentences (e.g., The boy watched the movie; The little boy watched the movie; The action movie was watched by the little boy).</li> </ul>	1,2,3,4,5,6,7
<p><b>L.2.2</b> - Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.</p> <ul style="list-style-type: none"> <li>a. Capitalize holidays, product names, and geographic names.</li> <li>b. Use commas in greetings and closings of letters.</li> <li>c. Use an apostrophe to form contractions and frequently occurring possessives.</li> <li>d. Generalize learned spelling patterns when writing words (e.g., cage → badge; boy → boil).</li> <li>e. Consult reference materials, including beginning dictionaries, as needed to check and correct spellings.</li> </ul>	1,2,3,4,5,6,7
<b>Knowledge of Language</b>	
<p><b>L.2.3</b> - Use knowledge of language and its conventions when writing, speaking reading, or listening.</p> <ul style="list-style-type: none"> <li>a. Compare formal and informal uses of English.</li> </ul>	1,4

## COMMON CORE STATE STANDARDS - LANGUAGE

Language Standards—Grade 2	Activities
<b>Vocabulary Acquisition Use</b>	
<p><b>L.2.4</b> - 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.</p> <ul style="list-style-type: none"> <li>a. Use sentence-level context as a clue to the meaning of a word or phrase.</li> <li>b. Determine the meaning of the new word formed when a known prefix is added to a known word (e.g., happy/unhappy, tell/retell).</li> <li>c. Use a known root word as a clue to the meaning of an unknown word with the same root (e.g., addition, additional).</li> <li>d. Use knowledge of the meaning of individual words to predict the meaning of compound words (e.g., birdhouse, lighthouse, housefly; bookshelf, notebook, bookmark).</li> <li>e. Use glossaries and beginning dictionaries, both print and digital, to determine or clarify the meaning of words and phrases.</li> </ul>	4,5,6
<p><b>L.2.5</b> - Demonstrate understanding of word relationships and nuances in word meanings.</p> <ul style="list-style-type: none"> <li>a. Identify real-life connections between words and their use (e.g., describe foods that are spicy or juicy).</li> <li>b. Distinguish shades of meaning among closely related verbs (e.g., toss, throw, hurl) and closely related adjectives (e.g., thin, slender, skinny, scrawny).</li> </ul>	4,6
<p><b>L.2.6</b> - Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using adjectives and adverbs to describe (e.g., When other kids are happy that makes me happy).</p>	1,2,3,4,5,6

**COMMON CORE STATE STANDARDS - MATHEMATICS**

<b>Mathematics—Grade 2</b>	<b>Activities</b>
<b>Mathematical Practices</b>	
1. Make sense of problems and persevere in solving them.	1,2,3,4,5,6,7
2. Reason abstractly and quantitatively.	1,2,3,4,5,6,7
3. Construct viable arguments and critique the reasoning of others.	1,2,3,4,5,6,7
4. Model with mathematics	1,2,3,4,5,6,7
5. Use appropriate tools strategically.	1,2,3,4,5,6,7
6. Attend to precision.	1,2,3,4,5,6,7
7. Look for and make use of structure.	1,2,3,4,5,6,7
8. Look for and express regularity in repeated reasoning.	1,2,3,4,5,6,7
<b>2.OA Operations and Algebraic Thinking</b>	
<b>A. Represent and solve problems involving addition and subtraction.</b>	
1. Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings, and equations with a symbol for the unknown number to represent the problem.	
<b>B. Add and subtract within 20.</b>	
2. Fluently add and subtract within 20 using mental strategies. By end of Grade 2, know from memory all sums of two one-digit numbers.	
<b>C. Work with equal groups of objects to gain foundations for multiplication.</b>	
3. Determine whether a group of objects (up to 20) has an odd or even number of members, e.g., by pairing objects or counting them by twos; write an equation to express an even number as a sum of two equal addends.	
4. Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.	

## COMMON CORE STATE STANDARDS - MATHEMATICS

Mathematics—Grade 2	Activities
<b>2.MD Measurement and Data</b>	
<b>A. Measure and estimate lengths in standard units.</b>	
1. Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.	
2. Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.	
3. Estimate lengths using units of inches, feet, centimeters, and meters.	
4. Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.	
<b>2.MD Measurement and Data</b>	
<b>B. Relate addition and subtraction to length.</b>	
5. Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.	
6. Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2,... and represent whole-number sums and differences within 100 on a number line diagram.	
<b>C. Work with time and money.</b>	
7. Tell and write time from an analog and digital clocks to the nearest 5 minutes, using a.m. and p.m.	
8. Solve word problems involving dollar bills, quarters, dimes, nickels, and pennies, using \$ and c symbols appropriately. Example: If you have 2 dimes and 3 pennies, how many cents do you have?	



**COMMON CORE STATE STANDARDS - MATHEMATICS**

Mathematics—Grade 2	Activities
<b>D. Represent and interpret data</b>	
9. Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same objects. Show the measurements by making a line plot, where the horizontal scale is marked off in whole =-number units.	
10. Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.	2,3,6

# PLANNING

## UNIT AT A GLANCE

Activity	Time to Complete	Lesson Level Learning Goal	Phenomenon/ Engineering Challenge	Summary: Students will...
1 <i>What Are Objects Made Of?</i>	Preparation: 20 minutes Activity: 4 classes Lesson 1A: 45-50 min. 2 class periods Lesson 1B: 45-50 min. 2 class periods	Develop an initial understanding of how to identify properties and how they make things useful.	<i>What Would Happen If? A Story of a Mixed-Up Day</i> Design challenge: • Determine materials to use based on the properties that are best suited to develop a structure that will withstand wind, rain, and keep a figure dry. <i>The Three Little Pigs</i>	<ul style="list-style-type: none"> <li>• Read about “What Would Happen If” situations when properties of materials are not considered in their construction.</li> <li>• Compare initial ideas about properties of objects.</li> <li>• Be introduced to a design challenge to choose material to move water from one place to another.</li> </ul>
2 <i>Exploring Properties</i>	Preparation: 10 minutes Activity: 4 classes Lesson 2A: 45-50 min. 2 class periods Lesson 2B: 45-50 min. 2 class periods	Use observations and explorations to develop an understanding of how texture, rigid and flexible, sink and float, and repel and absorb are properties that make things useful.	Design challenge: • Determine materials to use based on the properties that are best suited to develop a structure that will withstand wind, rain, and keep a figure dry.	<ul style="list-style-type: none"> <li>• Make observations and classify objects by texture, flexibility, buoyancy, sink and float and repel and absorb.</li> <li>• Complete a mini-design challenge at each property station.</li> </ul>
3 <i>Solving Problems with Properties</i>	Preparation: 15 minutes Activity 3: 2 classes Lesson 3A: 45-50 min. Lesson 3B: 45-50 min.	Use materials to design a model to suit a specific purpose. Analyze information to determine which materials have properties best suited for the intended purpose.	Design challenge: • Determine materials to use based on the properties that are best suited to develop a structure that will withstand wind, rain, and keep a figure dry.	<ul style="list-style-type: none"> <li>• Work together as a team of engineers to build a structure that can withstand wind and water, and keep things dry.</li> <li>• Test their designs and make adjustments for improvement.</li> </ul>

## UNIT AT A GLANCE

Students Figure Out How To:	Practices and Crosscutting Concepts	PE at Lesson Level and Assessment
<ul style="list-style-type: none"> <li>Construct explanations of the concept of how we identify properties of matter.</li> <li>Determine different properties that make things useful.</li> <li>Recognize patterns in data that can be used to describe how properties make things useful.</li> </ul>	<p>Constructing Explanations and Designing Solutions</p> <p>Obtaining, Evaluating, and Communicating Information</p> <p>Planning and Carrying Out Investigations</p> <p>Patterns</p>	<p><b>Formative Assessment</b></p> <p>Describing Objects chart</p> <p>Activity Page</p> <p>Journal Entry</p> <p>Science Talk</p>
<ul style="list-style-type: none"> <li>Construct explanations of the usefulness of the properties when designing objects.</li> <li>Begin to apply what they have learned to solve a problem.</li> <li>Analyze data based on tests at each activity station.</li> </ul>	<p>Constructing Explanations and Designing solutions</p> <p>Analyzing and Interpreting Data</p> <p>Developing and Using Models</p> <p>Patterns</p> <p>Cause and Effect</p>	<p><b>Formative Assessment</b></p> <p>Activity Page</p> <p>Journal Entry</p> <p>Science Talk</p> <p><b>Summative Assessment</b></p> <p>Journal Entry</p> <p>Science Talk</p>
<ul style="list-style-type: none"> <li>Work as a team of engineers.</li> <li>Choose material to fit the purpose.</li> <li>Test and redesign based on results and feedback.</li> <li>Present their solutions</li> </ul>	<p>Constructing Explanations and Designing Solutions</p> <p>Analyzing and Interpreting Data</p> <p>Engaging in Argument from Evidence</p> <p>Cause and Effect</p>	<p><b>Formative Assessment</b></p> <p>Activity Pages</p> <p>Science Talk</p> <p>Journal Entry</p> <p><b>Summative Assessment</b></p> <p>Journal Entry</p> <p>Engineering Presentation</p>

# PLANNING

## UNIT AT A GLANCE

Activity	Time to Complete	Lesson Level Learning Goals	Phenomenon/ Engineering Challenge	Summary: Students will...
4  <b>Liquids</b>	Preparation: 20 minutes Activity 4: 9 classes Lesson 4A: 45-50 min. 2 class periods Lesson 4B: 55-60 min. 2 class periods Lesson 4C: 45-50 min. 2 class periods Lesson 4D: 45-50 min. 2 class periods Lesson 4E: 45-50 min.	Conduct investigations and make observations to compare the properties of solids to the properties of liquids.  Plan and carryout investigations to find out how temperature changes the properties of water.	<b>Design challenge:</b>  • Determine materials to use based on the properties that are best suited to develop a structure that will fill the pond with water.	<ul style="list-style-type: none"> <li>Compare and adapt their ideas about properties of solids to properties of liquids.</li> <li>Develop an investigation into how temperature change can change water from solid to liquid and liquid to solid and determine what properties change in the phase change.</li> </ul>
5  <b>Melting and Freezing - Beyond Water</b>	Preparation: 20 minutes Activity 5: 4 classes Lesson 5A: 50-60 min. 2 class periods Lesson 5B: 45-50 min. 2 class periods	Construct an argument using evidence that some changes caused by heating and cooling are reversible and some are not.	<b>Challenge: Determine materials best suited to pack for a summertime car trip. What will survive in the hot car?</b>  Melting ice and thawing lettuce	<ul style="list-style-type: none"> <li>Plan and carry out an investigation into temperature change of a material of their choosing.</li> </ul>
6  <b>Taking Our Property Observations Outdoors</b>	Preparation: 5 minutes Activity 6: 4 classes Lesson 6A: 50-60 min. Lesson 6B: 45-50 min. Lesson 6C: 45-50 min. 2 class periods	Design an object that serves a purpose and mimics an item in nature.	<b>Design Challenge Part 1:</b>  Design a device that mimics nature.	<ul style="list-style-type: none"> <li>Make observations of properties in nature.</li> <li>Determine the importance of properties of living organisms for survival.</li> </ul>
7  <b>Rearranging the Pieces</b>	Preparation: 10 minutes Activity 7: 2 classes Lesson 7A: 50-60 min. Lesson 7B: 50-60 min.	Construct an argument using first hand experience that a structure made of small pieces can be disassembled and rearranged to make a new structure.	<b>Design Challenge Part 2:</b>  Rearrange materials to make new structures. Rearrange existing structure with a purpose to make a new structure with a different purpose.	<ul style="list-style-type: none"> <li>Disassemble and rearrange a structure.</li> <li>Determine if the properties and function have changed.</li> </ul>

## UNIT AT A GLANCE

Students Figure Out How To:	Practices and Crosscutting Concepts	PE at Lesson Level and Assessment
<ul style="list-style-type: none"> <li>Construct explanations of the concept of how we identify properties of matter.</li> <li>Recognize patterns that can be used to describe properties of solids and liquids.</li> <li>Complete the engineering design challenge.</li> <li>Plan and conduct an investigation.</li> </ul>	<p>Constructing Explanations and Designing Solutions            Analyzing and Interpreting Data            Developing and Using Models            Asking Questions and Designing Solutions            Obtaining, Evaluating, and Communicating Information            Planning and Carrying Out Investigations</p> <p>Patterns            Cause and Effect</p>	<p><b>Summative Assessment</b>            Activity Pages            Respond to Text            Journal Entries            Science Talk            Engineering Design Solutions            Student Investigations</p>
<ul style="list-style-type: none"> <li>Construct explanations of the effect of heating and cooling on different material.</li> <li>Determine if heating and cooling of different material is reversible or not reversible.</li> </ul>	<p>Constructing Explanations and Designing Solutions            Planning and Carrying Out Investigations            Asking Questions and Defining Problems            Analyzing and Interpreting Data</p> <p>Cause and Effect            Patterns</p>	<p><b>Formative Assessment</b>            Student Led Investigations            Activity Page            Science Talk            Journal Entry</p>
<ul style="list-style-type: none"> <li>Design an object that mimics a characteristic of an animal.</li> </ul>	<p>Constructing Explanations and Designing Solutions            Analyzing and Interpreting Data            Engaging in Argument from Evidence            Asking Questions and Defining Problems</p> <p>Cause and Effect            Patterns</p>	<p><b>Formative Assessment</b>            Group Observations            Science Talk</p> <p><b>Summative Assessment</b>            Science Talk            Journal Entry            Student Inventions</p>
<ul style="list-style-type: none"> <li>Construct a new structure from an existing structure by rearranging a small set of pieces.</li> <li>Test the structure to determine if the properties have changed.</li> </ul>	<p>Constructing Explanations and Designing solutions            Analyzing and Interpreting Data            Engaging in Argument from Evidence</p> <p>Energy and Matter            Cause and Effect            Patterns</p>	<p><b>Summative Assessment</b>            Activity Page            Journal Entry            Science Talk</p>

# PLANNING

# ACTIVITY 1

## WHAT ARE OBJECTS MADE OF?

### Teacher Background Information

Young children have natural curiosity that has led them to explore materials in their world by observing, manipulating, and experimenting. They naturally compare, describe, and sort as they begin to make sense of their world. The following activities provide opportunities to increase their understanding of the properties of objects that they encounter every day and encourage children's natural curiosity in a focused exploration using their senses and simple tools. Through observation, manipulation, and classification of common objects, children reflect on the similarities and differences of objects and begin to recognize how properties are important in the selection of materials for building and manufacturing tools we use every day.

The following lessons will narrow their focus of sorting objects by examining more defined properties, such as texture, flexibility, and floating and sinking of some materials.

### Considerations for Students With Special Needs, Diverse Backgrounds, and Emerging Bilingual Learners

Read *What Would Happen If?* aloud to students and have them follow along in the book. Ask a bilingual speaking student to translate or reread the story in Spanish or other language that is common in your classroom.

All prompts and passages should be read aloud, with repeated directions and checking for understanding prior to writing.

Students are asked to draw and write in their Student Journals. Students may benefit by working with a partner in the longer writing pieces. When developing their lists of materials and properties in Lesson 1A, students may benefit from developing the list as a whole group and allowing the students to choose the materials and properties from the whole group list. Students with an IEP should be allowed to dictate their ideas and answers.

This may be the first time students are asked to draw models and make the invisible, visible. Encourage students to draw what they are thinking and assure them that there are no wrong ideas when developing an initial model.

### Engage the Learner

This initial phase of learning activates prior knowledge regarding properties of matter and how properties influence materials we use to make things. Students make connections between what they have observed and the learning task. Before exploring properties of matter, the class is going to brainstorm

### ESTIMATED TIME

Lesson 1A: 45-50 minutes,  
2 classes

Lesson 1B: 45-50 minutes,  
2 classes

---

### LESSON LEVEL LEARNING GOALS

- Develop an initial understanding of how to identify properties and how they make things useful.

---

### MATERIALS NEEDED

#### For each student:

student pages

#### For each team of 2:

book: *What Would Happen If?*

#### For the class:

miscellaneous items

#### Teacher provides:

chart paper

markers

miscellaneous items (see  
Advance Preparation)

---

### PS1.A: STRUCTURE AND PROPERTIES OF MATTER

- Different kinds of matter exist, and many of them can be either solid or liquid, depending on temperature. **Matter can be described and classified by its observable properties.**
- **Different properties are suited to different purposes.**

# LESSON 1A

## TEACHING TIP

The term *matter* is addressed at a basic level for second-grade vocabulary. Matter is defined as what materials, things, or objects are made of at the macro level. The focus of the lessons is to explore the properties of matter, or the properties of different objects or things and how the properties of things are important in their function.

## READING

### KEY IDEAS AND DETAILS

**RI.1.1:** Ask and answer questions about key details in a text.

**RI.1.2:** Identify the main topic and retell key details of a text.

## FORMATIVE ASSESSMENT

Use the What We Think chart to assess students' initial understanding of properties of matter.

ideas about what they already know and have observed about how different objects are used in their daily lives.

## LESSON 1A: WHAT ARE OBJECTS MADE OF?

### Advance Preparation

Duplicate copies of the unit *Parent Letter* and *Activities To Do At Home* to be sent home.

Make a Describing Objects chart to record students' ideas about the properties of the objects in the reading (see example chart page 44).

Prepare a What We Think chart:

What We Think	Questions We Have	What We Did (Practices)	What We Figured Out (DCIs)	How Does That Help Us to Figure Out the Phenomenon?

Collect miscellaneous objects from the classroom for students to observe and investigate properties. Include items that may have more than one property or properties that are not obvious (e.g., water repellent, reflects light, texture, buoyancy, flexibility).

### Procedure

*Engage the learner.*

Ask the class what they think they will be exploring in a unit called *Solving Problems with Properties*. Ask students for their ideas about the meaning of the word properties. Ask: What do we mean when we say "properties of different objects and material"?

Introduce the book *What Would Happen If? A Story of a Mixed-up Day* to the class. Explain that the class will be using the story to help think about how properties of different materials help to make them useful. Decide on a reading strategy appropriate for your class.

Your students may benefit from reading the story in pairs and discussing the illustrations as they turn the pages. As a class, read and discuss the title of the story. Ask: Why do you think the author chose the title, *What Would Happen If? A Story of a Mixed-up Day*. Invite predictions about the title and the illustration on the cover. Do a "walk" through the story. Invite the students to make predictions about the main idea of the story. Set a purpose for reading the story.



The story, *What Would Happen If? A Story of a Mixed-up Day*, can be interactive and can evoke discussion as the properties of each material are evaluated. If you choose to read the story aloud to your class and have the students follow along as you read, stop and discuss the mystery that is encountered.

If you choose to have the students read the story in pairs, have the students read sections, stop, discuss, and continue reading. Join reading pairs to listen and observe their reading skills and how they interact when discussing the text and illustrations.

Conduct a class reading conference about the story. Tell the students that it may be helpful to make a chart and to keep a record of their ideas about properties as they read through the story.

*Explore the concept.*

Introduce the What We Think chart. Encourage the students to brainstorm and explain their initial ideas about the mixed-up properties of the materials in the story. Ask:

- Why do you think engineers are interested in knowing about properties of building materials?
- Can you think of an example of when it is important?
- What about the properties in Henry’s dream? Can someone explain how the properties of the pillow were “mixed-up”?
- Who can add to \_\_\_\_\_’s idea?
- What other objects had mixed-up properties? How do you know that? What properties should the \_\_\_\_\_ have to make it useful?

Record the students’ initial ideas about the meaning of the term *properties* and how they might investigate the properties of materials.

*Explain the concept and define the terms.*

Ask students to describe the different objects in the story and the problems with the properties of the materials they were made of. Write the terms the students use to describe the material along the top row of the chart. For example, if they mention “squishy” for foam rubber, write “squishy” as a property. Then ask students for their ideas of what properties should be used to make the objects more useful and write their terms on the chart. (Example: hammer-hard, rigid) Accept all reasonable responses and terms at this time.

### TEACHING TIP

In taking the time to identify and discuss the properties of different materials and developing their own properties chart, students gain a deeper understanding and have a need to attach vocabulary to their observations.

### PS1.A: STRUCTURE AND PROPERTIES OF MATTER

- Different kinds of matter exist, and many of them can be either solid or liquid, depending on temperature. **Matter can be described and classified by its observable properties.**
- **Different properties are suited to different purposes.**

### TEACHING TIP

Throughout the activities in the Teacher Guide, you will notice that specific student instructions from the Student Journal pages are italicized. Additional information for the teacher follows the italicized instructions in plain print.

# LESSON 1A

## MATHEMATICAL PRACTICES

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.

## OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.

- **Read grade-appropriate texts** and/or use media to obtain scientific and/or technical information **to determine patterns in and/or evidence about the natural and designed world(s).**
- **Describe how specific images (e.g., a diagram showing how a machine works) support a scientific or engineering idea.**
- **Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question and/or supporting a scientific claim.**

## TEACHING TIP

Save the Describing Objects chart to refer to in Lesson 6C.

Example Chart: Describing Objects

Object	hard	squishy	soft	flexible	rough	smooth	shiny
pillow		X	X	X		X	
metal	X					X	
t-shirt			X	X		X	
wood							
fork							
feathers							
hammer							
foam rubber							
bat							
cotton							
slide							
sandpaper							
dog's ball							

## Science Talk

After the students have completed their descriptions of the different objects from the reading, ask them to gather in a circle to share and discuss the purpose of each item and how the properties of the material that makes up the item are suitable for the purpose.

Ask:

- Can someone describe the best properties for a pillow? What properties would a pillow have if it suddenly turned to metal?
- Who can add to \_\_\_\_\_'s idea? Do the rest of you agree?
- What are the important properties of a hammer? Would the hammer be useful if it was made of foam rubber?
- Can someone think of another example of why the foam rubber hammer would not be useful?

As a class, analyze the chart and add properties that may not have been evident in the book. Have the class look around the classroom and look for other properties that they observe in different classroom objects. Discuss how the character in the story looked for patterns in his data from the day's mysteries.

Review the main idea of the story and the author's purpose for writing the story. Look for student ideas that relate to the importance of choosing the material that has properties that are best suited for the purpose of the object.

Elaborate on the concept/Evaluate the students understanding of the concept

Read the Journal Entry/Respond to Text prompt to the class.

### Pre-Writing Strategy: Science Talk

Divide the class into groups of four students. Give the groups sufficient time to orally discuss how they will respond to the prompt and listen to the ideas of others. Facilitate the Science Talk by circulating among the groups and listening to their ideas. To help the students elaborate on their ideas and construct explanations, ask:

- Why do you think that?
- How do you know?
- What do you mean when you say . . . ?
- Tell me more about . . .

### Journal Entry/Respond to Text

1. *Henry wanted to make a new bed for his dog, Rex. He wondered what would be the best material to use for a dog bed. List the material you think would be best for the dog bed.*
2. *Tell what properties Henry should think about before making the best bed. Write why you think the properties of material are important.*
3. *Draw a model of a dog bed you would make.*

### Formative Assessment

Use the Describing Objects chart, Journal Entry, and Science Talk to assess the students' initial ideas about the properties of material.

### TEACHING TIP

Science Talk is a conversation among students that allows them to have the opportunity to orally express their ideas and listen to the ideas of others. Allow sufficient time for each student to express ideas and opinions. Encourage student-led conversation in a circle. Conversations should be student-to-student with minimal teacher-led question and answer. (See Science Talk and Developing Effective Questions to Facilitate Science Talk in the Appendix, pp. 130-31)

### CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- **Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.**

### WRITING

**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.

**W.2.7:** Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).

# PLANNING

## LESSON 1B: WHAT ARE OBJECTS MADE OF?

### Teacher Background Information

This lesson introduces the engineering design challenge to the class. The challenge is introduced through the lens of the children’s story *The Three Little Pigs* and the choices they made in materials used to build their houses. This lesson also makes use of the What We Think chart to help students track their understanding and apply new knowledge to their engineering challenge.

### Considerations for Students With Special Needs, Diverse Backgrounds, and Emerging Bilingual Learners

In this lesson students are asked to write their ideas for an investigation and what they found out. Some students may find this task overwhelming and may benefit from a “write together” allowing students to contribute ideas that are written out for them to enter into their Student Journals. Students with an IEP should be allowed to dictate their ideas and answers.

### Advance Preparation

Prepare one aluminum pie pan with one of each item from the variety of items in the Sorting Bag for each group of 4 students. Use a pair of classroom scissors to cut the sponge into 8 equal pieces (one for each group of 4 students) and add one to each pie pan.

Prepare a *Word Sort Card* set for each group of 4 students (see Materials Needed).

Find a copy of the story *The Three Little Pigs* in your school library or on-line.

### Procedure

#### Engage the learner

Review the What We Think chart and the students’ initial ideas about properties and how engineers think about properties when designing things we use every day. Ask students to share their responses in the Journal Entry from the previous lesson.

Ask:

- What properties did you consider important for designing and making a dog bed?
- Can someone add to that idea?
- What other properties will make the bed more useful and comfortable for Rex?
- Can someone think of another object that they could design and build where properties are important?

### Materials Needed

#### For each student:

student pages

#### For each groups of 4:

1 aluminum pie pan  
one of each item from sorting bag (balloon, button, feather, rubber band, zip tie, bottle cap, rock, wooden ball, cork, nail, paper clip, bouncy ball, cotton ball, marble, packing peanut, sponge)

*Word Sort Card* set (property, color, size, shape, hard, soft, rough, smooth, texture)

#### For the class:

primary balance

centimeter/gram cubes

book: *Change It!*

story: *The Three Little Pigs*

#### Teacher provides:

chart paper

marker

scissors

story: *The Three Little Pigs*

---



---

### TEACHING TIP

If you are teaching this unit early in the school year, students may need assistance with writing the question they are investigating. Conduct a whole class conference regarding questions to investigate and reach a class consensus as to the appropriate question for their investigations.

---



---

### PATTERNS

- **Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.**

---



---

### MATERIAL MANAGEMENT

If you have sufficient space in your classroom, keep the pie pans with the sorting items together for use in following lessons.

# LESSON 1B

## CONSTRUCTING EXPLANATIONS AND DESIGNING SOLUTIONS

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- **Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.**

### TEACHING TIP

Display the primary balance and ask students what property they would be finding using the balance. Show the students how to measure the weight of the objects using the balance and gram cubes and how to compare the weight using two objects.

## PLANNING AND CARRYING OUT INVESTIGATIONS

Planning and carrying out investigations to answer questions or test solutions to problems in K-2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- **Plan and conduct investigations collaboratively to produce data to serve as the basis for evidence to answer a question.**

- Has anyone ever heard the story of *The Three Little Pigs*?
- Who can explain how properties might be important in that story?

Read the story, *The Three Little Pigs*.

Discuss the importance of the material each pig selected for building a house. Ask the students what properties were important in building a house that would keep the big hungry wolf out. Have students compare the straw, sticks, and bricks used by the pigs. Discuss real-life examples of when structures need to be able to hold up in wind, rain, and storms.

### Engineering Design Challenge:

Introduce the design challenge to the class. To help students think about the importance or properties of materials when designing structures and other objects, ask them to consider the material choices the pigs made in the story of *The Three Little Pigs*.

Review the students' initial ideas of the properties of the materials the pigs used that were useful and the properties that were not useful. Conduct a brainstorming session of other materials that the pigs might have used and how the lessons learned by the pigs can be used to help build structures in the real world.

Explain that the huffing and puffing of the wolf is a fairy tale, but there are conditions in nature that might blow a little house down.

Have students share experiences of when the wind blew very hard. Share experiences with trees swaying and sometimes limbs or trees falling in the heavy rain and wind. Discuss how engineers must build structures that will remain standing through wind, rain, and storms to make the structures safe and useful.

Read the challenge to the class:

You are a member of a team of engineers. Your challenge is to design a structure that will remain standing during a rain and wind storm. Your structure must also keep a figure placed inside the structure standing upright and dry.

*Explore the concept.*

Divide the class into groups of four. Tell students that they will be working in groups with a variety of objects in the pie pan. In their groups they are to work together to make observations to find out the properties of each item in the pan, determine the similarities and differences between the items and their properties, and consider which properties will be the most useful

in completing the design challenge. Distribute one aluminum pie pan with items to each group.

Read the instructions in the Student Journal to the class. Ask students if they have questions regarding their investigation. Remind students that when scientists investigate they begin by asking a question they would like to answer, make observations, collect and record their information, and discuss, compare, and summarize what they found.

*Investigating Properties:*

*How can we identify the properties of different things?*

*How can properties be used to sort a variety of things?*

*How can properties be used to choose materials to use to build other things?*

*You and your team have been given a pan with a variety of things. Work together to plan and conduct an investigation to describe and sort the different things by the properties you can see.*

*As a class, develop the question, what they already know, what they think they will find and record their investigation and observations in the student journal.*

1. *Write the question you are investigating.*
2. *Write what you already know about properties.*
3. *Write what you think you will find.*
4. *Use the materials in the pan.*
5. *Draw and write how you will set up your investigation.*
6. *Draw how you sorted the things in the pan.*
7. *Write what you found.*

Facilitate the activity by circulating among the teams. To check student progress and help them elaborate on their explanations, ask:

- Can someone explain how you have described and sorted your objects so far?
- Why did you decide to sort your objects by \_\_\_\_\_?
- Can you think of another way to sort them that would work?
- What do all the items in the bag have in common? Do they have any similar properties?
- What properties would be useful for building a structure in our design challenge? What makes you think that?

## PS1.A: STRUCTURE AND PROPERTIES OF MATTER

- Different kinds of matter exist, and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.
- Different properties are suited to different purposes.

### TEACHING TIP

Students may become confused with flexibility and keeping its shape. Use the rubber band as a demonstration of a solid that is also flexible.

### MATHEMATICAL PRACTICES

4. Model with mathematics.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

### SCIENCE TALK

Science talk is a critical component of science lessons. Science talk provides an avenue for the exploration of ideas and exchange of points of view, and is intellectually and academically challenging. Science talk is not an add-on to the lesson and provides academically productive talk that is critical for learning in science. (See Science Talk in the Appendix pp. 130-31.)

# LESSON 1B

## PATTERNS

- Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.

## LANGUAGE STANDARDS KNOWLEDGE OF LANGUAGE

L.2.3: Use knowledge of language and its conventions when writing, speaking reading, or listening.

L.2.6: Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using adjectives and adverbs to describe (e.g., When other kids are happy that makes me happy).

## TEACHING TIP

Be sure to include the list of properties they used for sorting: color, size, shape, texture, weight, hard/soft, etc. Inform the class that they will revisit their early ideas about properties and make adjustments to their charts as they gain new information.

To help students collectively make sense of sorting by properties, ask:

- What do you think about what \_\_\_\_\_ said?
- Does anyone else in the group know of a different way to sort the objects?
- Do you understand what \_\_\_\_\_ is saying?
- Can you explain why your plan makes sense?

As you visit the teams and they have sorted the objects one way, encourage them to choose a different way to sort the objects based on other similarities. Check to see if they are using descriptions and sorting categories that include: color, shape, size, feel (texture), weight (heavy/light), and hard/soft.

If some teams have completed their sorting, encourage them to visit other teams and compare their sorting ideas. Check for early understanding that they are all solids and ask how they know they are solids.

## Science Talk

*Explain the concept and define the terms.*

After the students have completed their exploration of sorting objects, have the students bring their Student Journals and sit in a circle to discuss their findings. Ask groups to volunteer to explain to the class one way they sorted the objects. Ask:

- Did anyone sort the object in a different way? Can you say more about that?
- What do you notice about choosing a property to sort objects by?
- Is there more than one way?
- Is there one property that can be used to describe all the objects you sorted?
- Can someone add to that idea?
- What do all the items have in common? Is there a pattern to our sorting that can help us find a common property among these items?
- What properties did you use to sort the balloon? What other items could you add to that category?
- Would it be helpful to make a list of the different categories the groups used to sort the items?

Listen for students to mention the term solid as a property that can be used to describe all the items in the bag. Hold up two different items and ask the class what they have in common.



Draw out ideas that the items have weight and take up space. Place the items on the balance and measure the weight of selected items. Even the cotton ball and feather have weight. Place several cotton balls on the balance and weigh them as a group and discuss if 10 cotton balls have weight, does one cotton ball have weight?

Write the terms *solid* and *property* on the board. Develop a class definition for the terms and have students write and/or draw their definitions in the Key Terms section of the Student Journal.

Revisit the What We Think chart. Record students' new and revised ideas in the What We Think column and additional questions they have, what they did, and what they figured out. Ask students if sorting and identifying properties gives them information to solve the engineering challenge.

*Elaborate on the concept.*

Introduce the book *Change It! Solids, Liquids, Gases, and You*. Ask students to predict what the book is about and how it might help them to learn more about properties of different objects. Explain that you will be using the book to learn more about properties and solids.

Divide the class into reading teams of two students and distribute a copy of *Change It! Solids, Liquids, Gases, and You*. Students can follow along as you read the book to them, or read as partners or in small reading groups. As a class, read and discuss the title of the book.

Ask: Why do you think the author chose the title, *Change It! Solids, Liquids, Gases, and You*?

Invite predictions about the title of the book. Do a "walk" through the book. Invite the students to make predictions about the main idea of the book. Explain that they will be reading the first section of the book on solids (pages 4-9) and will continue to use the book as they explore liquids later in the unit. Set a purpose for reading the book.

Decide on the reading strategy appropriate for your class. If you choose to read the book aloud to your class, have the reading teams follow along as you read. If you choose to have the students read the book in a group reading conference, join reading pairs to listen and observe their reading skills.

## READING

### KEY IDEAS AND DETAILS

RI.2.1: Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.

RI.2.2: Identify the main topic of a multi-paragraph text as well as the focus of specific paragraphs within the text.

RI.2.3: Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.

### CRAFT AND STRUCTURE

RI.2.4: Determine the meaning of words and phrases in a text relevant to a grade 2 topic or subject area.

RI.2.6: Identify the main purpose of a text, including what the author wants to answer, explain, or describe.

## OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.

- **Read grade-appropriate texts** and/or use media to obtain scientific and/or technical information **to determine patterns in and/or evidence about the natural and designed world(s).**
- **Describe how specific images (e.g., a diagram showing how a machine works) support a scientific or engineering idea.**
- **Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question and/or supporting a scientific claim.**

# LESSON 1B

## PS1.A: STRUCTURE AND PROPERTIES OF MATTER

- Different kinds of matter exist, and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.
- Different properties are suited to different purposes.

### EXTENSION/HOMEWORK

Have the students choose one room in their home that has tools or items with a specific purpose (kitchen, workroom, den) and select several items from that room and make a chart that lists the items and the properties of the items.

Assist the students with problem solving using decoding skills, context clues, and phonics. Provide reinforcement and encouragement when appropriate. Prompt as necessary.

Conduct a whole-class reading conference. Reread different sections of the text and revisit different illustrations.

Examples of text revisited or discussion points for a read-aloud:

- Pp. 4: The term matter is introduced for the first time in the unit. Ask a student to retell or explain the term and give examples from around the room. Ask students if the items they described and sorted from the pie pan fit the description of matter. Ask them to justify their reasoning.
- Write the term matter on the board next to the term solid.
- Pp. 6-7: Ask a student to explain the term solid in their own words and make a list of the solids that they see in the illustrations.
- Pp. 8-9: Ask students to relate the ability to change the shape of the clay to any items in the sorting pan and what they have discovered about flexibility.

As a class, discuss the meaning of the terms *matter* and *solid*. After the class is satisfied with their definitions, have them write and revise the definitions in the Key Terms of their Student Journal.

### Science Talk

*Evaluate the students' understanding of the concept.*

As a class, develop a statement that can be applied to all solids.

Example statements:

*Solids keep their shape unless an outside force is applied.*

*Solids take up space.*

Read the class statements and have the students test to see that they apply to all the items in the pie pan. Discuss how solids that are flexible can change shape when there is a force applied to make the shape change and that the original shape can be restored.

Return to the What We Think chart and review students original thinking about properties and how properties make things useful. Ask if students have additional questions, record what they did and what they figured out on the chart. Ask students if they have gained ideas for solving the Engineering Design challenge.

**Pre-Writing Strategy: Science Talk**

Read the Journal Entry prompt to the class. Ask the students to discuss the prompt in groups of four and orally express what they are going to write before entering their ideas on paper. Encourage students to work in teams and collaborate while writing the response in the Student Journal.

**Journal Entry**

*Choose one thing from the sorting bag. Write the name of the thing.* \_\_\_\_\_

*Make a list of the properties.*

*Tell if the thing might be useful in building a structure that can stay together in the wind and rain.*

**Assessment: Formative**

Use the Journal Entry and Science Talk to assess the students' ability to classify objects by their properties.

Use the Activity Page and Science Talk to assess the students' understanding that properties are suitable for different purposes.

## ENGINEERING DESIGN PROCESS

---

The Engineering Design Process provides students with a series of steps to guide them as they solve problems and design and test products, models, and solutions. The process is cyclical, yet not necessarily in an order. Students are encouraged to evaluate as they progress through the process, revisit the mission often, and revise thinking and their plan multiple times as the process unfolds.

Engineers do not always follow the Engineering Design Process steps in order, one after another. It is very common to design something, test it, find a problem, and then go back to an earlier step to make a modification or change the design. Engineers must always keep in mind the mission or problem they are trying to solve and the limitations (cost, time, material, etc.) that are part of the solution to the problem. Two key elements in working as an engineer are teamwork and design-test-and-redesign.

### **Mission**

- Defines the problem and what the engineers are trying to design or build.
- Describes the limitations within which the engineers must solve the problem.

### **Brainstorm Ideas**

- Imagine, discuss, and sketch possible solutions.
- Conduct research into what has already been done.
- Discover what materials are available, time frame, and other limitations.

### **Plan and Design**

- Draw and write a plan.
- Design your solution through drawing and manipulating materials.
- Develop a plan or steps and a schedule.

### **Build**

- Construct your engineering device or project.
- Follow your plan.
- Adjust and test along the way.

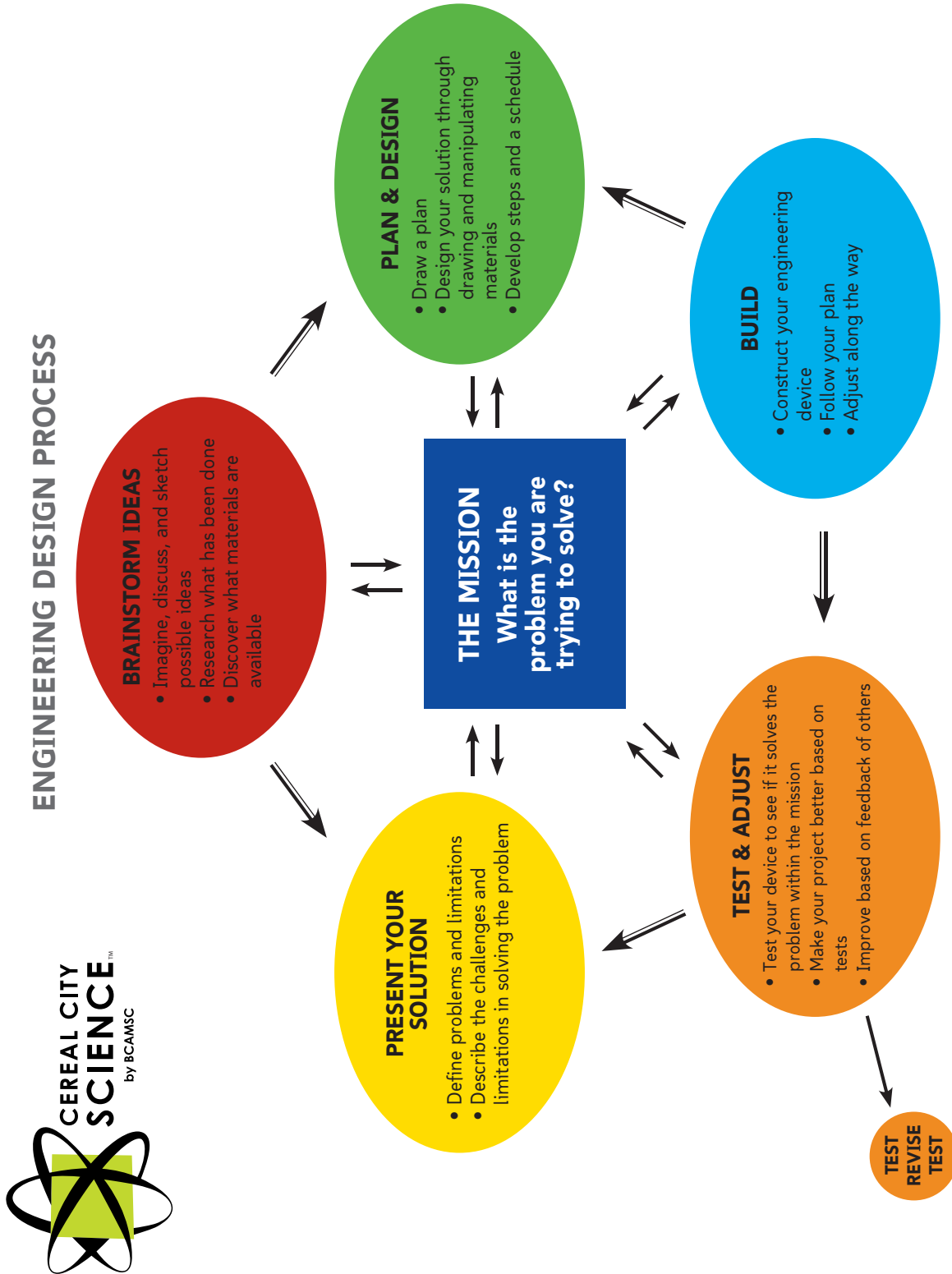
### **Test and Adjust**

- Test your device to see if it solves the problem within the mission and limitations.
- Make your project better based on tests: Test → Revise → Test.
- Improve based on feedback of others.

### **Present Your Solution**

- Demonstrate how your solution solves the problem.
- Define problems and limitations.
- Describe the challenges and limitations in solving the problem.
- Describe additional revisions that could improve the device or project.

**ENGINEERING DESIGN PROCESS**



*by Battle Creek Area Mathematics and Science Center  
Cereal City Science  
Adopted from the Carnegie Mellon Robotics Academy*







CEREAL CITY  
SCIENCE™  
by BCAMSC

Student Journal  
2.PS.NGSS

# Solving Problems with Properties 2PNG



S E C O N D   E D I T I O N

A second grade unit supporting Next Generation Science Standards  
and Michigan Science Standards

Name: \_\_\_\_\_





Name \_\_\_\_\_

Date \_\_\_\_\_

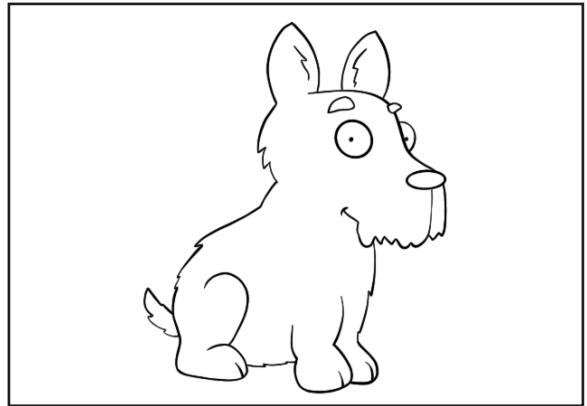
R E S P O N D T O  
T E X T

What Are Objects  
Made Of?

1A



1. Henry wanted to make a new bed for his dog, Rex. He wondered what would be the best material to use for a dog bed. List the material you think would be best for the dog bed.



Dog bed material:

Handwriting practice lines consisting of solid top and bottom lines with a dashed middle line, repeated multiple times for writing the answer.



Name \_\_\_\_\_

Date \_\_\_\_\_

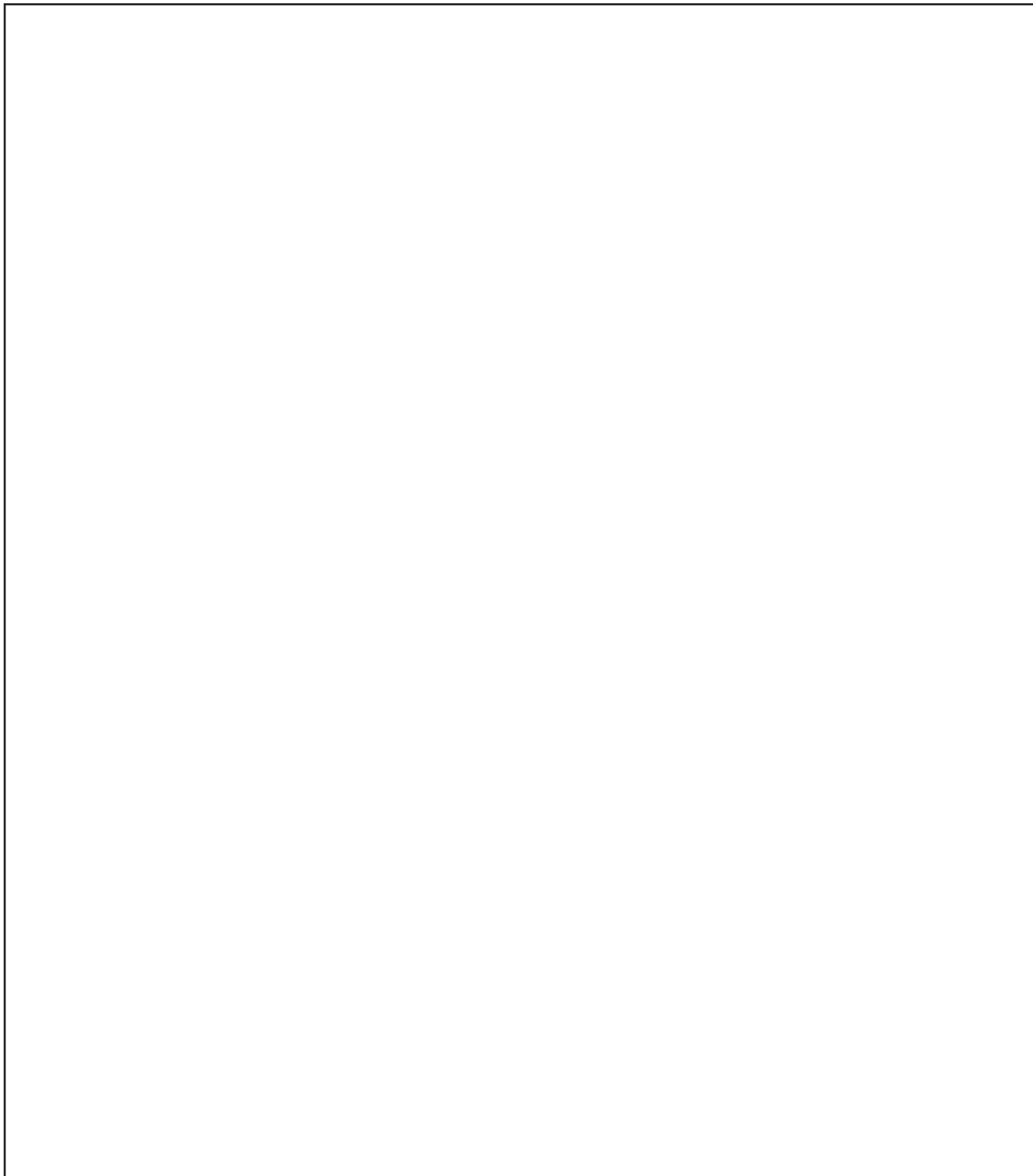
R E S P O N D T O  
T E X T

What Are Objects  
Made Of?

**1A**

.....

3. Draw a model of a dog bed you would make.



# 1B

## A C T I V I T Y

### What Are Objects Made Of?

Name \_\_\_\_\_

Date \_\_\_\_\_



### Investigating Properties

How can we identify the properties of different things? How can properties be used to sort a variety of things? How can properties be used to choose materials to use to build other things?

You and your team have been given a pan with a variety of things. Work together to plan and conduct an investigation to describe and sort the different things by the properties you can see.

1. Write the question you are investigating.

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

Name \_\_\_\_\_

Date \_\_\_\_\_

.....

2. Write what you already know about properties.

Handwriting practice lines for step 2, consisting of four sets of solid top and bottom lines with a dashed midline.

3. Write what you think you will find.

Handwriting practice lines for step 3, consisting of four sets of solid top and bottom lines with a dashed midline.

# 1B

## A C T I V I T Y

### What Are Objects Made Of?

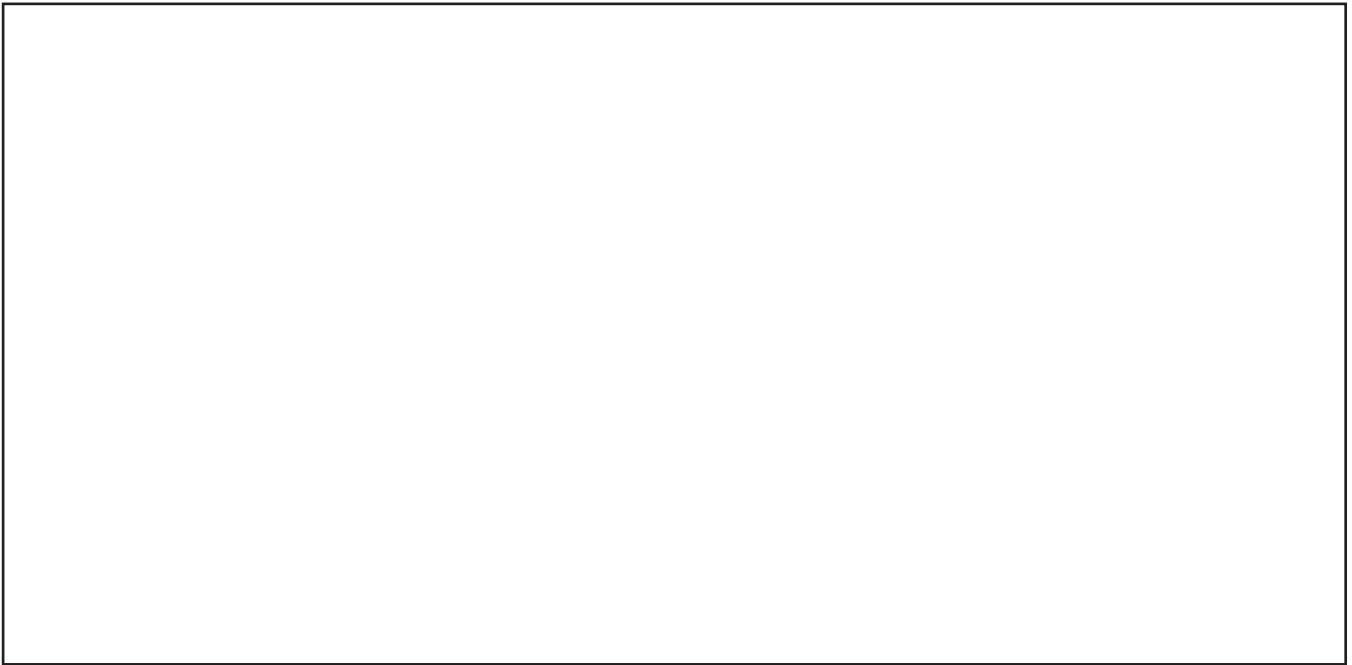
Name \_\_\_\_\_

Date \_\_\_\_\_

.....

4. Use the materials in the pan.

5. Draw and write how you will set up your investigation.



.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Name \_\_\_\_\_

Date \_\_\_\_\_

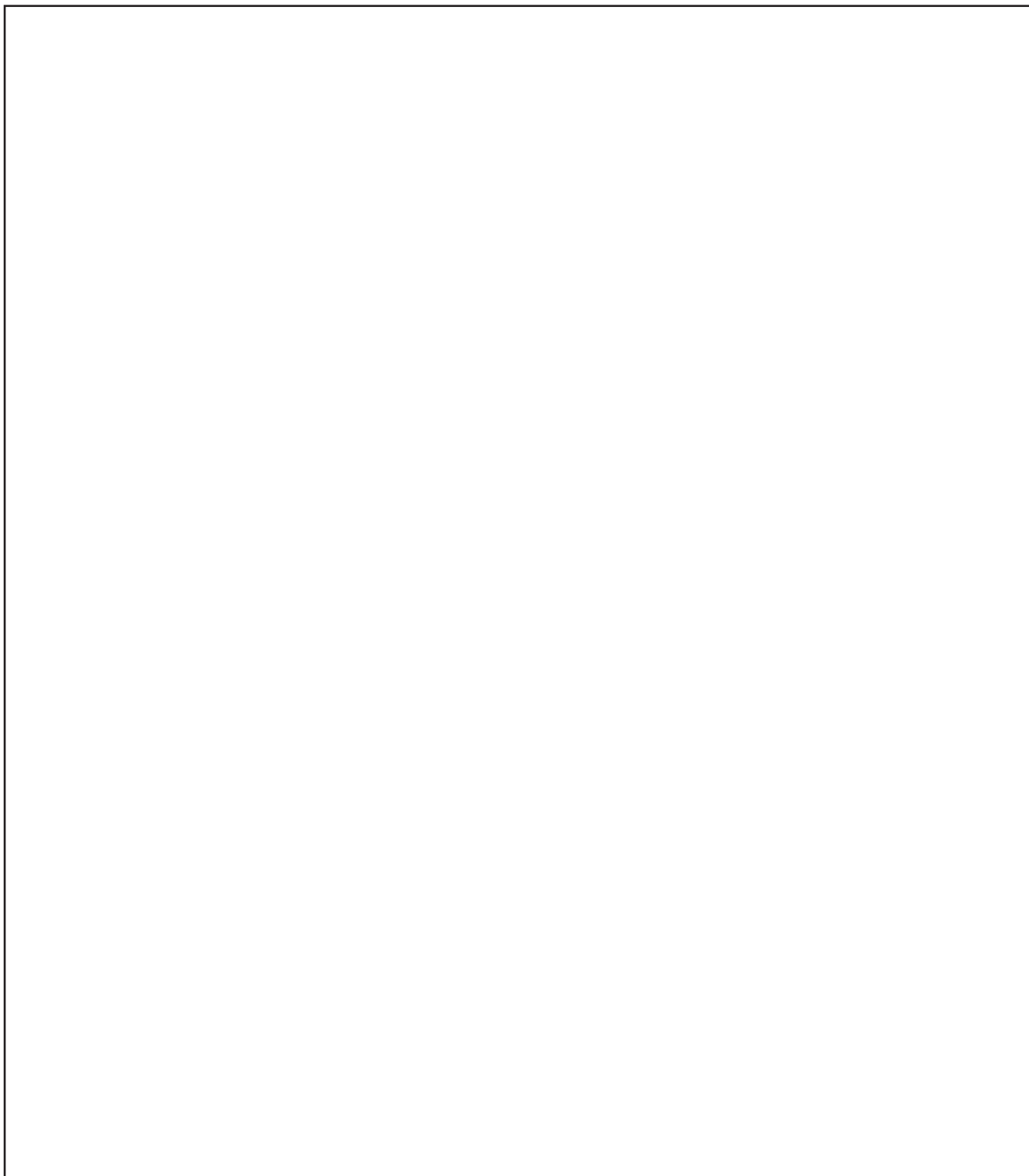
A C T I V I T Y

What Are Objects  
Made Of?

**1B**

.....

6. Draw how you sorted the things in the pan.



# 1B

A C T I V I T Y

## What Are Objects Made Of?

Name \_\_\_\_\_

Date \_\_\_\_\_

.....

7. Write what you found.

Handwriting practice lines consisting of solid top and bottom lines with a dashed middle line. There are 10 sets of these lines provided for writing.



Name \_\_\_\_\_

Date \_\_\_\_\_

.....

1. Choose one thing from the sorting bag. Write the name of the thing. \_\_\_\_\_

2. Make a list of the properties.

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

3. Tell if the thing might be useful in building a structure that can stay together in the wind and rain.

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

\_\_\_\_\_

-----

K E Y T E R M S

Name \_\_\_\_\_

Date \_\_\_\_\_

.....

Handwriting practice lines consisting of solid top and bottom lines with a dashed midline, repeated multiple times.