SCIENCE Grade 2
Unit: Properties of Matter
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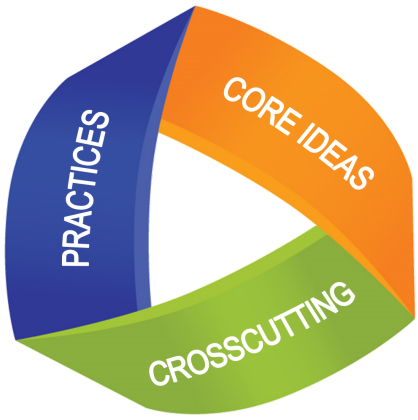
SOUTH WINDSOR PUBLIC SCHOOLS K-12 SCIENCE PROGRAM

The South Windsor science program adheres to the beliefs and standards articulated by the National Research Council (NRC) of the National Academy of Sciences in A Framework for K-12 Science Education,, which was used to write the next Generation Science Standards. "The Framework provides a sound, evidence-based foundation for standards by drawing on current scientific research—including research on the ways students learn science effectively—and identifies the science all K–12 students should know."

The overarching goal of the science department is for all students to have sufficient knowledge of science and the engineering process by the time they graduate highschool so that they can engage in public discussions on science-related issues, be careful consumers of scientific and technical information, and enter the careers of their choosing. The major goals of the science curriculum are as follows:

- To implement a guaranteed and viable district science curriculum that is aligned with learning expectations set forth in the Connecticut Core Science Curriculum Framework and the Next Generation Science Standards that helps children continually build on and revise their knowledge and abilities, starting from their curiosity about what they see around them and their initial conceptions about how the world works.
- To achieve scientific literacy preparing students to be confident and capable lifelong learners who are equipped with the skills needed to access, understand, evaluate and apply information and present coherent ideas about science, integrating common core science literacy skills into the curriculum.
- To develop a thorough understanding of scientific explanations of the world through experimentation of the disciplinary core ideas and applying these understandings to solve environmental and societal challenges.
- To foster each student's understanding and use of technology and engineering, including the ability to assess the relevance and credibility of scientific information found in various print and electronic media.

As written on the nextgensciece.org website, the National Research Council's (NRC) *Framework* describes a vision of what it means to be proficient in science; it rests on a view of science as both a body of knowledge and an evidence-based, model and theory building enterprise that continually extends, refines, and revises knowledge. It presents three dimensions that will be combined to form each standard:



Dimension 1: Practices

The practices describe behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of engineering practices that engineers use as they design and build models and systems. The NRC uses the term practices instead of a term like "skills" to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Part of the NRC's intent is to better explain and extend what is meant by "inquiry" in science and the range of cognitive, social, and physical practices that it requires. Although engineering design is similar to scientific inquiry, there are significant differences. For example, scientific inquiry involves the formulation of a question that can be answered through investigation, while engineering design involves the formulation of a problem that can be solved through design. Strengthening the engineering aspects of the

Next Generation Science Standards will clarify for students the relevance of science, technology, engineering and mathematics (the four STEM fields) to everyday life.

Dimension 2: Crosscutting Concepts

Crosscutting concepts have application across all domains of science. As such, they are a way of linking the different domains of science. They include: Patterns, similarity, and diversity; Cause and effect; Scale, proportion and quantity; Systems and system models; Energy and matter; Structure and function; Stability and change. The Framework emphasizes that these concepts need to be made explicit for students because they provide an organizational schema for interrelating knowledge from various science fields into a coherent and scientifically-based view of the world.

Dimension 3: Disciplinary Core Ideas

Disciplinary core ideas have the power to focus K–12 science curriculum, instruction and assessments on the most important aspects of science. To be considered core, the ideas should meet at least two of the following criteria and ideally all four:

- Have **broad importance** across multiple sciences or engineering disciplines or be a **key organizing concept** of a single discipline;
- Provide a **key tool** for understanding or investigating more complex ideas and solving problems;
- Relate to the **interests and life experiences of students** or be connected to **societal or personal concerns** that require scientific or technological knowledge;
- Be **teachable** and **learnable** over multiple grades at increasing levels of depth and sophistication.

Disciplinary ideas are grouped in four domains: the physical sciences; the life sciences; the earth and space sciences; and engineering, technology and applications of science.

In response to the shifts found within the Next Generation Science Standards, science units at each grade level begin with an anchoring phenomena to elicit student questions that will drive the instruction for the disciplinary core ideas presented in the unit. The performance expectations are bundled so that students can make real life connections that apply to what they are learning. The coherence of the science and engineering practices and crosscutting concepts are present in all units so that students are able to form their own ideas surrounding the anchoring phenomena. A wide range of age appropriate inquiry based science investigations build on the student's existing knowledge and encourages collaboration. It is our hope that through this process all students will gain an understanding and appreciation for science in our ever changing world.

K-2 Next Generation Science Standards: Science and Engineering Practices Summary

Science and Engineering Practice	K – 2
Asking Questions and Defining Problems Asking questions and defining problems in K-2 builds on prior experiences and progresses to simple descriptive questions that can be tested.	● Ask questions based on observations to find more information about the natural and/or designed world(s). ● Ask and/or identify questions that can be answered by an investigation. ● Define a simple problem that can be solved through the development of a new or improved object or tool.
Developing and Using Models Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.	● Distinguish between a model and the actual object, process, and/or events the model represents. ● Compare models to identify common features and differences. ● Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s). ● Develop a simple model based on evidence to represent a proposed object or tool.
Planning and Carrying Out Investigations K–2 students focus on simple investigations, based on fair tests, which provide data to support explanations or design solutions.	● With guidance, plan and conduct an investigation in collaboration with peers (for K). ● Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. ● Evaluate different ways of observing and/or measuring a phenomenon to determine which way can answer a question. ● Make observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons. ● Make predictions based on prior experiences. ● Make observations (firsthand or from media) and/or measurements of a proposed object or tool or solution to determine if it solves a problem or meets a goal.
Analyzing and Interpreting Data K–2 focuses on collecting, recording, and sharing observations from simple investigations.	● Record information (observations, thoughts, and ideas). ● Use and share pictures, drawings, and/or writings of observations. ● Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems. ● Compare predictions (based on prior experiences) to what occurred (observable events). ● Analyze data from tests of an object or tool to determine if it works as intended.

Using Mathematics and Computational Thinking K–2 students learn that mathematics can be used to describe the natural and designed world(s).	● Decide when to use qualitative vs. quantitative data. ● Use counting and numbers to identify and describe patterns in the natural and designed world(s). ● Describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs. ● Use quantitative data to compare two alternative solutions to a problem.
Constructing Explanations and Designing Solutions K-2 students use evidence and ideas to construct evidence-based accounts of natural phenomena and designing solutions.	● Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena. ● Use tools and/or materials to design and/or build a device that solves a specific problem or a solution to a specific problem. ● Generate and/or compare multiple solutions to a problem.
Engaging in Argument from Evidence K-2 focuses on comparing ideas and representations about the natural and designed world.	● Identify arguments that are supported by evidence. ● Distinguish between explanations that account for all gathered evidence and those that do not. ● Analyze why some evidence is relevant to a scientific question and some is not. ● Distinguish between opinions and evidence in one's own explanations. ● Listen actively to arguments to indicate agreement or disagreement based on evidence, and/or to retell the main points of the argument. ● Construct an argument with evidence to support a claim. ● Make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence.
Obtaining, Evaluating and Communicating Information K–2 students use 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. ● Communicate information or design ideas and/or solutions with others in oral and/or written forms using models, drawings, writing, or numbers that provide detail about scientific ideas, practices, and/or design ideas.

K-2 Next Generation Science Standard Cross Cutting Concepts Summary

Cross Cutting Concepts	K – 2
Patterns Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.	● Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.
Cause and Effect: Mechanism and Prediction Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.	● Events have causes that generate observable patterns. ● Simple tests can be designed to gather evidence to support or refute student ideas about causes.
Scale, Proportion, and Quantity In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.	● Relative scales allow objects and events to be compared and described (e.g., bigger and smaller; hotter and colder; faster and slower). ● Standard units are used to measure length.
Systems and System Models A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.	● Objects and organisms can be described in terms of their parts. ● Systems in the natural and designed world have parts that work together.
Energy and Matter: Flows, Cycles, and Conservation tracking energy and matter flows, into, out of, and within systems helps one understand their system's behavior.	● Objects may break into smaller pieces, be put together into larger pieces, or change shapes.
Structure and Function The way an object is shaped or structured determines many of its properties and functions.	● The shape and stability of structures of natural and designed objects are related to their function(s).
Stability and Change For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.	● Some things stay the same while other things change. ● Things may change slowly or rapidly.

The 5E Model of Instruction

5E Definition	Teacher Behavior	Student Behavior
Engage		
• Generate interest • Access prior knowledge • Connect to past knowledge • Set parameters of the focus • Frame the idea	• Motivates • Creates interest • Taps into what students know or think about the topic • Raises questions and encourages responses	• Attentive in listening • Ask questions • Demonstrates interest in the lesson • Responds to questions demonstrating their own entry point of understanding
Explore		
• Experience key concepts • Discover new skills • Probe, inquire, and question experiences • Examine their thinking • Establish relationships and understanding	• Acts as a facilitator • Observes and listens to students as they interact • Asks good inquiry-oriented questions • Provides time for students to think and to reflect • Encourages cooperative learning	• Conducts activities, predicts, and forms hypotheses or makes generalizations • Becomes a good listener • Shares ideas and suspends judgment • Records observations and/or generalizations • Discusses tentative alternatives
Explain		
• Connect prior knowledge and background to new discoveries • Communicate new understandings • Connect informal language to formal language	• Encourages students to explain their observations and findings in their own words • Provides definitions, new words, and explanations • Listens and builds upon discussion form students • Asks for clarification and justification • Accepts all reasonable responses	• Explains, listens, defines, and questions • Uses previous observations and findings • Provides reasonable responses to questions • Interacts in a positive, supportive manner
Extend/Elaborate		
• Apply new learning to a new or similar situation • Extend and explain concept being explored • Communicate new understanding with formal language	• Uses previously learned information as a vehicle to enhance additional learning • Encourages students to apply or extend the new concepts and skills • Encourages students to use terms and definitions previously acquired	• Applies new terms and definitions • Uses previous information to probe, ask questions, and make reasonable judgments • Provides reasonable conclusions and solutions • Records observations, explanations, and solutions
Evaluate		
• Assess understanding (Self, peer and teacher evaluation) • Demonstrate understanding of new concept by observation or open-ended response • Apply within problem situation • Show evidence of accomplishment	• Observes student behaviors as they explore and apply new concepts and skills • Assesses students' knowledge and skills • Encourages students to assess their own learning • Asks open-ended questions	• Demonstrates an understanding or knowledge of concepts and skills • Evaluates his/her own progress • Answers open-ended questions • Provides reasonable responses and explanations to events or phenomena

Based on the 5E Instructional Model presented by Dr. Jim Barufaldi at the Eisenhower Science Collaborative Conference in Austin, Texas, July 2002.

SOUTH WINDSOR PUBLIC SCHOOLS GRADE 2 SCOPE AND SEQUENCE

	UNIT 1	UNIT 2	UNIT 3
Unit Title	**Properties of Matter**	**Erosion and Landforms**	**Relationships in Ecosystems**
Suggested Time Frame	**Trimester 1 Approximately 17-20 40 minute class periods**	**Trimester 2**	**Trimester 3**
Performance Expectations	**2-PS1-1: Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.** **2-PS1-2: Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.** **2-PS1-3: Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.** **2-PS1-4: Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.** **K-2-ETS1-2: Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as need to solve a given a problem.**	**2-ESS1-1: Use information from several sources to provide evidence that Earth events can occur quickly or slowly.** **2-ESS2-1: Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land. *(directly addressed in PLTW)*** **2-ESS2-2: Develop a model to represent the shapes and kinds of land and bodies of water in an area.** **2-ESS2-3: Obtain information to identify where water is found on Earth and that it can be solid or liquid.** **K-2-ETS1-3: Analyze data from tests of two objects designed to solve the same problem to compare the strength and weaknesses of how each performs.**	**2-LS2-1: Plan and conduct an investigation to determine if plants need sunlight and water to grow.** **2-LS2-2: Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants. *(directly addressed in PLTW)*** **2-LS4-1: Make observations of plants and animals to compare the diversity of life in different habitats.** **K-2-ETS1-2: Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as need to solve a given a problem.**
Disciplinary Core Ideas	**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. (2-PS1-1) ● Different properties are suited to different purposes. (2-PS1-2),(2-PS1-3) ● A great variety of objects can be built up from a small set of pieces. (2-PS1-3)	**ESS1.C ESS2.A ESS2.B ESS2.C ETS1.C**	**LS2.A LS4.D ETS1.B**

	PS1.B: Chemical Reactions ● Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4) **ETS1.B: Developing Possible Solutions** ● Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2-ETS1-2)		
Essential Questions	**1. How are materials similar and different from one another?** **2. How do the properties of the materials relate to their use?**		
Common Assessment(s)	**Student Journal Responses**		
Engineering Design Lesson/ Performance Task	**Developing Possible Solutions: Design a spaceship to land on planet Oobleck**	**Optimizing the Design solution NEED TO ADD**	**Developing Possible Solutions: Designing Hand Pollinators**
ELA Connection	**N/A**		**Unit 6: Observing my world (March-May)**
Supporting ELA Standards	**RI.2.1** **RI.2.3** **RI.2.8** **W.2.1** **W.2.7** **W.2.8**	**RI.2.1** **RI.2.3** **W.2.6** **W.2.7** **W.2.8** **SL.2.2** **RI.2.9** **SL.2.5**	**W.2.7** **W.2.8** **SL.2.5**
Supporting Math Standards	**MP.2** **MP.4** **MP.5** **2.MD.D.10**	**MP.2** **MP.4** **MP.5** **2.NBT.A** **2.NBT.A.3** **2.MD.B.5**	**MP.2** **MP.4** **MP.5** **2.MD.D.10**

SOUTH WINDSOR PUBLIC SCHOOLS- GRADE 2 PROPERTIES OF MATTER UBD:

STAGE 1: IDENTIFY DESIRED RESULTS

Content Standard(s)
Generalizations about what students should know and be able to do

Content Topic: Human Sustainability Activities
Matter and its Interactions

Anchoring Phenomenon/Design Problem:

Oobleck Observations and Student Created Driving Questions

Performance Expectations:

- PS1.1 **Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.**[Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.
- PS1.2 **Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.*** [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.] [*Assessment Boundary: Assessment of quantitative measurements is limited to length.*]
- PS1.3 **Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.** [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]
- PS1.4 **Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.** [Clarification Statement: 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 heating paper.]

Science and Engineering Practices "What Students Do"	Disciplinary Core Ideas "What Students Know"	Cross Cutting Concepts "How Students think"
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 an investigation collaboratively	**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. (2-PS1-1)	**Patterns** ● Patterns in the natural and human designed world can be observed. (2-PS1-1) **Cause and Effect** ● Events have causes that generate observable patterns. (2-PS1-4)

to produce data to serve as the basis for evidence to answer a question.(2-PS1-1) **Analyzing and Interpreting Data** Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. ● Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2) **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. (2-PS1-3) **Engaging in Argument from Evidence** 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). ● Construct an argument with evidence to support a claim. (2-PS1-4) - **Connections to Nature of Science** **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** ● Science searches for cause and effect relationships to explain natural events. (2-PS1-4)	● Different properties are suited to different purposes. (2-PS1-2),(2-PS1-3) ● A great variety of objects can be built up from a small set of pieces. (2-PS1-3) **PS1.B: Chemical Reactions** ● Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4)	● Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-PS1-2) **Energy and Matter** ● Objects may break into smaller pieces and be put together into larger pieces, or change shapes. (2-PS1-3) - - - - - - - - - - - - - - - - - - - **Connections to Engineering, Technology, and Applications of Science** **Influence of Engineering, Technology, and Science, on Society and the Natural World** ● Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world. (2-PS1-2)

Enduring Understandings *Insights gained from exploring generalizations via the essential questions (Students will understand THAT…)*	**Essential Questions** **Inquiry used to explore generalizations** *(comes from or is modified from the Framework)*
● Students will understand that materials have similarities and differences to each other. ● Students will understand that the properties of materials are are related to their uses.	● How are materials similar and different from one another? ● How do the properties of the materials relate to their use?

Knowledge (vocabulary) and Skills

What students are expected to know and be able to do?

- Matter
- Observable
- Properties
- Natural
- manufactured
- Solid
- Liquid
- reversible

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 an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.(2-PS1-1)

Analyzing and Interpreting Data

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.

- Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2)

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. (2-PS1-3)

Engaging in Argument from Evidence

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).

- Construct an argument with evidence to support a claim. (2-PS1-4)

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Connections to Nature of Science

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- Science searches for cause and effect relationships to explain natural events. (2-PS1-4)

Anchoring Phenomenon/Storyline

Carefully describe how the anchoring phenomena will be used to engage students. *(You may embed a link to the phenomenon here, if available)* *Explain how each of the learning sequences explain the phenomena to build a coherent unit.*
Looking at already created *Oobleck,* students will generate driving questions based upon their observations. Examples of student questions may include: 1. What is this? (connects with learning sequences 1 and 2) 2. Is this a solid or a liquid? (connects with learning sequences 2 and 5) 3. What is its purpose? (connects with learning sequence 4) 4. Why does it roll into a ball, then 'melt'? (connects with learning sequence 3) Looking at already created *Oobleck,* students will determine whether they feel the *Oobleck* is a solid or liquid providing evidence for their thinking.

STAGE 2: DETERMINE ACCEPTABLE EVIDENCE

Performance Task(s) Authentic application in new context to evaluate student achievement of desired results designed according to GRASPS *(Goal, Role, Audience, Setting Performance, Standards)*	**Other Evidence** *Application that is functional in a classroom context only to evaluate student achievement of desired results*
Goal/Audience: Devise a ship using materials given that won't sink on *Planet Oobleck* **Role:** Aerospace Engineers **Situation**: You are traveling to *Planet Oobleck* to study its properties of matter. You will need to land safely on the planet, allowing yourself the ability to exit the craft without it sinking. How will you plan, devise, and create an aircraft that will be able to land safely on *Planet Oobleck* without sinking. **Product/Purpose:** The aircraft **Criteria/Evaluation**: Rubric that outlines the successes for the ship's ability to float (and for how long). (2-PS1-1) ***See learning sequence 6	• Student Journals, • Formative Assessments, • Reflections, • Evidence based discussions/arguments, (2-PS1-3, 2-PS1-4) • Classification of properties investigation (2-PS 1-1) • End of Unit Test

STAGE 3: LEARNING PLAN/STORYLINE

Bold items are common to the grade level (MUST DO's)
(Use "Building Coherence Templates" to construct plan prior to writing out final storyline)

See learning sequences below...

Learning Sequence/Lesson 1 DCI Content Drive Question (Teacher):	**Expected Student Outcomes (multidimensional):**	**How will this impact student understanding of the anchoring**

Lesson Level Driving Question: • What is matter? • What is its purpose? • How can we use our observations to figure out what this is?	• Students will investigate the patterns of matter based upon its properties.	**phenomena?** • This is the introduction to the phenomena. This lesson will allow the students to generate questions that they have about the OObleck. These questions will be used to guide instruction throughout the unit so that they students can figure out what Oobleck is.
Learning Sequence/Lesson 2 DCI Content Drive Question (Teacher): **Lesson Level Driving Question:** • What is matter? • Different kinds of matter exist (e.g. wood, metal, water) • Matter can be described and classified by its observable properties (e.g. visual, aural, textual) • Matter can be described and classified by whether it occurs naturally or is manufactured **Lesson-Level Phenomenon:** Lay out different materials (steel cube, metal cube, plastic cylinder) Generate questions/discussion about materials (properties of)	**Expected Student Outcomes (multidimensional):** • Students will investigate the patterns of matter based upon its properties. Other: Student Journal	**How will this impact student understanding of the anchoring phenomena?** • After looking at the properties of various matter, students will go back and see if they will make changes to their thoughts about whether *Oobleck* is a solid or liquid.
Learning Sequence/Lesson 3 DCI Content Drive Question (Teacher): **Lesson Level Driving Question:** • How does heating and/or cooling change matter? • Many types of matter can be solid or liquid depending on temperature • Heating or cooling may cause change that can be observed • Some are reversible • Some are not reversible (e.g. baking a cake) **Lesson-Level Phenomenon:** Ice cube melting	**Expected Student Outcomes (multidimensional):** • Students will construct explanations to describe the effects of temperature of different types of matter.	**How will this impact student understanding of the anchoring phenomena?** • Students will go back to their *Oobleck* and test to see whether heating or cooling has affected it. They will record their findings and make changes to their initial thoughts about whether *Oobleck* is a solid or liquid as needed.

Time lapse video		
Learning Sequence/Lesson 4 DCI Content Drive Question (Teacher): **Lesson Level Driving Question:** ● How is matter classified? ● How can we use small objects to make something new and different? ● Matter can be described and classified by its uses ● A variety of objects can be built up from a small set of pieces (e.g. blocks) ● Different properties are suited for different purposes **Lesson-Level Phenomenon:** Build a Tower (use different materials: newspaper, popsicle sticks, straws)	**Expected Student Outcomes (multidimensional):** ● Students will design and build structures using a variety of smaller objects to make a larger structure (Energy and Matter) for a specific purpose. ● Students will construct evidence based arguments to determine a matter's purpose based on its structure and function.	**How will this impact student understanding of the anchoring phenomena?** ● After looking at the properties of various matter, students will go back and see if they will make changes to their thoughts about whether *Oobleck* is a solid or liquid.
Learning Sequence/Lesson 5 DCI Content Drive Question (Teacher): **Lesson Level Driving Question:** ● What can we use to describe the properties of an object? ● Objects' or samples' sizes can be measured (Volume only for liquid measurement) ● Objects or samples can be weighed ● Objects' or samples' sizes can be described **Lesson-Level Phenomenon:** Weigh different materials (steel cube, metal cube, plastic cube) or (golf ball, ping pong, tennis ball, baseball)	**Expected Student Outcomes (multidimensional):** ● Students will analyze data to determine why one object weighs more than another.	**How will this impact student understanding of the anchoring phenomena?** ● Students will determine the best way with which to measure their *Oobleck.* They will record and share their findings and construct evidence based arguments as to the best way to measure it.
Learning Sequence/Lesson 6 Final Performance Task	**Expected Student Outcomes (multidimensional):** ● Students will develop a model that will float on a substance based on their knowledge of the properties of said substance.	**How will this impact student understanding of the anchoring phenomena?** ● Students will use their new knowledge of what *Oobleck* is to design an aircraft that will float on the planet *Oobleck.*

SOUTH WINDSOR PUBLIC SCHOOLS- GRADE 2 PROPERTIES OF MATTER UNIT LESSON PLANS:

Grade Level/Class: Grade 2 Science	**Topic/Unit:** Properties of Matter	**Learning Sequence # __1_ in a series of __6__ Learning Sequences**

Suggested Time Frame: 10 minutes

Lesson/Unit- Level Phenomena:

Anchoring Phenomena~ Looking at already created *Oobleck* students will generate driving questions based upon their observations, and determine whether they feel the *Oobleck* is a solid or liquid.

Performance Expectation(s):

- **PS1.1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.**[Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.
- **PS1.2 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.*** [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.] [*Assessment Boundary: Assessment of quantitative measurements is limited to length*.]
- **PS1.3 Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.** [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]

Brief Lesson Description:

This is the first lesson in the unit. you will introducing the anchoring phenomena to the students. encourage them to discover things about it by making observations and asking questions about it. You can prompt them if they are having trouble coming up with questions, but refrain from telling them any answers about it or to their questions.
Looking at already created *Oobleck,* students will generate driving questions based upon their observations. Examples of student questions may include:
What is this?
Is this a solid or a liquid?
What is its purpose?
Why does it roll into a ball, then 'melt'?

Student Learning Outcomes: (from UBD learning sequence)

Students will investigate the patterns of matter based upon its properties.

Narrative / Background Information

Prior Student Knowledge:

Students will know that different objects feel, look, and react differently.

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
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 an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.(2-PS1-1) **Analyzing and Interpreting Data** Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. ● Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2) **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. (2-PS1-3)	**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. (2-PS1-1) ● Different properties are suited to different purposes. (2-PS1-2),(2-PS1-3) ● A great variety of objects can be built up from a small set of pieces. (2-PS1-3)	**Patterns** ● Patterns in the natural and human designed world can be observed. (2-PS1-1) **Cause and Effect** ● Events have causes that generate observable patterns. (2-PS1-4) ● Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-PS1-2) **Energy and Matter** ● Objects may break into smaller pieces and be put together into larger pieces, or change shapes. (2-PS1-3) - - - - - - - - - - - - - - - - - - - **Connections to Engineering, Technology, and Applications of Science** **Influence of Engineering, Technology, and Science, on Society and the Natural World** ● Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world. (2-PS1-2)

Possible Preconceptions/Misconceptions:

That everything is either a solid, liquid or gas and not realized they they can change under different conditions

LESSON PLAN – 5-E Model

<u>ENGAGE:</u> Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions:

1. Make the Oobleck according to the directions prior to class.
2. Put it in small containers so that each pair of students has some.

Day 1: 5-10 minutes

<u>EXPLORE:</u> Lesson Description – Materials Needed / Probing or Clarifying Questions:

1. Ask students to observe it without actually touching it, but they can touch the container
   a. What do you notice?
   b. What happens to this substance if you tip the container to one side?

2. Then allow them to observe it with the sense of touch. it may get messy, so it's best to tell them to keep it on a paper plate or paper towel.
3. Students should complete the chart on the first page of their journal about what they notice and wonder. have the student share their ideas about what they wonder with their partner in order to elicit more possibly wonderings from each others ideas.
4. Looking at already created *Oobleck,* students will determine whether they feel the *Oobleck* is a solid or liquid providing evidence for their thinking.

Materials Required for This Lesson/Activity			
Quantity	**Description**	**Potential Supplier (item #)**	**Estimated Price**
Class set	Student Journal	Print from link	FREE
	cornstarch	Stop and Shop	
1 per school	Reditainer Plastic Disposable Portion Cups Souffle Cup with Lids, 4-Ounce, 100-Pack	https://www.amazon.com/Reditainer-Plastic-Disposable-Portion-100-Pack/dp/B009VSFZCK/ref=sr_1_1?ie=UTF8&qid=1497368575&sr=8-1&keywords=small+clear+plastic+cups+with+lids	10.65

Grade Level/Class: Grade 2 Science	**Topic/Unit:** Properties of Matter	**Learning Sequence # __2_ in a series of __6__ Learning Sequences**

Suggested Time Frame: 3- 40 minute classes

Lesson/Unit- Level Phenomena:

Anchoring Phenomena from previous learning sequence carries over into this learning sequence

Performance Expectation(s):

- **PS1.1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.**[Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.

Brief Lesson Description:

Students will be using different materials (steel cube, metal cube, plastic cube) to plan and conduct investigations in order to classify the objects based on their properties. They will be working together to look for patterns in the object's properties so that they can classify them. Students should be generating/discussing the materials (properties of) and recording observations in their science journal.

Student Learning Outcomes: (from UBD learning sequence)

Students will investigate the patterns of matter based upon its properties.

Narrative / Background Information

Prior Student Knowledge:

Students will know that different objects feel, look, and react differently.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
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 an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.(2-PS1-1)	**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. (2-PS1-1)	**Patterns** ● Patterns in the natural and human designed world can be observed. (2-PS1-1) **Connections to Engineering, Technology, and Applications of Science** **Influence of Engineering, Technology, and Science, on Society and the Natural World** ● Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world. (2-PS1-2)

Possible Preconceptions/Misconceptions:

The larger the item, the heavier it is, objects are not able to change shapes

LESSON PLAN – 5-E Model

Day 1: 15-20 minutes (with anchoring phenomena introduction)

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions:

1. After starting class with the anchoring phenomena (learning sequence 1) continue here...
2. Lay out different materials (metal cube, plastic cube, wooden block, ping pong ball, acrylic cylinder, rubber ball, leaf, stick, rock, etc.) *Suggested activity to take kids on nature walk to gather sticks, etc.
3. Have students generate questions about the materials and properties of them (some examples could include What do you notice about the size of the objects? What do you think this object is made of? Questions about its color, texture, hardness, and flexibility)
4. Create an anchor chart of questions generated.
5. Have students complete the "What I know and Wonder" section of the "What is Matter?" chart in their journals.

Day 1: 20-25 minutes
Day 2: 15 minutes

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:

1. Allow students to use stationed materials for their explorations. (i.e. water stations, balances, books and rulers for "rolling")
    a. Station Suggestions:
        - Bucket with water to test floatation
        - Create different size ramps to test rollability
        - Pan Balance
        - Equal Arm Balance
        - Stackability
2. Using the questions generated from the Lesson-Level Phenomena (in the engage section above), create opportunities for students to explore these questions by allowing them to plan "tests" for the objects. You could have some materials out to give them ideas about what they could test for (such as a tub of water to test for floatation) Have students use the "Planning an Investigation" pages in their journals.
3. Then give them time to try out their tests and record their observations (data).
    a. Guide students to classify their objects as to what they can and/or cannot do (i.e. roll, bounce, float, sink)
4. Have students record their observations (can use the created Science Journals as their resource). As they are recording, have them talk to each other about what they found out. Make sure to tell them to add to their journal if someone shares a new observation with them.
5. Students are to engage in discourse with their peers comparing results.
6. Guide students to discuss whether an object being natural or man-made makes a difference (in terms of if it floats, sinks, rolls, etc?) based on its properties. Students can go back and complete the final column in the "What is Matter" chart in their journals.
7. Close this part of the lesson by having the students go back and look at their original thoughts about *Oobleck* and make any changes about whether they feel it is a solid or a liquid.

Day 2: 25 minutes (can continue to day 3 if needed)

EXPLAIN: Concepts Explained and Vocabulary Defined:

1. Watch *It's a Property* music video to review ways to determine different properties
2. Read the book *What is a Solid?* by Jennifer Boothroyd to discover the following:
    a. Different kinds of matter exist (e.g. wood, metal, water)
    b. Matter can be described and classified by its observable properties (e.g. visual, aural, textual)
    c. Matter can be described and classified by whether it occurs naturally or is manufactured
3. Ask the students questions pertaining to the above discoveries. Have them give examples when possible.
4. Possible Video to show: *Mr. Rogers- How Crayons are Made* to show how some matter is manufactured.

Vocabulary: matter, observable, properties, natural, manufactured, solid

Day 3: 25-30 minutes

ELABORATE: Applications:

1. After exploring various properties of various matter, students will go back and see if they will make changes to their thoughts about the materials presented in the lesson level phenomena (in the engage section).
2. Allow students to retest these objects, possibly with new ideas for tests after learning about what the properties are, to determine what properties of matter they have or don't have.
3. Have students record their new ideas and observations in their journals.
4. Students are to engage in discourse with their peers comparing results.

Day 3: 10-15 minutes

EVALUATE:

Formative Monitoring (Questioning / Discussion):

1. After exploring various properties of various matter, students will go back and see if they will make changes to their thoughts about whether *Oobleck* is a solid or liquid. Have the students go back and look at their original thoughts about *Oobleck in their journal* and make any changes about whether they feel it is a solid or a liquid. Record in journal. at the bottom of page 3.

Summative Assessment (Quiz / Project / Report):

None at this time

Elaborate Further / Reflect: Enrichment:

None at this time

Quantity	Description	Potential Supplier (item #)	Estimated Price
?	*What is a Solid?* by Jennifer Boothroyd	Amazon	$5.95
Class set	Student Journal	Print from link	FREE
	Steel Cubes	2nd Grade Balancing and Weighing	
	Metal Cubes	2nd Grade Balancing and Weighing	
	Acrylic Cylinders	2nd Grade Balancing and Weighing	
	Ping Pong Balls	2nd Grade Balancing and Weighing	

	Rubber Balls	2nd Grade Balancing and Weighing	
	Leaves	Collect from Outside	
	Sticks	Collect from Outside	
	Rocks	Collect from Outside	
	Mr. Rogers- How Crayons are Made Video	You Tube	FREE
	It's a Property	Discovery Education	
	Pan Balance		

Grade Level/Class: Grade 2 Science	**Topic/Unit:** Properties of Matter	**Learning Sequence # __3_ in a series of __6__ Learning Sequences**

Suggested Time Frame: 4- 40 minutes classes

Lesson/Unit- Level Phenomena:

Anchoring Phenomena from previous learning sequence carries over into this learning sequence

Performance Expectation(s):

- **PS1.4 Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.** [Clarification Statement: 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 heating paper.]

Brief Lesson Description:

After watching a brief time lapse video of an ice cube melting students will explore how the matter of some objects can change due to heating or cooling them by looking at them through the cause and effect lens.

Student Learning Outcomes: (from UBD learning sequence)

Students will construct explanations to describe the effects of temperature of different types of matter.

Narrative / Background Information

Prior Student Knowledge:

Liquids can change states (i.e. water to ice, vise versa)

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
• **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. (2-PS1-3)	**PS1.B: Chemical Reactions** • Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2-PS1-4)	**Cause and Effect** • Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-PS1-2)

Possible Preconceptions/Misconceptions:

Once something melts, it cannot change form again, Heat can change any type of matter, All liquids can freeze

LESSON PLAN – 5-E Model

Day 1: 5-10 minutes

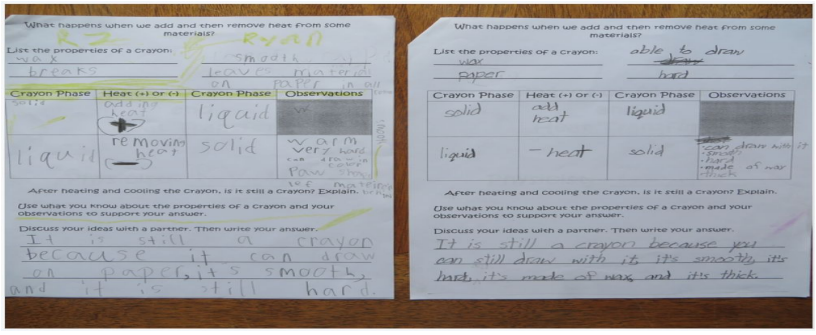
*Prior to starting Day 1- Put some of the Oobleck in the freezer for at least 24 hours.
* Prior to Day 2- cook ½ box of noodles before class

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions:

1. Show: Ice cube melting time lapse video (Mute Sound)
2. Discuss: Turn and talk about what they noticed. they should record notes in their science journals on the "Changing States of Matter" page 6.
    a. Why do they think the ice cube melted the way it did?
    b. What caused the ice cube to melt?
    c. How did the properties of the ice cube change?
    d. Can it change again? If so, what would cause it to change?

Day 1: 30-35 minutes (crayon activity # 1-4)
Day 2: 40 minutes (noodle and graphing activities # 5-8)
Day 3: 40 minutes (graphing to Oobleck observations # 8-9)

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:

1. Ask students the following question to begin a conversation about reversible changes (click for detailed lesson plan)
    a. What are the properties of a crayon? Have them share out ideas, write them on the board.
    b. What will happen if we add heat to the crayons? Why do you think that?
    c. When it cools, what do you think it will turn into? Why do you think that?
    d. Tell them that when scientists are presented with a question that they don't know the answer too, they test it out.
2. Using a melting pot, place crayons of the same color (no wrappers) in the pot and turn it on. Use the document camera to show the students the melting crayons. While students are watching have them list the properties of a crayon in the journal on page 7. Ask students what they are noticing/observing is happening to the crayons. Have them fill out the first row of the chart.
3. While students are filling this out, pour the melted wax into the molds and let them harden and cool. ask them what they predict will happen as the substance cools.
4. Once they are cooled, pop them out of the molds and give them to the students. Have them test them out to determine if they are still a crayon or not. They should compare the "new thing" to their original list of properties. Then have them complete the second row on the chart and complete the question at the bottom. Make sure they are supporting their answer with evidence from the demonstration.
5. 

6. Day 2- Start class by reviewing yesterday's lesson…"When a material can change back and forth between phases, this is called a reversible change. What are materials that can change back and forth between phases when heat is removed or added? Today we are going to learn about the opposite of reversible...irreversible changes" (click here for detailed lesson plan- start at #3)
7. Hand each student an uncooked noodle and have them write the properties that make the noodle a noodle in their journal page 9.
8. Explain to the students that you added heat to the noodles by cooking them and then hand them a cooked noodle to observe and record observations on the worksheet. Have them complete the

second row on the chart and complete the question at the bottom. Make sure they are supporting their answer with evidence from the demonstration.This is an irreversible change.

9. Ask the students the following questions. Have them record their thoughts in their journals on page 11.
    - Can you freeze Oobleck?
        - Ask students:
            - What will happen to Oobleck if you heat it?
            - What will happen to Oobleck if you cool it?
        - Take a poll:
            - Who thinks Oobleck will freeze like an ice cube?
                - Create a class bar graph with results in journals
10. Take out the Frozen Oobleck- possibly the next day if you run out of time...
    - Discuss what happened record in journals.
        - Ask: Does this change what you think about Oobleck? Is it a solid? Is it a liquid?

Day 4: 30 minutes

<u>EXPLAIN:</u> Concepts Explained and Vocabulary Defined:

1. Watch *Solid to Liquid Phase Change*
2. Have the students discuss the following
    a. Many types of matter can be solid or liquid depending on temperature
    b. Heating or cooling may cause change that can be observed
    c. Some are reversible
    d. Some are not reversible (e.g. baking a cake)

Vocabulary: matter, observable, properties, natural, manufactured, liquid

Day 3: 10 minutes

<u>ELABORATE</u>: Applications:

1. After looking at the properties of various matter, students will go back and see if they will make changes to their thoughts about the Oobleck. Record in journal at the end of lesson 2 page.

Day 3:

<u>EVALUATE:</u>

Formative Monitoring (Questioning / Discussion):
After looking at the properties of various matter, students will go back and see if they will make changes to their thoughts about whether *Oobleck* is a solid or liquid.

Summative Assessment (Quiz / Project / Report):

None at this time

Elaborate Further / Reflect: Enrichment:
Plastic Cup Art Narrative
Lemonade lesson

Quantity	Description	Potential Supplier (item #)	Estimated Price
	Solid to Liquid Phase Change	you tube	
	Frozen Oobleck	put in freezer 24 hours in advance	

1 per school	Silicone Mold Bakeware Set - Dinosaurs, Numbers, Alphabet Letters, Cute Figures - Baking Pan Kit for Chocolate, Candy, Candle, Soap, Cakes - Brown	https://www.amazon.com/Silicone-Mold-Bakeware-Set-Dinosaurs/dp/B00XN0L184/ref=sr_1_6?s=home-garden&ie=UTF8&qid=1495132629&sr=1-6&keywords=crayon+molds	8.99/ 4 pack
about 20 per class	crayons of the same color	broken crayons in your classroom/ staples	
2-4 per school	Wilton Chocolate & Candy Melts Melting Pot, 2104-9006	https://www.amazon.com/Wilton-Chocolate-Candy-Melting-2104-9006/dp/B00KBUGQNY	23.99
4 boxes per school	spaghetti noodles ½ cooked and 1/2 uncooked	Stop and Shop	.99/each

Grade Level/Class: Grade 2 Science	**Topic/Unit:** Properties of Matter	**Learning Sequence # _4_ in a series of __6_ Learning Sequences**

Suggested Time Frame: 5- 40 minute classes

Lesson/Unit- Level Phenomena:

Anchoring Phenomena from previous learning sequence carries over into this learning sequence

Performance Expectation(s):

- **PS1.2 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.*** [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.] [*Assessment Boundary: Assessment of quantitative measurements is limited to length.*]

Brief Lesson Description:

Build a Tower- (use different materials: newspaper, popsicle sticks, straws)

Student Learning Outcomes: (from UBD learning sequence)

- Students will design and build structures using a variety of smaller objects to make a larger structure (Energy and Matter) for a specific purpose.
- Students will construct evidence based arguments to determine a matter's purpose based on its structure and function.

Narrative / Background Information

Prior Student Knowledge:

Different materials are used to build structures, smaller things can make larger things, different objects have different properties

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
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. (2-PS1-3) **Engaging in Argument from Evidence** 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). • Construct an argument with evidence to support a claim. (2-PS1-4)	**PS1.A: Structure and Properties of Matter** • Different properties are suited to different purposes. (2-PS1-2),(2-PS1-3)	**Energy and Matter** • Objects may break into smaller pieces and be put together into larger pieces, or change shapes. (2-PS1-3) **Influence of Engineering, Technology, and Science, on Society and the Natural World** • Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world. (2-PS1-2)

Possible Preconceptions/Misconceptions:

Any hard material can be used successfully to build a structure that will hold an item.

LESSON PLAN – 5-E Model

Day 1: 20 minutes

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions:

1. Use the slideshow Structures Around the World and the journal pages for lesson 3 to elicit student questions about what these structures of made of and why they were used.
2. Activate Prior Knowledge with Student Lead Discussions

Day 1: 20 minutes
Day 2: 40 minutes
Day 3: 40 minutes

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:

1. Introduce the following activity with the students. Building a Tower Student Sheet (teacher notes found here) in their journals on pages 12-14. Use the remaining time in day 1 for the students to plan their structure and complete the planning sheet in their journals. Choose a material to build a tower that will hold a book. Explain why that material was chosen and how it will do its job. (Explain in Science Journal).
2. On day 2 have the students create their structure. They have 30 minutes to build. (use different materials: newspaper, popsicle sticks, straws)
3. Day 3 is spent testing each structure to see if it will hold the book.
4. As you test each design have the student explain what they used and why. Then have the class determine what worked well in each design.

Day 4: 40 minutes

EXPLAIN: Concepts Explained and Vocabulary Defined:

1. Have the students complete the conclude question in their journals. Keep all structures in view so that students can use ideas from other groups to help them give detailed answers.
2. Read the text "What if Rain Boots Were Made of Paper?" Students should take away the following points:
    a. Matter can be described and classified by its uses
    b. A variety of objects can be built up from a small set of pieces (e.g. blocks)
    c. Different properties are suited for different purposes

Vocabulary: matter, observable, properties, natural, manufactured,

Day 5: 10 minutes

ELABORATE: Applications and Extensions:

1. Connect the conversation back to the original slideshow, Structures Around the World after reading about different materials and using materials in different ways on their structures. Have students discuss expand on their original answers.

Day 5: 30 minutes

EVALUATE:

Summative Assessment (Quiz / Project / Report):

1. Have the students build another structure to hold a book, making changes to the materials used in the original structure as needed. Record in science journal *why* these changes were made. If no changes were made, explain *why* there was no need. (you will be going back to the journal for this activity to complete the last page in lesson 3)

Formative Monitoring (Questioning / Discussion):

- After exploring how the properties of matter help to build structures, students will go back and see if they will make changes to their thoughts about whether *Oobleck* is a solid or liquid and *why.*

Elaborate Further / Reflect: Enrichment:

- What materials would you combine to create the best structure? Why?

Quantity	Description	Potential Supplier (item #)	Estimated Price
	Structures Around the World slideshow	Created	
	Newspaper	from home/library	
1 per school	Popsicle Sticks	https://www.amazon.com/Perfect-Stix-Wooden-Sticks-Length/dp/B009EE2VIW/ref=sr_1_3?ie=UTF8&qid=1495140838&sr=8-3&keywords=popsicle+sticks	9.90
2 per school	Straws	https://www.amazon.com/Drinking-Straws-Multi-Colored-Disposable-Assorted/dp/B01HS98QYM/ref=sr_1_13?ie=UTF8&qid=1495140898&sr=8-13&keywords=straws	8.71
	Construction Paper		
1 roll per teacher	Aluminum Foil/ 2 pack	https://www.amazon.com/Reynolds-Wrap-Aluminum-Foil-Pack/dp/B015FBNBX6/ref=sr_1_4?ie=UTF8&qid=1495140985&sr=8-4&keywords=aluminum+foil	8.71
2 per school	Rubber Bands	https://www.amazon.com/BAZIC-Assorted-Dimensions-Rubber-Bands/dp/B000BLJEKU/ref=sr_1_6?s=office-products&ie=UTF8&qid=1495141023&sr=1-6&keywords=rubber+bands	4.49
	Scissors	in classroom	
1 per school	Masking Tape	https://www.amazon.com/Outus-General-Purpose-Masking-Industrial/dp/B06VY93H9G/ref=sr_1_1?s=office-products&ie=UTF8&qid=1495141107&sr=1-1-spons&keywords=masking+tape&psc=1	11.99
	Building a Tower Student Sheet	Created	
1 per teacher	*What if Rain Boots Were Made of Paper?* By Kevin Beals and P. David Pearson		

Grade Level/Class: Grade 2 Science	**Topic/Unit:** Properties of Matter	**Learning Sequence # _5_ in a series of __6__ Learning Sequences**

Suggested Time Frame: 2- 40 minute classes

Lesson/Unit- Level Phenomena:

Anchoring Phenomena~ Looking at already created *Oobleck* students will generate driving questions based upon their observations, and determine whether they feel the *Oobleck* is a solid or liquid.

Performance Expectation(s):

- **PS1.1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.**[Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.

Brief Lesson Description:

Students will weigh different materials (steel cube, metal cube, plastic cube) or (golf ball, ping pong, tennis ball, baseball) in order to see that size does not matter for weight; it is its matter that determines how much it weighs.

Student Learning Outcomes: (from UBD learning sequence)

- Students will analyze data to determine why one object weighs more than another.

Narrative / Background Information

Prior Student Knowledge:

Different objects have different weights

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
Analyzing and Interpreting Data Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. ● Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2)	**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. (2-PS1-1)	**Energy and Matter** ● Objects may break into smaller pieces and be put together into larger pieces, or change shapes. (2-PS1-3)

Possible Preconceptions/Misconceptions:

Objects of the same size will have the same weight, Larger objects will weigh more than smaller objects

LESSON PLAN – 5-E Model

Day 1: 40 minutes

ENGAGE/EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:

1. Working in groups, have students weigh different solid materials (steel cube, metal cube, plastic cube) or (golf ball, ping pong, tennis ball, baseball) in nonstandard and standard measurements in their journals in lesson 5.
2. Weigh various liquid materials (water, glue, corn syrup) by volume.

Day 2: 15-20 minutes

<u>EXPLAIN:</u> Concepts Explained and Vocabulary Defined:

1. Have a group discussion about the following after completing the above activity.
    a. Objects' or samples' sizes can be measured (Volume only for liquid measurement)
    b. Objects or samples can be weighed
    c. Objects' or samples' sizes can be described

Vocabulary: matter, observable, properties, natural, manufactured, solid, liquid, volume

Day 2: 15 minutes

<u>ELABORATE:</u> Applications and Extensions:

1. Have students measure the Ooblek. Let them decide what they should use for measurement.
2. After looking at the properties of various matter, students will go back and see if they will make changes to their thoughts about the materials presented in the lesson level phenomena

EVALUATE:

Formative Monitoring (Questioning / Discussion):

- After looking at the properties of various matter, students will go back and see if they will make changes to their thoughts about whether *Oobleck* is a solid or liquid.

Summative Assessment (Quiz / Project / Report):

None at this time

Elaborate Further / Reflect: Enrichment:

- Read various books to learn more about matter, so that you can add to the anchor chart. Books include, What is matter? All about Matter and the nature of Matter

Quantity	Description	Potential Supplier (item #)	Estimated Price
	Scales	in balancing and weighing kits	
	steel cubes		
	metal cubes		
	acrylic cylinders		
	golf balls		
	ping pong balls		
	tennis balls		
	baseballs		
	measuring cup sets		
	corn syrup	stop and shop	

Grade Level/Class: 2	**Topic/Unit:** Properties of Matter	**Lesson Sequence # _6_ in a series of _6_ lesson Sequences**

Suggested Time Frame: 3- 40 minute classes

Lesson/Unit- Level Phenomena:

Anchoring Phenomena~ Looking at already created *Oobleck* students will generate driving questions based upon their observations, and determine whether they feel the *Oobleck* is a solid or liquid.

Performance Expectation(s):

- **PS1.1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.**[Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.
- **PS1.2 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.*** [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.] [*Assessment Boundary: Assessment of quantitative measurements is limited to length.*]
- **PS1.3 Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.** [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]

Brief Lesson Description:

Goal/Audience: Devise a ship using materials given that won't sink on *Planet Oobleck*

Role: Aerospace Engineers

Situation: You are traveling to *Planet Oobleck* to study its properties of matter. You will need to land safely on the planet, allowing yourself the ability to exit the craft without it sinking. How will you plan, devise, and create an aircraft that will be able to land safely on *Planet Oobleck* without sinking.

Product/Purpose: The aircraft

Criteria/Evaluation: Rubric that outlines the successes for the ship's ability to float (and for how long).

Student Learning Outcomes:

Students will develop a model that will float on a specific substance based on their knowledge of the properties of said *substance.*

Narrative / Background Information

Prior Student Knowledge:

Students know that the properties of matter can change, smaller structures can create larger ones, different objects have different amounts of matter, larger size does not mean greater amount of matter

Science & Engineering Practices: Developing and Using Models	Disciplinary Core Ideas: PS1.A: Structure and Properties of Matter	Crosscutting Concepts: Structure and Function
Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. ● Develop a model to represent patterns in the natural world.	● 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. (2-PS1-1) ● Different properties are suited to different purposes. (2-PS1-2),(2-PS1-3) ● A great variety of objects can be built up from a small set of pieces. (2-PS1-3)	● The shape and stability of structures of natural and designed objects are related to their function(s).

Possible Preconceptions/Misconceptions:

Any misunderstandings from previous lesson sequences will impact their final designs.

LESSON PLAN – 5-E Model

Days 1 -3: 40 minute classes

EVALUATE:

1. Day 1 is used to introduce the Performance Task (teacher notes found here) in their journals on page 18 to the students. Show them the Oobleck again. Have them work in groups to make a plan using the planning sheet in the journal.
2. Then have them build their ship.
3. On day 2 test the ships making sure they complete the evidence portion of the journal. Make sure to have conversations with the students as you test each ship as to what seemed to work well, how the ship reacted to the Oobleck or how the Oobleck reacted to the ship. Emphasize patterns in the materials of the designs that work best.
4. On day 3, allow the students to make it better by completing the planning sheet in the journal titled " Let's make it Better" and creating a new ship
5. Day 4 is testing day and reflecting on the process in their journals.
6. This rubric could be used to assess the engineering design process. (click here for teacher specifics)

Elaborate Further / Reflect: Enrichment:
None at this time

Quantity	Description	Potential Supplier (item #)	Estimated Price
1 per school	toothpicks	https://www.amazon.com/Chenille-Kraft-Toothpicks-Natural-CKC369001/dp/B009R61ACA/ref=sr_1_5?ie=UTF8&qid=1495144828&sr=8-5&keywords=toothpicks	6.36
1 per school	masking tape	https://www.amazon.com/Outus-General-Purpose-Masking-Industrial/dp/B06VY93H9G/ref=sr_1_1?s=office-products&ie=UTF8&qid=1495141107&sr=1-1-spons&keywords=masking+tape&psc=1	11.99
1 per school	straws	https://www.amazon.com/Drinking-Straws-Multi-Colored-Disposable-Assorted/dp/B01HS98QYM/ref=sr_1_13?ie=UTF8&qid=1495140898&sr=8-13&keywords=straws	8.71
	construction paper		

	rulers		
	scissors		
2 per school	glue sticks	https://www.amazon.com/Elmers-Purpose-School-Washable-0-24-ounce/dp/B0013CDGT6/ref=sr_1_3?ie=UTF8&qid=1495144982&sr=8-3&keywords=glue+sticks	9.86
1 per school	pipe cleaners	https://www.amazon.com/Creativity-Chenille-Classroom-000-Count-AC9115-01/dp/B003E7FADI/ref=sr_1_5?ie=UTF8&qid=1495144759&sr=8-5&keywords=pipe+cleaners	14.99
1 per school	rubber bands	https://www.amazon.com/BAZIC-Assorted-Dimensions-Rubber-Bands/dp/B000BLJEKU/ref=sr_1_6?s=office-products&ie=UTF8&qid=1495141023&sr=1-6&keywords=rubber+bands	4.49
2 per class	sponges	https://www.amazon.com/Qisc-Multi-Purpose-Super-Lightweight-Scrubbers-Completely/dp/B01FDSA3GE/ref=sr_1_17?ie=UTF8&qid=1495144877&sr=8-17&keywords=sponges	6.99
	paper towels		
	Reflection Sheet		

Student Journal

Name: _____

Oobleck!

Observe your oobleck. What do you notice? What do you wonder? Write your thoughts below.

Notice	Wonder

What is Matter?

Observe the materials at your desk record on the chart below what you see.

Material	What I Know	What I Wonder	Man made or Natural?
metal cube 			
plastic cube 			
wooden block 			
ping pong ball 			

leaf 			
rubber ball 			
stick 			
rock 			

What I now think about Oobleck...

_____

_____

_____

_____

Planning an Investigation

Using the materials at your desk think of some things you could do to learn more about each of the objects.

Material	What materials I used	What I did with the materials	What I found out about the object
metal cube 			
plastic cube 			
wooden block 			
ping pong ball 			

leaf 			
rubber ball 			
stick 			
rock 			

After doing the tests I planned I noticed that _____
is similar to _____.

the pattern I see is _____.

Changing States of Matter

After you watch the video turn and talk to a partner about the following questions:

- *Why do they think the ice cube melted the way it did?*
- *What caused the ice cube to melt?*
- *How did the properties of the ice cube change?*
- *Can it change again? If so, what would cause it to change?*

Notes:

Crayons!

What happens when we add and then remove heat from some materials?

List the properties of a crayon:

_____
_____
_____
_____
_____
_____

Crayon Phase	Heat (+) or (-)	Crayon Phase	Observations

After heating and cooling the crayon, is it still a crayon? Explain.

_____

_____

_____

_____

_____

_____

Use what you know about the properties of a crayon and your observations to support your answer. (Discuss your ideas with a partner. Then write your answer.)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Noodles!

What happens when we remove and then add heat to some materials?

List the properties of a noodle:

_____
_____
_____
_____
_____
_____

Noodle Phase	Heat (+) or (-)	Noodle Phase	Observations

After heating and cooling the noodle, can it be returned to the same noodle properties at the start of the lab? Explain.

_____
_____
_____
_____
_____
_____

Use your property descriptions and observations to support your answer. (Discuss your ideas with a partner. Then write your answer.)

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

OOBLECK!

Turn and Talk:

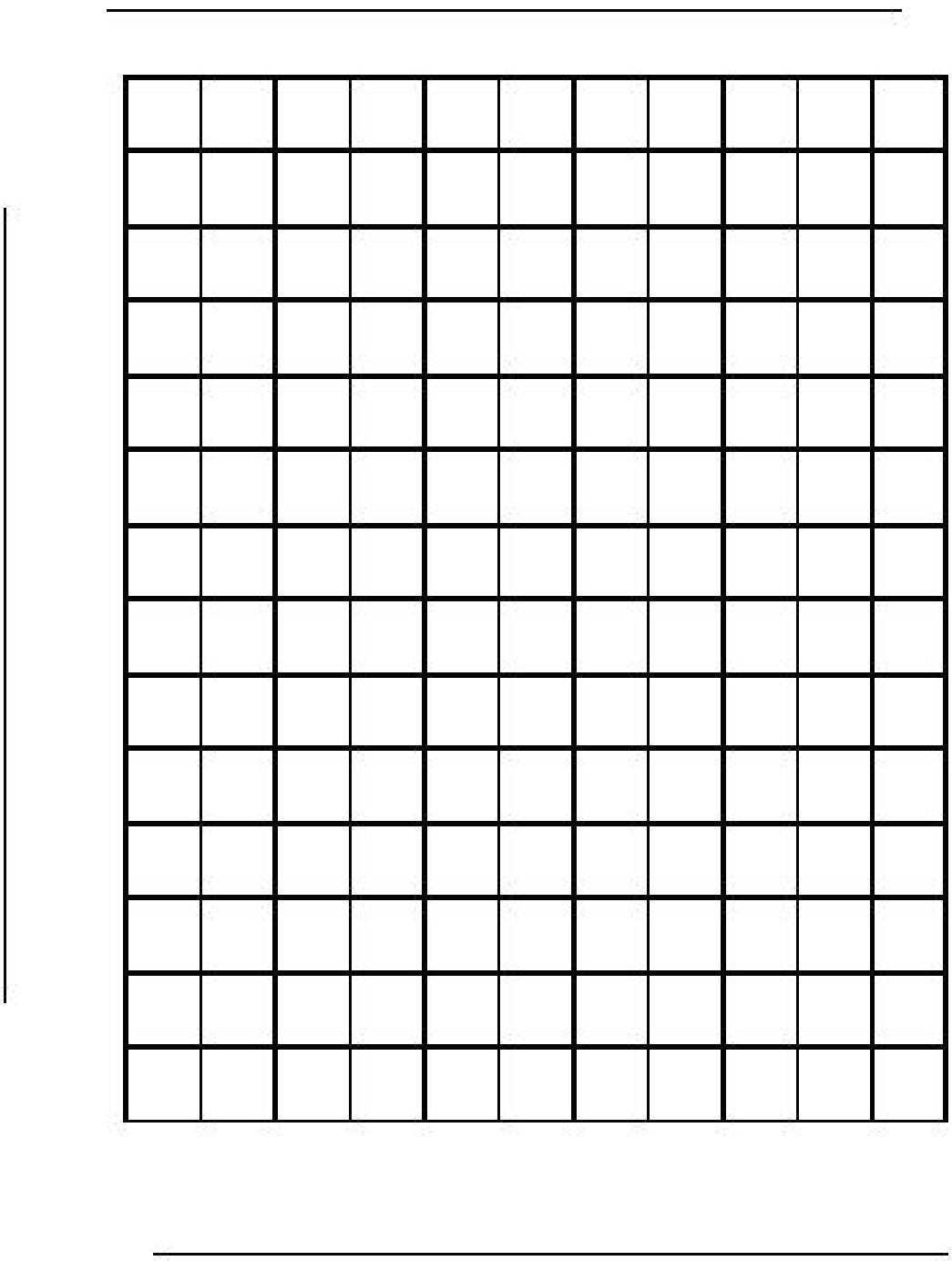
What do you think will happen if you heat oobleck? Why?

Notes:

What do you think will happen if you cool oobleck? Why?

Notes:

Class poll: Can you freeze Oobleck?



After 24 hours in freezer...

I think the reason _____
is becuase _____
_____
_____.

What I now think about Oobleck...

_____
_____
_____
_____

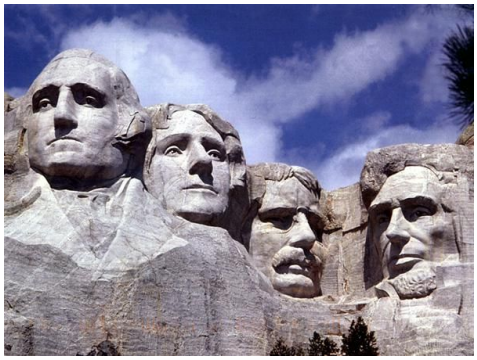
How is matter classified?

Engineers build structures out of different materials. *What do you notice about the pictures below? What do you think they are made out of? Why do you think the engineers decided to use the materials they did?*

Statue of Liberty

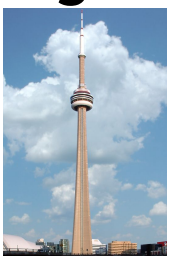
Eiffel Tower

Mount Rushmore



Washington Monument

Building Towers



Have you ever wondered why builders choose certain materials to build different things? Today you are the engineer! Your job is to design a tower strong enough to hold a book. There are a few rules though...

1.) You may only use the materials provided.
   a. You don't have to use all of them but can't get anything else.
   b. You cannot mix the materials

2.) You must build a 3D structure more than 12 inches tall that can hold a book without falling over.

3.) You will have 10 minutes to look at materials and plan with your team.

4.) You will have 30 minutes to build your structure.

Teammate(s): _____

Draw your tower design here.

Predict:

Why do you think that your design will work?

_____

_____

_____

_____

_____

_____

_____

_____

_____

Conclude:

Was your design successful? Explain why you think this happened.

_____

_____

_____

_____

_____

_____

_____

_____

_____

Evaluate:

What could you have done differently to make it successful?

_____

_____

_____

_____

_____

_____

_____

_____

_____

Draw your revised tower design here.

What changes did you make? Why did you make these changes?

_____

_____

_____

_____

_____

_____

_____

_____

_____

Describing Objects

Use the tools provided to take two different measurements of each object.

Material	Nonstandard Measurement	Standard Measurement
metal cube 		
plastic cube 		
wooden block 		
ping pong ball 		

golf ball 		
rubber ball 		
baseball 		
Water 		
corn syrup 		

Engineering Performance Task

Challenge: Using the materials on your table, create a spaceship which can land, but not sink, on Planet Oobleck. As you design, test, and change your ship, record your observations below.

Design 1

Drawing of the Ship Include measurements and label materials used.
Explanation Of why you designed the way you did.

Evidence How did this plan work? Did you ship sink or float?

Let's make it better!

Design 2

Drawing of the Ship Include measurements and label materials used.
Explanation of why you made the changes you did.

Evidence How did this plan work? Did you ship sink or float? Was it better than your original plan?

In conclusion:

The parts of _____ helped the ship to

_____.

What properties did these materials have that allowed them to work so well?

_____

_____

_____

_____

____

The best materials for making a ship to land on Planet Oobleck were

_____

_____ because

_____

_____

_____

_____

___.

What stuck with you?

(vocabulary, pictures, diagrams, etc.)